Research Article

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The Subsistence Strategy of Linear Pottery Culture in Moravia (Czech Republic): Current State of Knowledge

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Abstract: The main goal of this article is to present an overview of current knowledge about the subsistence strategy of Linear Pottery culture (LBK) in Moravia, Czech Republic. The main aspect of the subsistence strategy mentioned here will be the issue of dietary. Early Neolithic sites that in some way contributed to the knowledge about the dietary character (both meat and plant food) will be presented here. On this occasion, a case study of the Žádovice site, which belongs to the most recently analyzed settlements, will be presented. In addition, the methods used in the subsistence strategy of LBK in Moravia will be mentioned. The existing knowledge will be included in a broader settlement context and will be compared with each other. For the time being, it seems that in terms of the species spectrum of farmed animals, the area of Moravia does not differ from the situation known from Central Europe. Certain geographical differences are possible in Moravia, but this hypothesis must be verified in the future, depending on the expansion of the database. The study thus represents a springboard for further research in this area.

Keywords: subsistence strategy, Early Neolithic, LBK, Moravia, animal husbandry

1 Introduction

In recent decades, the subsistence strategy has often been discussed in archaeology and has already been recognized by Moravian archaeology as well. The Moravian archaeological community thus responds to the generally changing approach to archaeological material. We became more interested in the background of these finds, not just the finds themselves. In other words, the current research is increasingly focused on the discovery and reconstruction of the ancient way of life. This approach is more significant in research of the Moravian Neolithic period.

Traditionally, the Neolithic period has been connected with the term “Neolithic revolution,” which (among others) is strongly related to subsistence strategy – activities used for the satisfaction of basic survival needs. As we know from numerous studies, the process of neolithization, including that in Central Europe, was not as fast and sudden as was hypothesized by earlier generations of archaeologists (Podborský, 1993). More probably, it was a sequence of gradual changes that took place in different places at different times. In the same way, other previously experienced concepts associated with the Neolithic

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(the so-called Neolithic package, etc.; Çilingiroğlu, 2005) are now gradually being overcome (e.g., Bickle, 2016; Divišová, 2012; Gronenborn, 2007; Mateiciucová, 2008; Reingruber, 2011; Shennan, 2018).

Of course, certain convictions used to work in Moravian archaeology as well. For example, in connection with Linear Pottery culture (LBK), the system of relative chronology, based on pottery styles, has survived for a long time due to a lack of radiocarbon data. Presently, the concept of relative chronology is being challenged (Kuča et al., 2012; Trampota, 2016). Fortunately, another conviction is slowly disappearing: the knowledge of settlement structures. Based on this statement, we should have found the LBK sites primarily just in lowlands (up to 300–350 m a.s.l.) nearby the riverine on a slight south slope (Podborský, 1993). In recent research, however, we already know many sites that do not follow this pattern, especially in the area of southwestern and eastern Moravia (Bartík, 2012; Schenk, 2007; Vaškových, 2006; Vaškových, Schenk, Kuča, Škrdla, & Langová, 2008). We are still lacking a synthesis that would consolidate the overview of new information and connect it to a broader context. In addition, this synthesis could be a starting point for further and more systematic research.

This article aims to draw attention to the current state of research of Neolithic subsistence strategy in Moravia, specifically on LBK. Another goal is an effort to put a proposal for the next direction in this research.

In connection with research on subsistence strategy, the case study of the Žádovice site, dated to the early phase of the Moravian LBK, was chosen. A large set of animal bones was obtained from this site that was osteologically analyzed, and the first results are presented here.

2 Case Study – Site Žádovice

2.1 Introduction

Site Žádovice belongs to one of the best-excavated LBK sites in the area of southeastern Moravia. The archaeological excavation took place in 1986–1987 in the form of rescue excavation. It is a polycultural site not continuously inhabited from the Early Neolithic to the Late Eneolithic. Some partial findings from specific settlement phases have been published before (Matějčková, 1999; Šmíd, 2002), as well as some findings from the LBK settlement (Nerudová, 2011). The greatest attention has so far been paid to burials (ten individuals), also preliminarily dated to LBK (Čižmář & Geislerová, 1998). More complex processing of findings and evaluation of spatial structures was then the subject of the diploma thesis of the author of this article (Čerevková, 2015).

During the excavation, a considerable number of finds were obtained, but knowledge about the settlement is still entirely untapped. At present, the attention is mainly focused on the skeletal remains of buried humans and animals to obtain additional information about diet.

2.2 Environment

The site is situated in southeastern Moravia (Czech Republic), about 18.5 km north of Hodonín and about 47 km southeastern of Brno (Figure 1, bottom right). The settlement itself is conveniently located on a slightly elevated terrace at an altitude of approximately 220 m (Čižmář & Geislerová, 1998; Geislerová, 1989). Watercourses (creeks and small rivers) shape the surrounding landscape. The streams flow near the site and thus naturally delimit its area. The elevation difference between the confluence of the rivers and the terrace of the settlement is in the range of 15–20 m. The Morava river, the largest watercourse in the surrounding landscape and an important landscape feature, is about 12 km southeast of the site.

From the geomorphological point of view, the area belongs to the Žádovická uplands; its filling consists of tertiary sands, clays, lignite, and rarely gravels of lacustrine, possibly brackish origin. Sedimentation

Figure 1: The location of the case study site of Žádovice (author: L. Bedáň).

took place mainly during the Upper Miocene (Pannon stage). The subsoil is formed by Pleistocene loess, on which black soil and brown soil were formed (Bína & Demek, 2012; Chlupáč, Brzobohatý, Kovanda, & Stráník, 2011; Demek, 1987).

The site's dominant location is interesting – its protection by natural barriers: watercourses, the Chříby mountains, and other ridges. At the same time, however, it probably provided a good overview of the adjacent area of the Morava river, which could represent an important communication corridor. With its location, the settlement refers to some of the earliest Moravian sites dated to the LBK, where also the raw material spectrum is similar (Mateiciucová, 2008; Vaškových et al., 2008).

2.3 Radiocarbon Dating

Burials in the settlement have already been analyzed in detail in a study by Čižmář and Geislerová (1998), and their conclusions can be supplemented by a radiocarbon date, which confirms the dating of one of the graves (82/100-HI) to 5369–5224 cal BC (Reimer et al., 2013), which corresponds phase Ib in Moravian relative chronology system (Čižmář, 1998). The absolute age of other funerals is currently being verified. It seems that one of the ten individuals mentioned above will be chronologically younger and will belong to the Eneolithic period.

2.4 Current Knowledge about Subsistence Strategy at Žádovice

Žádovice is one of the several LBK sites that were osteologically evaluated (basic analysis performed by G. Dreslerová). A relatively large collection of animal bones was obtained from the site; a total amount of 4,539 bones (65,884 g) came from the LBK pits (including objects probably dated to the LBK). Regarding the number of bones, about one third (1,247 bones = NISP) was determined by species (Table 1), but it was

Table 1: Numbers of determined animal bones in connection with LBK pits from case site Žádovice

Pit no.	Chronology	CaL	SuSd	O/C	Bos	Cer	SuS	Eq	Lep	Cas	Cri	Em	Total amount
46	LBK			3	18	1							22
47	LBK			3	6								9
48	LBK Ib				1								1
49	LBK Ib				9								9
52	LBK Ib		2		17								19
57	LBK Ib		23	6	101	2						7	139
58	LBK Ib/IIa		1	2	7								10
62	LBK Ib/IIa			8									8
64	LBK		2	5	12	14		1		1			35
67	LBK Ib/IIa				6								6
68	LBK Ib/IIa		7	8	29	1							45
71	LBK				1						6		7
72	LBK Ib			1									1
73	LBK Ib		2		13								15
74	LBK Ib		4	10	29	1							44
75	LBK Ib/IIa			4	12								16
76	LBK				2								2
78	LBK				3						3		6
80	LBK II		1		3								4
82, 100	LBK Ib		1	3	31								35
85	LBK			1									1
88	LBK		7	59	77	1	1						145
89	LBK	1		6	5								12
91	LBK Ib/IIa		2		10								12
92	LBK Ib		1	3	5								9
93	LBK Ib		4	4	37	7							52
94	LBK			1	3								4
95	LBK			1	12								13
96	LBK		1	1	3								5
98	LBK IIb		2	7	9	1							19
99	LBK II		12	5	13	1							31
101	LBK				2								2
103	LBK Ib				3								3
104	LBK Ib		1		4								5
105	LBK IIb				5								5
106a	LBK				1								1
107	LBK Ib			1	4								5
108	LBK				1								1
110	LBK Ib				3								3
111	LBK IIa		1	3	2		1						7
114	LBK IIa			1	2								3
115	LBK Ib		1		4								5
116	LBK Ib				9								9
117	LBK				1								1
118, 101	LBK				4								4
121	LBK Ib/IIa		1		4								5
123	LBK Ib			4	18								22
124	LBK		1										1
126	LBK Ib				1								1
127	LBK Ib		3	11	12	2			4		3		35
129	LBK				2								2
132	LBK			1									1
134	LBK		3	6	7								16
136	LBK		5	1	5								11
137	LBK Ib		5	6	3								14

(Continued)

Table 1: Continued

Pit no.	Chronology	CaL	SuSd	O/C	Bos	Cer	SuS	Eq	Lep	Cas	Cri	Em	Total amount
138	LBK				3								3
142	LBK Ib		8	26	111	1							146
146	LBK				1								1
150	LBK Ib/Ila				1								1
156	LBK Ib				1								1
166	LBK Ib/Ila			4	10								14
171	LBK Ib		1	2	4								7
172	LBK		3										3
173	LBK		1	1									2
175	LBK				5								5
177	LBK?				2								2
181	LBK			3	9								12
183	LBK				1		1						2
192	LBK Ib		3	2	12	1	2						20
195	LBK Ib			13	20								33
196	LBK		2	1									3
200	LBK	1											1
202	LBK			1	2								3
205	LBK			1	1								2
207	LBK			3	13								16
208	LBK			2	1								3
210	LBK Ib/Ila				6								6
218	LBK Ib				7								7
219	LBK			6	13								19
223	LBK Ib				2								2
224	LBK Ib				4								4
225	LBK				3								3
228	LBK Ib		1	8	15								24
234	LBK Ib				1								1
236	LBK Ib			1	2								3
Total		2	112	249	821	33	5	1	4	1	12	7	1,247

Chronology (settlement phases) of pits is based on pottery decoration that is still used for Moravian LBK relative dating (Čižmář, 1998): Ib, older phase; Ila, younger “classical” phase; Ilb, younger “degenerative” phase. Animal species abbreviations: **CaL**, *Canis lupus* f. familiaris; **SuSd**, *Sus scrofa* f. domestica; **O/C**, *Ovis/Capra*; **Bos**, *Bos primigenius* f. taurus; **Cer**, *Cervidae* (*Cervus elaphus* + *Capreolus capreolus*); **SuS**, *Sus scrofa*; **Eq**, *Equus* sp.; **Lep**, *Lepus europaeus*; **Cas**, *Castor fiber*; **Cri**, *Cricetus cricetus*; and **Em**, *Emys orbicularis*.

?: uncertain.

almost 75% of the whole amount in terms of weight. Based on the osteological analysis, it was found out that domesticated animals predominate here very strongly – 95%. It means a strongly self-sufficient economy focused primarily on livestock. Among domesticated animals, we can distinctly see a predominance of cattle (about 65%), followed by sheep/goat and pig (Figure 2). Rarely has the dog remains appeared.

The cervids (deer and roe deer) were the most common species of wild fauna here, while most of the bones came from the head (skull, teeth, antlers, including dropped antlers). However, bone and antler tools are preserved in only a few pieces in Žádovice, so the connection between deer bones and the purpose of tool production cannot be reliably proved. Other wild (hunted) fauna were represented by wild boar, beaver, horse, hare, and hamster. Interestingly, a few fragments of the carapace of a mud turtle appeared. This turtle species seeks out the still waters of the blind branches of rivers and reservoirs with warm shoals. Near Žádovice, the flow of the Morava river comes into consideration, where this turtle could have been

Figure 2: Ratio of animals in a case study site of Žádovice: (a) domesticated animals in relation to wild fauna and (b) representation of wild fauna.

“hunted,” or parts of its carapace could be collected. The Morava river meanders here and creates numerous blind branches, suitable habitat for the turtle. The occurrence of the horse, as well as of the hamster, is rather associated with the open steppe landscape, which, however, does not exclude the presence of a large watercourse. The species *Equus hydruntinus* is assumed to occur in the open landscape, which may have been associated with river valleys during the Neolithic (Crees & Turvey, 2014). In Moravia, *E. hydruntinus* has been documented relatively abundantly in the Mesolithic site Smolín (Musil, 1978), where we also assume the proximity of a steppe, modeled by a larger watercourse (Oliva, 2018; Valoch, 1978). The horse was identified in Žádovice only based on one uncut tooth (molar/stool) of a juvenile individual, so the exact species determination is unclear. The occurrence of horses in LBK sites in Moravia has been proved reliably

(Berkovec & Nývltová Fišáková, 2003; Dreslerová, 2004; Kratochvíl, 1973; Nývltová Fišáková, 2003, 2004a, 2004b). In addition to the species *E. hydruntinus*, the species *Equus ferus* is also known from the Moravian and Bohemian Neolithic. The difference between these two species is that the *E. ferus* should be of more considerable height (Kyselý & Peške, 2016).

Spatial analysis of specified bones (age, type of bone) is currently underway. According to preliminary results, it appears that there are some differences in the deposition of animal bones (Figure 3). Species representation also apparently varied between households. The highest concentration of wild animals is tied to houses 1 and 2 (with house 1 the most) except boar, which did not appear in any connection to houses. However, it should be borne in mind that relatively few bones of wild animals have generally been identified, so the results should be taken with caution. In addition, the cervids are distributed in the whole settlement area and their only connection with particular households is with houses 1 and 2. At the first glance, it seems that no specific pattern can be observed in domestic animals and their relations to particular households. The cattle bones are somehow connected with all households, and the same can be said for pig bones. The sheep/goat bones were also found near houses except houses 3 and 4. In general, the highest concentration of bones of domesticated animals was found in pit no. 57, 88, and 142 (see Table 1 and Figure 3 – marked with red captions). There could be the question of some killing or butchering site with pit 88 or 142, but there is only one bone with cutting marks from pit 142 (four cuts altogether from the whole settlement) so we cannot confirm this idea. Because most pits were dated to the older phase of LBK (relative dating based on pottery decoration; Čížmář, 1998), most animal bones can also be associated with this phase. According to relative chronology, it seems that only one house belongs to the younger phase of LBK, namely house 3. The spectrum of animal species found here is practically the same as in the other houses, only the number of bones differs.

The spatial distribution of animal bones was also monitored in Těšetice-Kyjovice (Vostrovská, 2018) and Bylany (Pavlů, 2014). An example from Cuiry-lès-Chaudardes (Hachem, 2000, 2011; Hachem & Hamon, 2014) is also well known. However, the issue of waste disposal in Neolithic settlements is relatively

Figure 3: Case site Žádovice plan showing the spatial distribution of animal bones in connection settlement structure (red captions).

complex, as several factors enter into this process, some of which are difficult to define (Květina & Řídký, 2016; Neustupný, 1998; Vostrovská, 2018).

Many stone tools used to process plant food also evidence the diet in Žádovice. It supports the hypothesis that the subsistence economy of the settlement population was very self-sufficient, strongly oriented toward farming. According to the basic anthropological analysis performed on buried individuals, traces of wear and tear were observed on their teeth, related to the significant consumption of plant foods. Here, too, the presence of anemia was found in at least two individuals. The lack of meat diet is considered to be one of the causes of this disease (Čižmář & Geislerová, 1998; Jarošová, Dočkalová, & Fojtová, 2008).

2.5 The Current State of Knowledge of Subsistence Strategy of Moravian LBK Culture

In Moravian Neolithic archaeology, the subsistence strategy is associated only with diet (Kuča et al., 2012). However, all activities leading to the satisfaction of basic human needs should be included (Maslow, 2014; Soukup, 2015). Aspects, such as housing, are usually assessed separately within the inner structure of the individual site.

To date, we have identified more than 400 sites of LBK in Moravia. Unfortunately, most of them are known only from rescue excavations and surface surveys. For this reason, only a small number of them were systematically excavated.

2.6 Hunting and Breeding

If we start with food (or diet), the most common evidence (and often the only one applicable) is animal bones. However, in some sites, there are few bones available due to unsuitable conditions.

Animal bones were not previously the main research focus of archaeologists within the study of Neolithic sites. From older excavations (circa until the early 1960s), we have animal bones disposed of rather seldom, as can be seen from the state of most museum collections. From recent excavations, animal bones are common; however, they are from rescue excavations and are waiting to be analyzed. Since relatively few experts in Moravian archaeology deal with the information potential of animal bones, there is minimal knowledge in this area. In the Czech Republic, we encounter more detailed osteological analyses of animal bones in the early 1970s (Clason, 1970; Kratochvíl, 1973). Since then, the state of research has not much improved, limiting the development of dietary research of the Moravian LBK. At the same time, the potential regional differences (Kováčiková, 2011) that we reliably observe in the production of ceramics and raw materials of stone tools are not reflected either.

G. Dreslerová drew attention to the unfortunate state of osteologically studied Neolithic localities (including LBK) in Moravia almost 20 years ago (Dreslerová, 2004, 2006). Since then, the situation has not improved much, and the number of sites has not increased (Uhlířová, 2012). To date, 15 collections of animal bones from Moravian LBK sites have been analyzed (Table 2). In this table, the number of bones determined at the species level is presented. Therefore, for this study, only the number of bones was considered (in NISP). At first sight, the disparity in the volume of individual collections is apparent. Unfortunately, the more detailed information from two sites (Drysice, Velatice) is not yet available. In addition, from a statistical aspect, one site is somewhat problematic – the Malhostovice, where only four fragments of cattle teeth were found. Another problem can be observed in connection with the Holubice site when the portion of the hunted game was not specified. In these circumstances, the 11 sites provide quite usable data. Of course, more extensive collections of determined bones are better for formulating possible hypotheses about the economics of a particular settlement. If we focus on sites with a larger collection of osteologically determined animal bones, we can see the substantial prevalence of domesticated animals

Table 2: A basic overview of information (location, NISP, animal species representation, radiocarbon dating) about the Moravian LBK sites with the collection of animal bones analyzed

Site	Location	NISP	Cattle (%)	Sheep/ goat (%)	Pig (%)	Domestic animals (%)	Wild animals (%)	Radiocarbon dating	References
Olomouc-Nemilany	Intravilán	140	12.1	13.6	72.9	98.6	1.4		Dreslerová, 2007a; Holub, 2013; Plesníková, 2017
Postřelmov	U Františka	12	Too few bones					cca 5000 cal BC	Davidová, 2007; Goslarm 2004; Goš & Halama, 2004
Vedrovice	Široká u lesa, Žádovice	241	41.9	21.2	28.2	91.3	8.7	5450–5000 cal BC	Berkovec & Nývtová Fišáková, 2003; Nývtová Fišáková, 2003, 2004a, 2004b
Těšetice-Kyjovice	Sutny	889	44.2	29.6	21.4	95.2	4.8	5200–5000 cal BC	Dreslerová, 2004, 2006; Uhlířová, 2012; Vostrovská, 2018
Hluboké Mašůvky	Nivky	78	46.2	19.2	21.8	87.2	12.8		Hájek, Humpolová, & Balcárková, 2015
Uničov	Na nivách	62	51.6	25.8	12.9	90.3	9.7		Dreslerová, 2005
Hulín I	U Izidorů	15	Too few bones						Nývtová Fišáková, 2007
Mikulov	Jelení Louka	565	56.8	23.8	13.8	95.3	4.7		Klíma, 1971; Kratochvíl, 1973
Žádovice	Kravín	1,247	64.7	21	9.5	95	4.6	5369–5224 cal BC	Čerevková, 2015
Brodek u Prostějova	Hůrka	22	Too few bones						Dreslerová, 2007a
Chornice	Pod Hušákem	67	88.1	0	4.5	92.6	7.4		Dreslerová, 2007b
Holubice	not known	52	88.5	7.7	3.8	?	?		Geislerová, 1985; Peške, 1985
Malhostovice	Rybníčky	4	Too few bones						Čerevková, Kuča, Petřík, & Uhlířová, 2011
Velatice	Velatický široký	More detailed information	currently unavailable						Rebrošová, 2013; Uhlířová, 2013
Dryse	Dolní Radlicus	More detailed information	currently unavailable						Geislerová, 1992

?: unknown.

Figure 4: The ratio of domesticated animals and wild fauna in the sites of the Moravian LBK, where the collection of animal bones was analyzed.

(>90%; see Figure 4). This trend is also evident in all sites, except Hluboké Mašůvky, where the material comes from pits in superposition with the Late Neolithic settlement (Lengyel culture). Among the domesticated species, the cattle usually predominate except in Olomouc-Nemilany, where the pigs were more abundant. Based on the results of osteological analysis, it was not always possible to distinguish whether it was a domesticated or wild form of the pig, so the percentage of species may be a little different. In any case, the portion of pigs is relatively high, so probably they would predominate anyway. Except for the Olomouc-Nemilany and Postřelmov (where a small collection was analyzed), the portion of pigs is relatively low at Moravian LBK sites and usually not exceeded 14%. Only at four sites (Těšetice-Kyjovice,¹ Hluboké Mašůvky, Vedrovice, and Olomouc-Nemilany) the pigs were more than 20%. The amount of sheep/goat category is higher or almost similar to that of pigs. The percentage of sheep/goats is about 20–30% except for Olomouc-Nemilany, Holubice, and Chornice. In Chornice, the sheep/goats were not identified at all. Both Holubice and Chornice have a little osteological collection so that the results may be affected by several determined bones. As indicated in Figure 4, usually, the most kept animal at LBK Moravian sites is cattle. Exception is Olomouc-Nemilany, where pigs replace cattle. At other sites, the portion of cattle fluctuates between about 40 and 88%. It points to the fact that cattle did not always so overwhelmingly outweigh other livestock. This hypothesis will need to be updated in the future as more data become available.

It is obvious that Moravian Neolithic people did not completely abandon hunting although the portion of wild fauna at so far analyzed LBK sites is just a few percent. Recently, the issue of the Mesolithic–Neolithic transition has begun to be discussed, also in connection with subsistence strategies. The long-term survival of various Mesolithic phenomena undoubtedly existed (Jizerské mountains area, northern Bohemia) in connection with subsistence and stone tools (Šída, 2013, 2014) and other activities. Unfortunately, in Moravia, Mesolithic sources are still sporadic (Janák, 2004; Oliva, 2018; Sádlo, Pokorný, Hájek,

¹ The correct name is Kyjovice because the archaeological site is situated in the cadastre area of Kyjovice village, but given that the site is closer to Těšetice village, the name Těšetice or Těšetice-Kyjovice is traditionally used. In addition, inhabitants of Těšetice village were always more interested and helpful in the archaeological excavations at the site (Vostrovská, 2018, note 4).

Dreslerová, & Čílek, 2008; Valoch, 1978). In any case, some differences between the Mesolithic and Neolithic diets are noticeable as we know from stable isotope analyses (Bickle, 2018). It is probably not possible to discuss too specifically about the continuity of the economics and other activities from Mesolithic to Neolithic, even if we have some small connections. At least for Moravia, we still have too little data to solve this issue.

2.7 Fishing

Fishing played a significant role in the livelihood of hunting and gathering communities. Fishing is tied to suitable conditions, that is, the presence of a watercourse or water surface. Reliable documents of fishing appear from the late Paleolithic (Cristiani, Dimitrijević, & Vitezović, 2016; Rainsford, O'Connor, & Miracle, 2014; Richards, Jacobi, Cook, Pettitt, & Stringer, 2005).

Within the Czech Republic, the artifacts associated with fishing are very sporadic. Various methods of fishing were used (nets, baskets, etc.), but most of them do not leave archaeologically detectable marks in Moravia. From the Mesolithic period, we have narrowed stones from the settlement agglomeration of Smolín, which are considered as weights of fishing nets (Valoch, 1989). Similar findings are also known from the LBK period from northern Moravia (or Silesia; Janák, 2004; Janák, Knápek, & Papáková, 2011; Šikulová, 1961). It seems that in Moravia the fishing technique could have remained the same as we have similar fishing net weight from Mesolithic Smolín and LBK sites in northern Moravia.

Evidence of fish consumption includes, as with other animals, the findings of their bones. This also applies to fish bones. Usually, small and thin fish bones are difficult to distinguish during excavation, so if the filling of the objects has not been floated, the fish bones can easily escape attention. Within Moravian LBK, the findings of fish are known from the Těšetice-Kyjovice site, where one catfish (*Silurus glanis*) bone (probably vertebra), six unspecified fragments of northern pike (*Esox lucius*) bones, three unspecified fragments of *Cyprinidae* fish bones, and 20 unspecified fish bones. Near Těšetice-Kyjovice, the flows of the rivers Jevišovka (3 km away) and especially Dyje (Thaya; 6 km away) come into consideration as a place of the natural occurrence of the catfish, the other species prefer rather still water or slight flow river. The occurrence of fish bone in Těšetice-Kyjovice is influenced by the excavation methods, where the floating was used as it increases the number of found bones (Dreslerová, 2004, 2006; Sůvová, 2018). Unfortunately, floating is not usually used during excavations of Moravian LBK sites.

2.8 Plants

Based on archaeobotanical research, the last summary of cultivated crops in the Moravian Neolithic and Eneolithic found based on paleobotanical analyses, was given by Kočár and Dreslerová (2010). According to their findings, for LBK, we have reliably documented the occurrence of single-grain and two-grain wheat (*Triticum*) while single-grain occurs only in a set with two-grain (not separately). It is, after all, typical for the whole of Central Europe, where the single-grain plant itself occurs in only a few sites. The millet (*Panicum*) and barley (*Hordeum*) in the Early Neolithic cannot be reliably documented yet. Instead, we know it from younger periods, in the case of polycultural sites, where the affiliation of the findings cannot be reliably associated with the LBK. Barley is reliably documented in Poland in connection with the LBK. Similar conclusions can be drawn in the case of millet, which we also document in the form of imprints on ceramics. However, contamination by younger settlements cannot be ruled out. In addition to cereals, legumes – pea (*Pisum*) and lentil (*Lens*) – were found on about 20 sites, with peas predominating (Bogaard, 2004, 2005; Bogaard, Krause, & Strien, 2011; Bogaard et al., 2013; Kočár & Dreslerová, 2010).

From this point of view, the best-researched site in Moravia is Těšetice-Kyjovice, where all of the plants mentioned above were identified. In addition, some harvested crops were found – mainly the nuts (*Corylus*

avellana) and berries (*Fragaria vesca*, *Rosa* sp.). In addition, the poppy (*Papaver somniferum*) was determined, which is often connected with younger phases of LBK (Vostrovská, 2018; Vostrovská, Bišková, Lukšíková, Kočár, & Kočárová, 2018). The findings of the poppy are rare in Central Europe (Bakels, 1992).

3 Methods Used in Moravian LBK Research of Subsistence Strategy

The most widely used method for research on the LBK subsistence strategy is an osteological analysis of animal bones. In the study of Moravian LBK, two sites occupy a leading position: Vedrovice and Těšetice-Kyjovice. Vedrovice is well known in European Neolithic archaeology due to a large LBK cemetery (about 4,500 m², at least 104 graves altogether), which is holding the attention of researchers since its excavation in the 1960s (Podborský et al., 2002). The anthropological material from buried individuals strongly contributed to the revelation and reconstruction of the way of life of Moravian Early Neolithic people. In connection with buried individuals, the analyses of teeth microabrasion and stable isotopes were used. The analysis of traces on the enamel surface revealed the predominance of plant food, especially in female individuals. Evidence of meat consumption more often belonged to men. Proteins turned out to be more of animal origin, but there were also traces of plant proteins, probably from legumes (Jarošová & Tvrđý, 2017; Jarošová et al., 2008; Nystrom, 2008; Richards et al., 2005; Smrčka, Bůzek, & Zocová, 2008a; Smrčka et al., 2008b). As mentioned in section 2.6, the osteological analysis of animal bones from Vedrovice was used.

In Těšetice-Kyjovice, also the buried individuals were found, a total of 12 people (Dočkalová, 2005; Dočkalová & Čížmář, 2007; Dočkalová & Koštuřík, 1996; Koštuřík & Dočkalová, 1992; Koštuřík & Lorencová, 1989; Vostrovská, 2018; Vostrovská et al., 2012). Stable isotope analyses were also used here: primarily to determine the origin and potential migration of the deceased (Bickle et al., 2014; Smrčka, Bůzek, & Zocová, 2008a). In addition, stable isotope analysis was applied to animal (sheep) bones, mainly to investigate mortality (Gillis, 2018). Interestingly, Těšetice-Kyjovice is one of the few Neolithic localities where the presence of lipids on pottery sherds was investigated by gas chromatography (GC), gas chromatography-mass spectrometry (GC-MS), and gas chromatography-combustion-isotope ratio mass spectrometry (GC-C-IRMS) analysis. These analyses showed the presence of animal (ruminants and pigs) fats and, in one case, also milk fats in the vessels (Dunne, Roffet-Salque, & Evershed, 2018). As mentioned above, analyses of plant macroresidues are also used at the site (Lukšíková, 2013; Vostrovská, 2018).

4 Discussion

The fact that the reconstruction of the life of Early Neolithic communities has recently received increased attention; it seems that the area of Moravia lags a bit behind the rest of Central Europe. Research in Moravia has focused mainly on two sites (Vedrovice and Těšetice-Kyjovice), whereas knowledge about other settlements permeates the literature only very slowly. However, individual findings help to supplement the existing information. For this reason, it is hoped that the research of the Žádovice site will bring further information.

For the time being, it seems that the settlement in Žádovice corresponds with other Moravian LBK sites, at least in terms of focusing on animal husbandry. We can observe a predominance of cattle, followed in various proportions by sheep/goats and pigs. There are, of course, differences between the analyzed collections, but it could be caused by the collection size and the number of determined bones. From a geographical point of view (Figure 5), we can think of areas with a higher share of pig breeding: southwestern Moravia (Těšetice-Kyjovice, Hluboké Mašůvky, Vedrovice) and the area of the upper course of

Figure 5: The location of Moravian LBK sites, where the collection of animal bones was analyzed: (1) Velatice, (2) Brodek u Prostějova, (3) Olomouc-Nemilany, (4) Postřelmov, (5) Hulín I, (6) Chornice, (7) Holubice, (8) Hluboké Mašůvky, (9) Vedrovice, (10) Těšetice-Kyjovice, (11) Žádovice, (12) Malhostovice, (13) Uničov, (14) Mikulov, and (15) Drysice (authors: L. Bedáň and A. Čerevková).

Morava river (Postřelmov, Olomouc-Nemilany, and maybe Uničov). However, we still have a relatively small amount of data to confirm or refute this hypothesis. In addition, the character of settlement areas (inner structure, chronology, etc.) should be considered. A strong focus on cattle breeding is known as a pan-European phenomenon (Arbogast & Jeunesse, 2013; Berthon, Kováčiková, Tresset, & Balasse, 2018; Bickle & Whittle, 2013; Bogucki, 1982; Kováčiková, Bréhard, Šumberová, Balasse, & Tresset, 2012), except the southern Europe where the animal husbandry was more focused on sheep/goats (Ethier et al., 2017; Tresset & Vigne, 2001).

The proportion of game at Moravian Early Neolithic sites seems to be relatively uniform, which does not exceed 10%. The only exception in Moravia so far is the Hluboké Mašůvky site, where, however, the data may be affected by later activities. After all, the portion of meat from hunted animals in the diet of the first farmers in the whole Czech Republic (including Moravian and Bohemian sites) usually did not exceed 10% (Dreslerová, 2006; Kováčiková, 2009; Peške, 1989). In the wider context of Europe, the situation is more variable and the proportion of game varies depending, for example, on the adaptation and use of the environment (Benecke, 2001; Tresset & Vigne, 2001) and the period of the settlement (Arbogast, 2001; Uerpmann, 2001). The situation may also differ within one settlement, among individual households

(Hachem, 2000, 2011, 2017; Vostrovská, 2018). In the case study Žádovice, some pattern was observed as well: wild animals were concentrated within houses 1 and 2, whereas the subsistence of other houses seems to be more focused on domesticated animals. Based on the total number of animal bones, house 1 with its close pits stands out from other households thus we can suggest that there were some differences in diet preference.

Undoubtedly, somewhere the Early Neolithic people maintained subsistence activities from previous periods before the full agricultural subsistence took place (Borić et al., 2004). However, grinding stone tools, traditionally associated with plant food, were proven in Moravia in the Mesolithic period – at the only explored local site Smolín (Valoch, 1978). The patterns of (Late) Mesolithic plant use are known from other parts of Czech Republic, mainly the northern Bohemia (Divišová & Šída, 2015).

Some aspects of the subsistence strategy can be identified based on the findings obtained, as can be seen in the example of the Žádovice settlement and other Early Neolithic Moravian sites. Unfortunately, the means to ensure the application of a wide range of interdisciplinary methods and approaches are only slowly gaining ground. In any case, other aspects related to the subsistence strategy, such as the use of water resources (including wells), still need to be considered (Folejtarová, 2017; Přichystal, 2008; Rulf & Velímský, 1993; Stolz, 2004). It could lead to the spread of the notion of the Neolithic way of life. A separate chapter is on food storage (Kunz, 2004; Květina et al., 2015). As for other activities ensuring the survival of Early Neolithic communities, we must, of course, accept that we will probably not document them archaeologically in the area of Moravia due to conditions.

Considering the settlement structures of the Moravian LBK together with the evaluation of the material source base and their mutual comparison could lead to further findings. It would be appropriate to create specific models of subsistence strategies that could be retrospectively tested, for example, with the help of the results of interdisciplinary analyses. Only time will reveal whether this path is correct.

5 Conclusions

The Moravian Early Neolithic is still relatively little studied in terms of subsistence strategy. It may be related to the fact that the concept of subsistence strategy within the research of the Moravian LBK but also the whole Neolithic is practically exclusively connected with diet. However, the subsistence strategy also includes other activities that lead to the satisfaction of the basic needs necessary for survival, which is, in addition to food, primarily ensuring protection from external natural conditions. The definition of basic (or otherwise primary) and secondary needs may differ, depending on the sociological and psychological foundations we base ourselves on.

From the findings so far, it seems that the Moravian Early Neolithic subsistence strategy is no different from the situation we know from Central Europe. If we look at the species composition of farmed animals, we find that in most cases, the cattle predominate, followed by sheep/goats and pigs. There are, of course, exceptions that show differences in the ratio of species of this basic breed spectrum. Furthermore, in Moravia, the portion of wild animals did not exceed 10%. We can also think about some potential geographical differences, but this hypothesis should be affected by the obtained data. There is still relatively little knowledge about it to make relevant conclusions, and other aspects such as settlement strategy or the character of the sites should be considered.

The case study of the Žádovice site presented here provided valuable information in animal husbandry in the Early Neolithic of Moravia as it provided an extensive collection of animal bones. The predominance of cattle, followed by pigs and sheep/goats, is obvious. The spatial distribution of bones according to animal species was also observed here: some differences between particular households were observed, but not always very significant. In any case, the Žádovice site may offer the potential for further research, which is currently being used.

Abbreviations

GC	gas chromatography
GC-C-IRMS	gas chromatography-combustion-isotope ratio mass spectrometry
GC-MS	gas chromatography-mass spectrometry
GIS	Geographic Information System
NISP	Number of Identified Specimens

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