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Decoding the Neolithic Building Complex: the Case of the Extraordinarily Large House III from Hrdlovka, Czech Republic

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ABSTRACT

The article presents the methodological approach used in the case of a Neolithic building complex, where the subject of investigation is the long tripartite house III from the Hrdlovka site in the Czech Republic. A method of chronological analysis is suggested and demonstrated. The site located in north-west Bohemia was excavated in the area of an open-cast mine between the years 1987 and 1990 as part of a rescue excavation. The house is an extraordinarily long building of a slightly trapezoid shape with a length of 47.5 m. Archaeological assemblages originating from sunken features around the building enabled the formulation of the relative chronology, based on data acquired from ceramic fragments decoration, supported by a multivariate analysis. An analysis of ceramics individuals, lithics and animal bones combined with radiocarbon data made several argumentation steps possible, attempting to shed some light on the house III chronological position with respect to the transitional Linear Pottery Culture/Stroked Pottery Culture (LBK IV/SBK I) period. The majority of the sunken features appertain to the house unit; however, certain sunken features in the chosen 5 perimeter were assigned as chronologically unrelated. Analysis of lithics recorded the use of local quartzite and northern Bohemian metabasite, while the investigation of animal bones detected a common structure of a domestic herd. Finally, the extraordinarily large house itself is discussed, representing an example of huge Neolithic architecture, which may have demonstrated prestige and power.

1. Introduction

Analyses of Neolithic houses in Central Europe are usually based on artefactual and other material characteristics associated with a content of sunken features in the near surrounding of the building structure. It is believed that discarded material from long sunken features, usually referred to as "loam pits", reflects human activity around the house (Pavlů 2000). Another concept emphasizes the material and chronological heterogeneity of such deposits, reflecting the extended period of the space use and the complicated taphonomy of the archaeological assemblages (Květina, Končelová 2011a; 2011b). This paper presents a methodological approach which reflects both concepts. The subject of investigation is one house from the area of the Neolithic site of Hrdlovka. The site was excavated by the corresponding author of this article in 1987–1990 (Beneš 1991a; 1991c) as part of large rescue excavations undertaken in the forefield of the open-cast mining area. The form of analysis presented here could be useful as a methodological approach for further research and a complete evaluation of the site.

A specific aim of this paper is to present an analytical approach specifically in connection with the extraordinarily large house III from the Hrdlovka site. Prior to initiating a detailed description analysis of the house III, a short outline of the archaeological history of the site discovered needs to be provided. The Neolithic site of Hrdlovka was situated in north-west Bohemia in the Czech Republic in the lowlands of the Podkrušnohoří basin extremely close to the foothills of the Krušné Hory Mountains (Figure 1).

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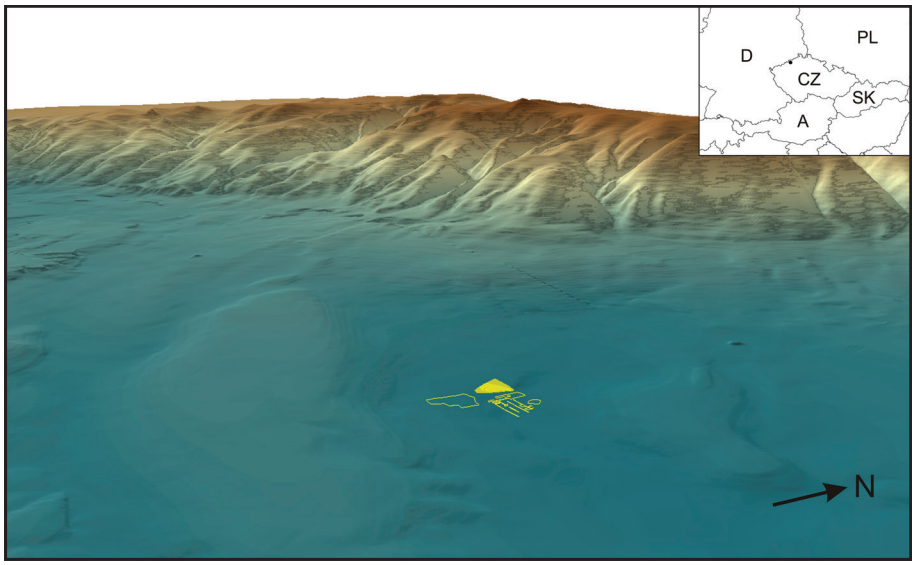

Figure 1. Geographical position of the Neolithic Hrdlovka site in the Podkrušnohorská pánev basin which is currently deeply modified by mining activity (created by K. Křováková).

Figure 2. Hrdlovka site location projected onto a current aerial photo of the destroyed area (map source in 2014, http://geoportal.cuzk.cz).

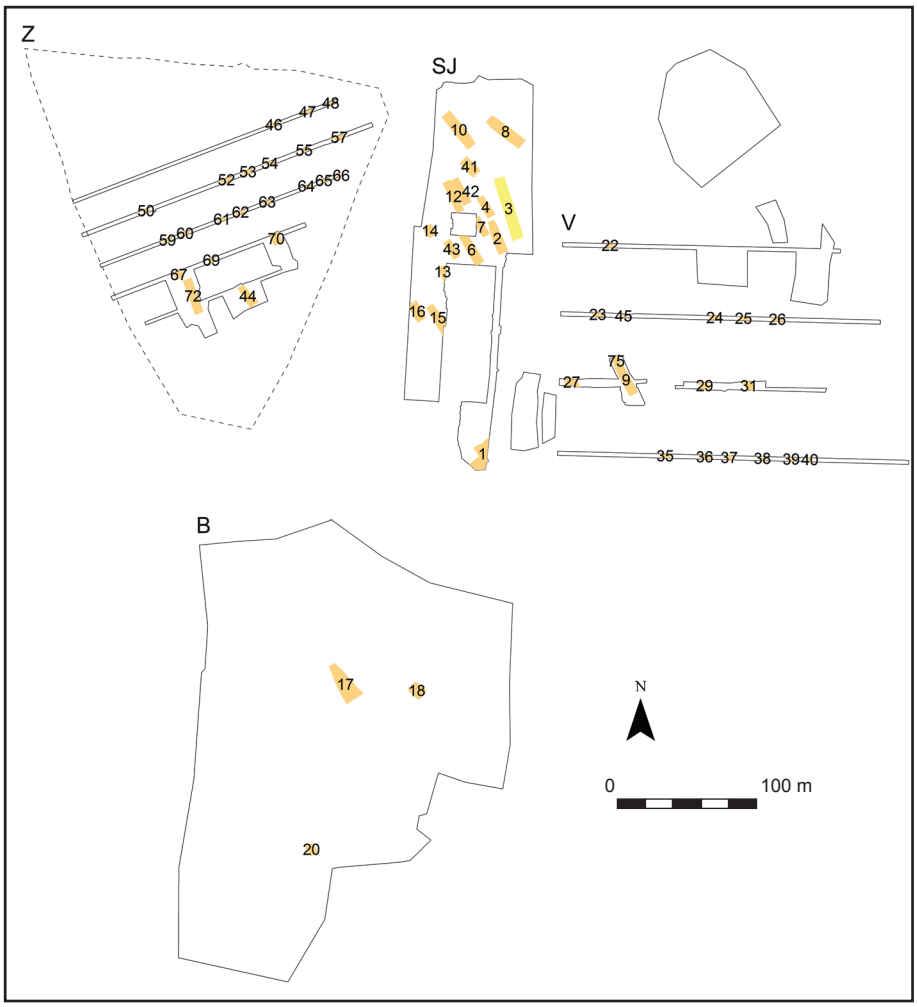

Figure 3. Plan for the Hrdlovka site. House III is highlighted in yellow.

with a short time span for all of the field rescue activity there, which took an entire three years.

The site with traces of the Neolithic features and artefacts was divided in several smaller areas called "V", "SJ", "Z" and "B" (Figure 3). The areas were determined somewhat technically based on their surface condition and technical accessibility. The most endangered eastern area V (the closest area to the quarrying front) was due to a lack of time only sampled by long mechanical trenches in the east-west direction, enabling simple evidence of house plans and the excavation of only chosen associated units, usually sunken "loam pits".

The area SJ was investigated with particular attention and with relatively enough time in comparison with the other areas (Figure 4). The excavation here was determined by the existence of long provisional depositions of arable soil, which had been scraped away by heavy machinery with a tilting bucket prior to the archaeological survey (Figure 5). This area was chosen for complex excavation in detail. Apart from the Neolithic period, the area is characterised by the presence of archaeological features dating to the Eneolithic (the Late Neolithic) and the La Tène period. The last mentioned chronological component is represented here by a cluster of sunken houses and loam pits lying south of the La Tène ditch. Certain archaeological components at the Hrdlovka site dating back to the Corded Ware period, the Early Bronze Age and the Early Medieval period were recorded, excavated, analysed and have already been published on (Beneš 1999; Beneš, Dobeš 1992; Meduna 2011).

The remaining areas Z and B were investigated with a lack of time over the years 1989 and 1990. Area Z was sampled by long mechanical trenches maintaining a similar approach as in the case of area V and area B; it was uncovered using a wheel tractor-scraper.

It has been more than 20 years since the end of the rescue excavation analytical work concerning the Neolithic Hrdlovka site, which began as a research grant under the leadership of the director of excavation. The primary goal of the current Hrdlovka research project is to present the results of the old rescue investigation to the public within the context of recent methodology. The research project comprises a complete evaluation of this unique site. The most important factor for the Hrdlovka site was the extremely good visibility of the building details of the Neolithic architecture in the field, this even being enhanced by the colour contrast between the yellow tertiary clay and the extremely dark infill of the Neolithic features and structures. The specific reason for initiating the research project was the processing and

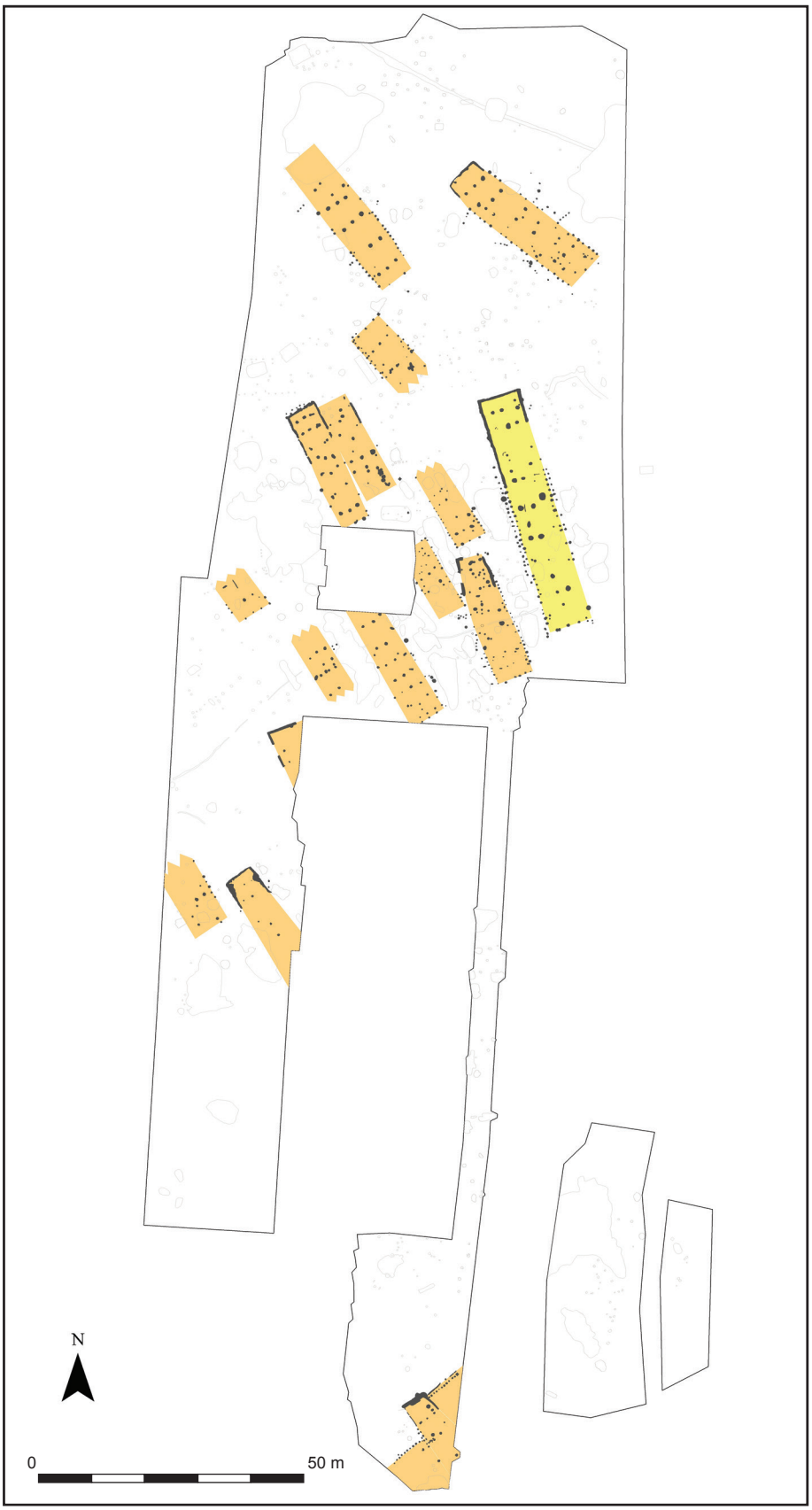

Figure 4. Hrdlovka. Plan of the area SJ with house III. Excavation 1987–1991.

evaluation of material obtained from 58 detected Neolithic houses. The preliminary dating of half of the completely excavated house ground plans and the related sunken features to the Stroked Pottery Culture (SBK) makes this site rare within the context of the Central European Neolithic (Beneš 1991a; 1991c).

Figure 5. View of the excavated ground plan of house III in the year 1987 (photo J. Beneš).

1.1 House III

The example of Hrdlovka house III is an excellent opportunity to demonstrate the method which was used in the analytical work in the current post-excavation process. The architecture of house III with associated ceramic artefacts, lithics and animal bones provides a complex research challenge in current Neolithic studies of the LBK and SBK periods. The choice of the house was based on several conditions. The tripartite ground plan of the house was almost completely preserved, not considerably overlapped by any other ground

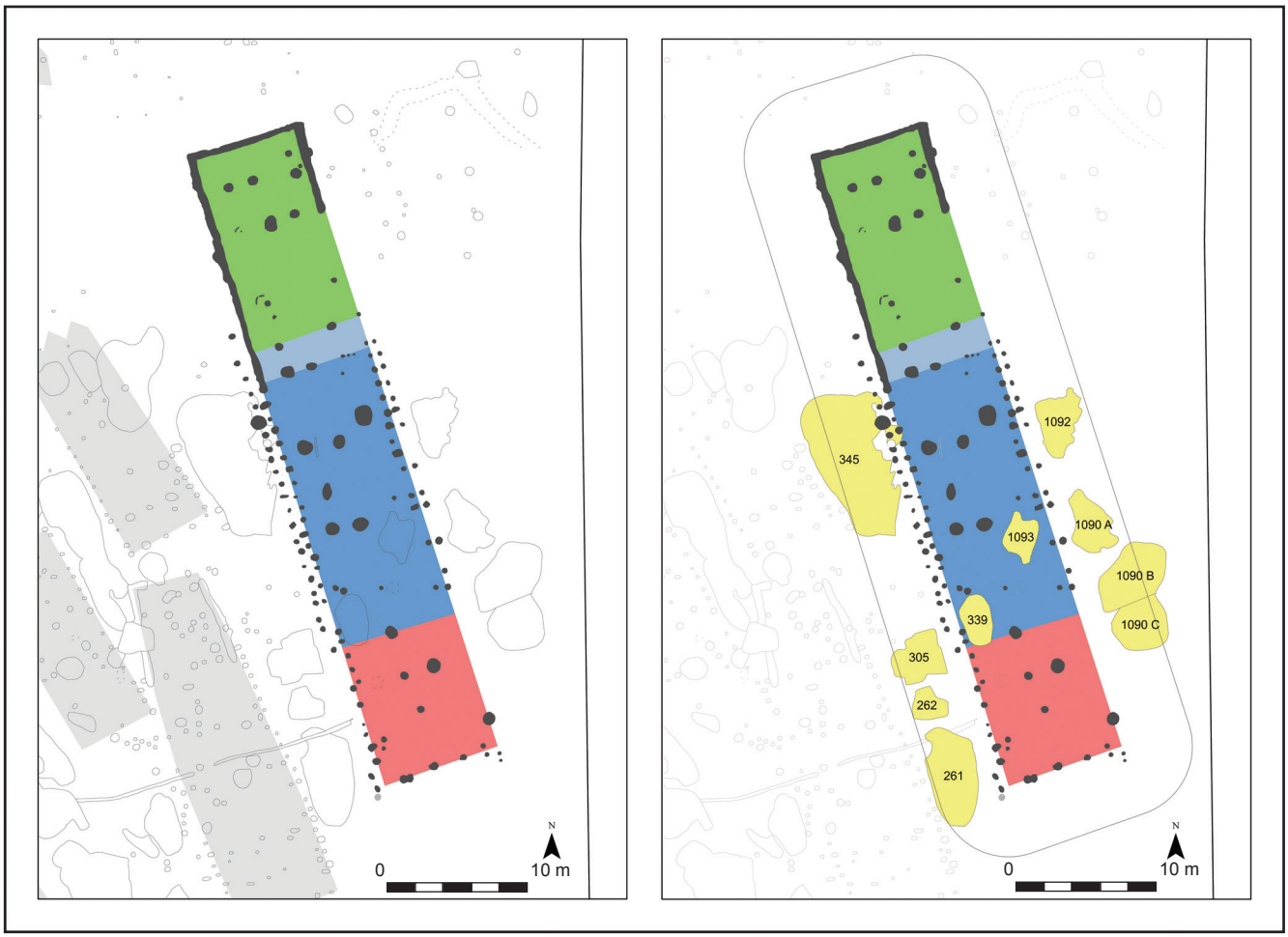

Figure 6. Setting of house III in the area SJ (left) and sunken features, spatially associated with house III in 5 m perimeter (right).

Table 1. House III metric characteristics.

	Length	Width	Area	Declination	Construction
southern part	11.1	9.5	84.4	17°	single wall
middle part*	22	–	179.6	17°	double wall
northern part	14.4	8.6	114.2	17°	trench
house	47.5	–	378.2	17°	–

*including corridor

plans. The length of the house III is 47.5 m and in this aspect could be considered one of the longest houses within the area of the Czech Republic (Figure 6). The ground plan of the house is slightly trapezoidal (the width varies from 8.6 to 9.5 m), although it is questionable, if the difference of approximately one metre was intentional or not with the context of such an enormous length (Table 1). The inner structure of the postholes is relatively regular, consisting of 3 rows of bearing posts. The dimensions of some of the large posthole pits reach even 1.25 m in diameter, while the darker shadows of the wooden posts were well visible in contrast to the colouring during excavation indicating that the diameters of the wooden poles vary between 40 and 45 cm (Figure 7).

The northern part of the house was limited by a huge wall trench, which is rectangular and orientated identically with the rest of the ground plan. The western part slightly extends into the middle part and both parts are divided by a so-called corridor. The eastern part of the northern trench is shorter resulting in a gap in the house wall. Construction of the northern part could have been either

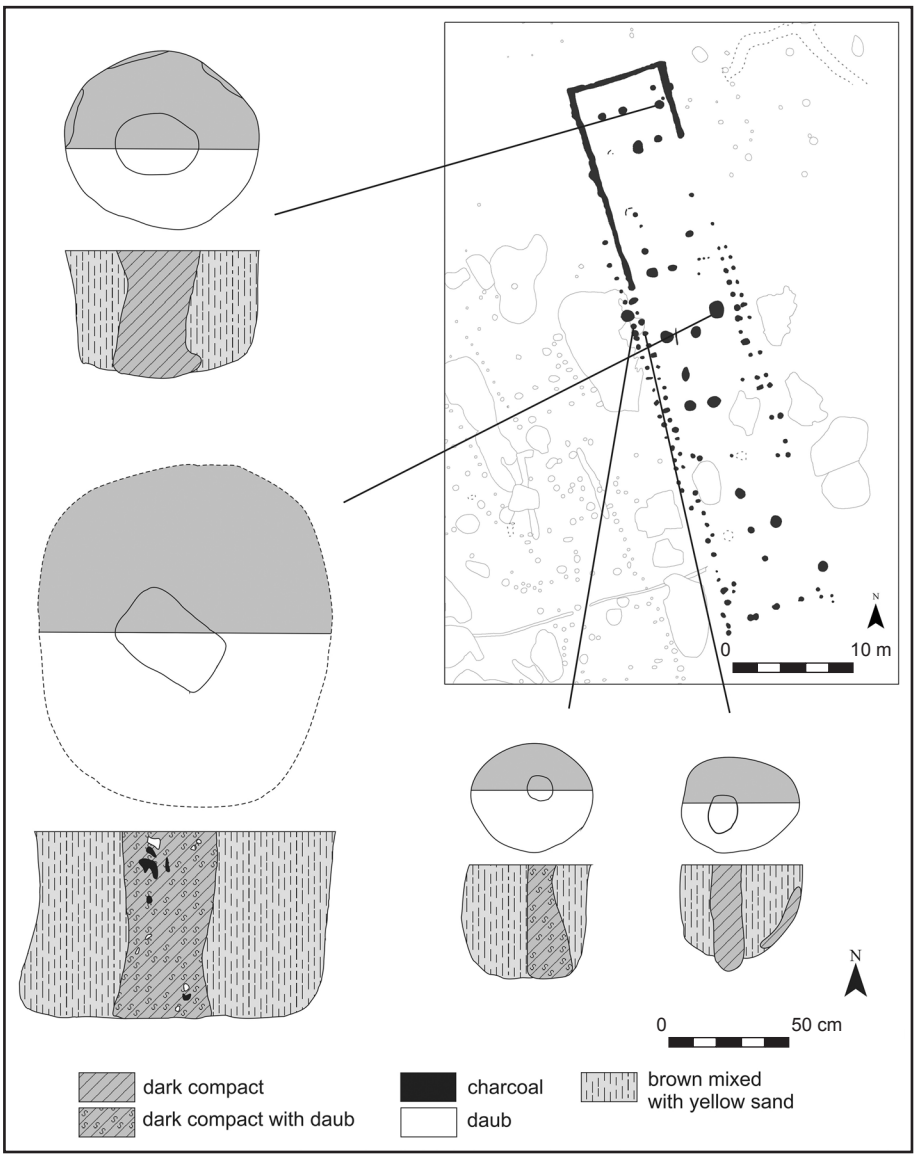

Figure 7. Comparison of inner and wall postholes. Profiles show the well preserved 'shadows' of former wooden posts.

open at this place (less probable) to the east or covered by some lighter archaeologically unpreserved construction. The middle part of the building was limited from the west and east by smaller double postholes shaping the western and eastern walls. The wall posts of the house ground plan show diameters of 15–20 cm, while the bearing posts in the middle part remained extremely strong. Doubled walls are particularly characteristic for ground plans as of the end of the LBK period. The southern part comprises a simple row of postholes, though it should be considered that this part was discovered in the season 1989, unlike the rest of the ground plan discovered in the seasons 1987 and 1988. There could be small differences in the overburden depth, although the depth of the mechanical uncovering was carefully controlled. It is not excluded that the empty space in the eastern wall in the southern part of the house could also indicate some lighter construction or an open space. An interesting detail is represented by one doubled posthole in the southern frontage, which could be interpreted as reparation treatment[1]. In the case of Hrdlovka it is also important to consider incoherent sands under the thin geological layer of the yellow clay, which are at these locations in the bedrock situated closer to the surface. This situation could have forced builders to reinforce the construction. Overlaps of longitudinal walls, so-called antes, extend beyond the southern plan of the ground plan. Based on certain above-mentioned characteristics, house III is close to the late LBK group 1b according to Modderman's typology (Modderman 1986).

In the northern wall trench, the identified postholes were inserted into its body. The postholes with a larger diameter were situated in the corners, the smaller between them at a regular distance (as can be deduced from the situation in the southern part of the trench). The trench was discovered by a method of longitudinal profiles, which unfortunately did not provide such quality information as transversal profiles used in other houses (*e.g.* I, II, VIII), where it was possible to identify the "shadows" of carpenter construction work. These planks were most likely positioned vertically in the trench with added supporting posts.

2. Material and Methods

The hand-drawn field documentation was transformed and processed in the virtual GIS interface. For the purposes of the material and archaeological situations, analyses were also created at the Hrdlovka Database in the MS Office Access 2010 interface. The concept and certain descriptive systems come from the database elaborated for the Bylany settlement, Czech Republic (Květina, Pavlů 2007), which carried out long-term research at this site and established the standard for such extensive assemblage processing. After completion of the processing of all the Neolithic components from Hrdlovka, the database will be accessible for researchers as an analogy searching tool.

Analysis of the material associated with the house ground plan proceeded in the following steps. Firstly, the nearest vicinity of the house was defined based on the methodology developed by I. Pavlů. It suggests a 5 m perimeter as the closest activity area (Pavlů 1977, 13–14) as the arbitrary definition of the house activity area. Based on our approach (Figure 6, right), this area represents only a spatial, not necessarily a functionally and chronologically associated unit. Such parameters can be used as a hypothesis that the majority of the sunken features were with high probability part of the house III building complex. Naturally, one cannot exclude more distant sunken features as part of the building complex, however, their affiliation is not easy to detect and recognize. Additionally, features in the house interior (339 and 1093) were included, although their functional affinity to the house is questionable (see below). On the basis of the 5 m perimeter, feature 345 was included, even though it is penetrated by the house III wall. Its assemblage has a role in the control sample in the analyses.

The second step is the analysis of the particular kinds of archaeological assemblages. The sunken features spatially associated with house III contained ceramics, lithics, daub and animal bones (Figure 8). Ceramic fragments were assigned to the ceramic *individuals* during laboratory elaboration at the level of the archaeological contexts (layer or feature). Unlike other periods of prehistory, the decoration of Neolithic pottery is common and relatively chronologically sensitive, which enables the solution of specific questions (Květina 2005, 10). Based on ceramic decoration, the descriptive system of the Czech LBK created during Bylany site processing (*e.g.* Pavlů, Zápotocká 1978; 1983; Pavlů *et al*. 1985; 1987) and the descriptive system of Czech SBK elaborated by M. Zápotocká (1978; 1998) were used.

In our analysis we use specific terminology, where the crucial term is the *decorative style*. This notion was established according to a grouping of *decoration elements* appearing together in the archaeological contexts within the frame of a single building complex at the Bylany site in eastern Bohemia (CHRON86: Pavlů *et al*. 1986, 314–315). Both approaches comprising elements and styles are used and compared.

In the case of Hrdlovka, certain changes in the commonly accepted Bylany system were performed and adopted. Primarily, the LBK and SBK components were incorporated into one unit, which needed in certain cases a fusion of both descriptive systems (*e.g.* the shapes of vessels, knobs, handles). The basic analysed entity was the ceramic individual, which is defined as a fragment of one vessel contained in a specific context (usually a layer). The factor of matching played an important role. We assume that only the physical matching is irreversible evidence of a common origin of fragments (*cf.* Káčerik 2011, 678). Material retrieved from settlement deposits (in contrast with, for example, funeral sites) was specifically affected by strong fragmentation of ceramic vessels and archaeological deposition in the contexts was diverse.

[1]An analogical situation was detected in LBK ground plans in 2013 on the site of Těšetice-Kyjovice (oral announcement by Z. Hájek).

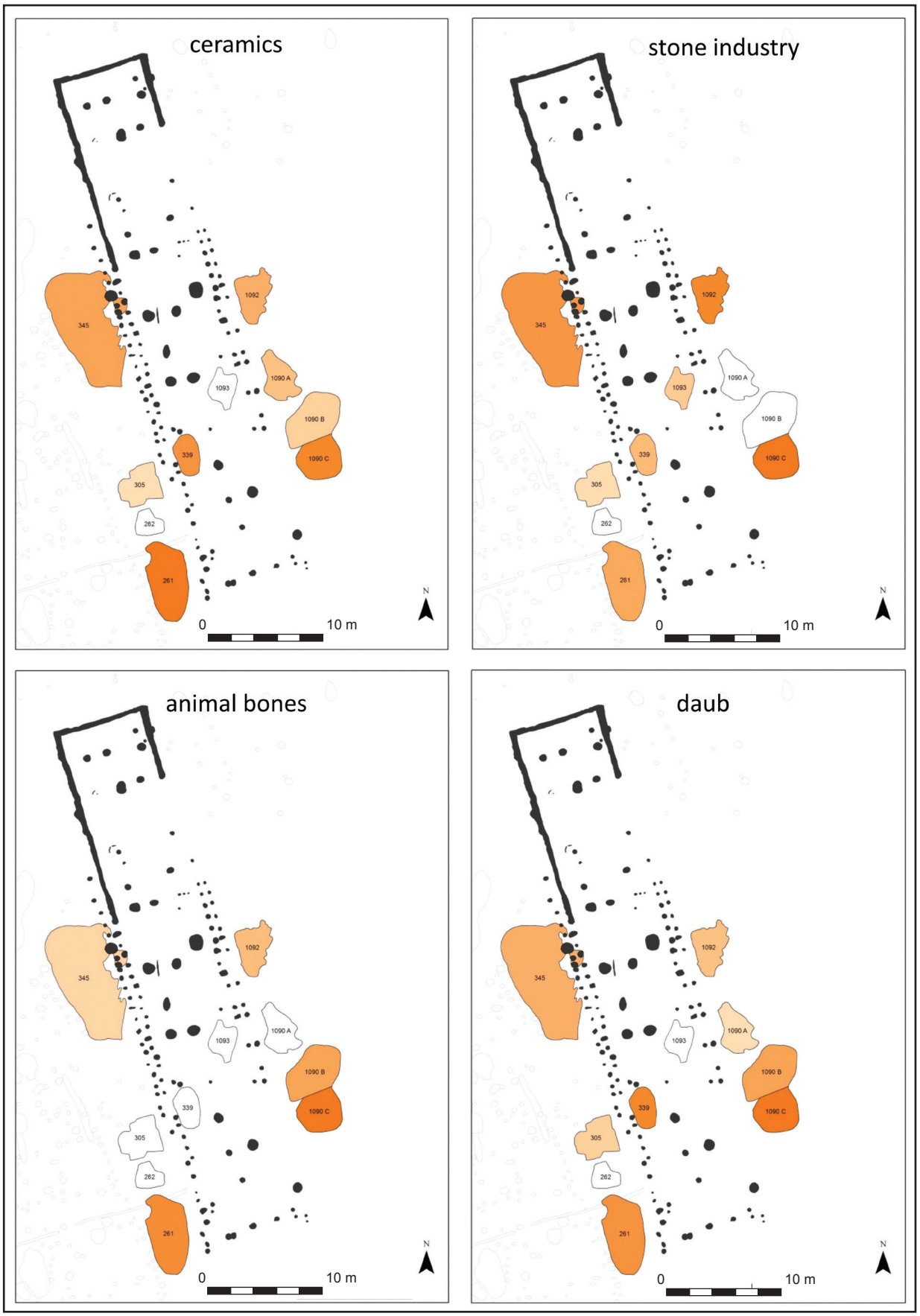

Figure 8. Sunken features spatially associated with house III. The colour spectrum indicates the amount of material related to the excavated context volume (kg/m^3). The feature volume was calculated as a product of the feature area and maximal depth (see Květina 2010, 364).

After the ceramics description, unconstrained ordination technique Principal Components Analysis (PCA) was used to analyse the composition of the particular decoration techniques (elements) of ceramic fragments found within the recorded features (8 features in total) and to analyse the composition of styles of ceramic fragments found within the recorded features. The Canoco for Windows 4.5 package (ter Braak, Šmilauer 2002) was used for all multivariate analyses.

The stone industry from Hrdlovka was evaluated using the method published in Šída (2007). The greatest attention was dedicated to the technotypological description and raw material determination. A complex description of the attributes of artefacts and other lithics ordered in a normalized database was used. The main attributes of the artefact are technotypes and raw material description completed with three main artefact dimensions. Additional traits such as reburning, patination and other characteristics were recorded. Such a formalisation enables a comparison with other lithics assemblages. Raw material determination is based on Přichystal (2009) and Šída, Kachlík (2009).

The archaeozoological analysis was carried out at the Laboratory of Archaeobotany and Palaeoecology in České Budějovice. The faunal spectra were established using the Number of Identified Specimens (NISP). The Minimum Number of Individuals (MNI) was calculated from dental remains. The estimation of age at death of the animals was based on the stages of tooth eruption, replacement and wear. For the cattle, the age at death was estimated according to the stages of tooth eruption and replacement provided by Higham (1967) and the abrasion indexes for the molars proposed by Ducos (1968). For sheep and goats the Payne's wear stages (1973) were used. The age at death for pigs was estimated from the abrasion stages of the lower jaw teeth (Grant 1982).

Selected animal bones from sunken features, associated with the house III ground plan, were analysed in the Poznan radiocarbon laboratory to obtain relevant ^{14}C dating. Collagen from animal bones was used for AMS dating. The calibration was carried out with the OxCal software.

The final step in the analytical process comprises a comparison of the studied assemblages of ceramics in sunken features and their position in order to define the relative chronology of the house III building unit. Such an approach is crucial for the determination of the spatial relevancy or irrelevancy of the ceramics from particular sunken features in the sense of their chronological position.

3. Results

3.1 Ceramics

Altogether 1619 ceramic individuals (1803 fragments, 23,351 g) from sunken features surrounding house III were comprised into the analysis. The first observed group includes metric characteristics (size, thickness, weight and curve). In companion with the degree of abrasion, it serves particularly for the determination of the analysed context fragmentation (Table 2). The rate of fragmentation is commonly high in the Hrdlovka site. The entire vessel (preserved in its profile from rim to bottom) was not detected in the surroundings of house III at all and only 6 whole vessels were present in the assemblage of the entire Hrdlovka site. Although it was possible to match 16% of the fragments within the house III assemblage, most of them represent about 2 or 3 matched pieces. In the case of the house III assemblages, 29% was composed of decorated individuals (linear, stroked, technical and plastic decoration) (Figure 9).

3.2 Lithics

The assemblage consists of 91 artefacts (Table 3). The chipped industry is represented by 67 artefacts (73.6%). The debitage is represented by 71.6% of the chipped industry; the remaining artefacts are retouched tools. Typical types of the Neolithic period such as end-scrapers (7 pieces, 10.4%), truncated blades (sickle blades, 6.9%), laterally retouched blades (3.4%) and notched blades (2.3%) can be found among them. There was only one retouched flake (1.5%) present in the collection. Debitage consists of 24 blades (35.8%), 12 flakes (17.9%) 11 amorphous fragments (16.4%) and 1 core (1.5%). Sickle flash was recorded on only 2 artefacts (3%), 10 artefacts bear signs of utilisation (14.9%), 4 artefacts are burnt (6%).

Local quartzite from north-west Bohemia represents the predominant material for the chipped stone industry

Table 2. Ceramic metric characteristics expressed by mean and standard deviation.

Feature	Indiv.	Frag.	Frag/ Individ	Size*		Thickness (mm)		Weight (g)		Curve** (mm)	
				$\overline{X}$	σ	$\overline{X}$	σ	$\overline{X}$	σ	$\overline{X}$	σ
261	1126	1234	1.1	2.4	0.91	6.76	2.6	12	18.98	1.25	1.5
305	12	16	1.33	1.83	0.58	5.33	1.44	3.5	2.68	1.42	1.31
339	86	120	1.4	2.94	0.99	6.86	2.28	15.16	14.74	2.23	2.1
345	213	236	1.11	2.61	0.85	6.51	2.06	12.4	13.54	1.76	1.61
1090	130	136	1.05	2.38	0.9	6.88	2.41	11.73	14.3	1.24	1.23
1092	52	61	1.17	2.38	0.66	7.13	2.66	12.33	17.60	1.19	0.97
total	**1619**	**1803**	**1.11**	**2.46**	**0.91**	**6.75**	**2.5**	**12.14**	**17.7**	**1.37**	**1.54**

*size was measured by a circle template with a 2 cm step.
**curve express rate of the fragment bend.

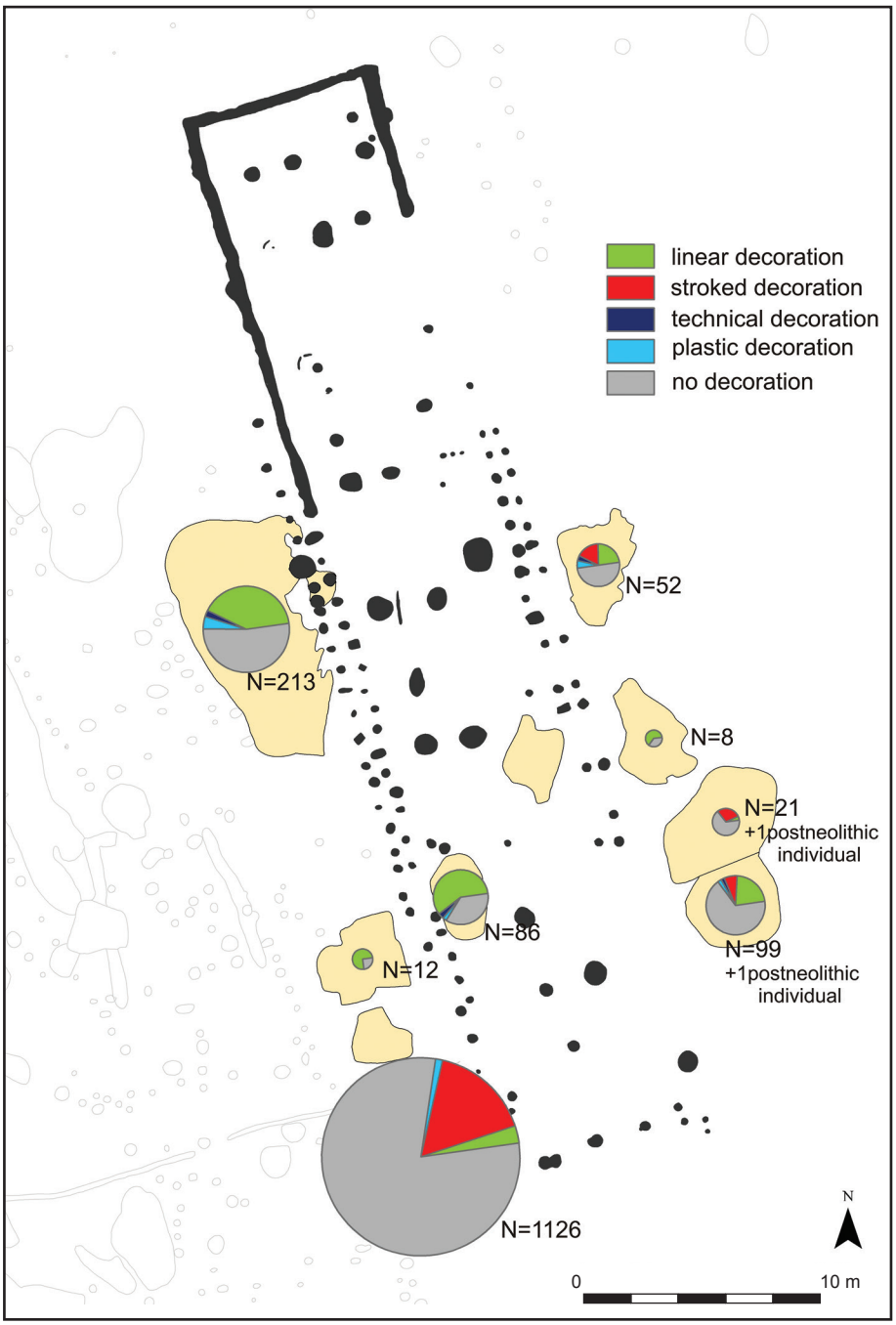

Figure 9. Spectrum of ceramic decoration within sunken features.

production (40 pieces, 59.7%). Flint (SGS) from a 50 km distant source is used (25 pieces, 37.3%). Quite exceptionally there was the use of limnosilicite recorded. This material originates in the basin of Permocarbon in the Kladno region or Pilsen region some 70 km distant. There was also one piece of Bavarian chert from a distance of more than 250 km imported (1.5%). Based on the chipped stone assemblage, the community could be characterised as self-supplying, there is no evidence of either over-production of blades from cores or transport of semi-finished products around the area of the house (Šída 2007).

The polished industry is represented by 9 artefacts. There is no evidence of traces of polished industry production in the vicinity of the house. Finds of polished industry fragments and sandstone could be connected with common re-utilisation of tools. All the artefacts of polished industry are damaged and one case of secondary reuse as hammerstone is recorded. Three fragments of polished tools are evidenced; one fragment of stone adze and one flake of polished tool and three polished axes are recorded. The most interesting artefact represents a small drilled pendant from schist found within the infill of feature 305. Quite common material for the polished industry is metabasite of the Jizerské hory type (Šída 2007), which is represented by 7 pieces. Two remaining artefacts are made from microdiorite and from schist. One fragment of adze and one fragment of axe are burnt.

Table 3. Stone industry assemblage.

	Flint	Tušimice Quartzite	Skršín Quartzite	Kamenná Voda Quartzite	Limnosilicite	Bavarian Chert	Schist	Microdiorite	Metabasite Of Jizera Mountains	Coarse Sandstone	Fine Sandstone	Quartz Sandstone	Sandstone	Arkosa Sandstone	Quartz Porphyre	Quartzite	Fine Quartzite	Conglomerate	Total	% Of Group	% Total
amorphous fragment	2	5	3		1														11	16.4	12.1
blade	11	9	4																**24**	35.8	26.4
flake	5	6		1															**12**	17.9	13.2
core		1																	**1**	1.5	1.1
debitage	18	21	7	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**48**	71.6	52.7
scraper	3	3	1																**7**	10.4	7.7
cross retouched blades	3	2	1																**6**	9	6.6
laterally retouched blades			2			1													**3**	4	3.3
notch on blade		1	1																**2**	3	2.2
retouched flake	1																		**1**	1.5	1.1
types	*7*	*6*	*5*	*0*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	***19***	28.4	*20.9*
chipped industry	*25*	*27*	*12*	*1*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	***67***	100	*73.6*
hoof like axe									1										**1**	11.1	1.1
axe									3										**3**	33.3	3.3
drilled pendant							1												**1**	11.1	1.1
flake of polished tool									1										**1**	11.1	1.1
fragment of polished tool								1	2										**3**	33.3	3.3
polished industry	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*1*	*7*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	***9***	100	*9.9*
grinding stone										3	1			1	3		1	1	**10**	66.7	11.0
amourphous fragments																1			**1**	6.7	1.1
hammerstone/axe									1										**1**	6.7	1.1
flat whetstone													1						**1**	6.7	1.1
polisher													1						**1**	6.7	1.1
manuport *												1							**1**	6.7	1.1
other industry	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*3*	*1*	*1*	*2*	*1*	*3*	*1*	*1*	*1*	***15***	100	*16.5*
total	***25***	***27***	***12***	***1***	***1***	***1***	***1***	***1***	***8***	***3***	***1***	***1***	***2***	***1***	***3***	***1***	***1***	***1***	**91**		***100***
%	*27.5*	*29.7*	*13.2*	*1.1*	*1.1*	*1.1*	*1.1*	*1.1*	*8.8*	*3.3*	*1.1*	*1.1*	*2.2*	*1.1*	*3.3*	*1.1*	*1.1*	*1.1*	***100***		

* stone transported by humans

Additional stone industry is represented by 15 artefacts, particularly by fragments of grinding stones (10 pieces, 66.7%) with traces of use, 3 of them are burnt. The material used, which includes coarse sandstone, quartz sandstone, arkosa sandstone, quartzite, and fine quartzite, is extremely variable. A flat whetstone and polisher were present in the near vicinity of the house. One manuport (see Table 3) from quartz sandstone was originally prepared as a polisher, but was devaluated by burning.

3.3 Animal bones

The osteological data totalled 552 faunal remains found in five archaeological features (261, 345, 1090 B, 1090 C and 1092). Faunal spectrum is summarized in Table 4.

The share of identified faunal remains was low (29.5%, NISP=163). The amount of undetermined bone elements was preponderated (70.5%, N=389). The total weight of animal bones was 587 g (average weight of one fragment was 1.1 g). The low weight of animal remains revealed the considerable fragmentation and damage of osteological material which negatively influenced its determination. The remains of Bovinae were predominantly registered (*Bos* sp.; NISP=143; 87.7 % of total NISP) where the cattle bones predominated (*Bos taurus*; NISP=141; 86.5%). Only one bone belonged to aurochs (*Bos primigenius*; NISP=1; 0.6%). The identification of this taxon was based on osteometric analysis (Degerbøl, Fredskild 1970). The remains of sheep and goats (*Ovis/Capra*; NISP=12; 7.4%) and pigs (*Sus* sp.; NISP=8; 4.9%) were discovered sporadically.

Table 4. Faunal spectrum in the studied assemblage.

Taxon	NISP	MNI
Cattle (*Bos taurus*)	141	6
Aurochs (*Bos primigenius*)	1	1
Cattle/aurochs (*Bos taurus/primigenius*)	1	–
Caprines *(Ovis/Capra)*	12	3
Pig *(Sus domesticus)*	1	1
Pig/wild boar (*Sus domesticus/scrofa*)	7	–
Category	**N**	**–**
Large mammal	17	–
Medium mammal	2	–
Undetermined mammal	370	–
Total	**552**	**11**

Teeth and their fragments, in particular the resistant remains of teeth enamel, were represented as the most frequently components (N=145; 26.3% of total finds). Apart from the teeth, autopodial bones were found (N=35; 6.3%). The mentioned animal remains weathered slower in comparison with other parts of the skeleton (Behrensmeyer 1978). Fragments of vertebra, skull or shoulder blade occurred rarely (N=8; 1.4%).

In spite of a poor preservation of analysed teeth, a slaughtering age of six cattle individuals could be estimated (Table 4). The age of two individuals was between 5 and 18 months. The other two were killed before the age of 30 months. These four individuals were slaughtered until reaching their maximum weight. Number of cattle older than 30 months was low. One individual was slaughtered between 5 and 8 years and a second one lived more than 9 years. Concerning small ungulates, a sheep/goat aged between 12 and 36 months and pig slaughtered between 8 and 22 months were determined. Unfortunately, number of teeth of the domestic animals was too small to provide reliable information about economy of the Neolithic people living at this site.

3.4 Daub

Daub was identified in all features apart from 1093 and 262 in the surroundings of house III. Categories of weight, size and eventually construction imprints were observed (Table 5). The highest amount (32% of the overall weight) and fraction size (pieces measuring 15–20 cm in diameter) was recorded in feature 339. The daub in this feature forms a 10 cm thick layer distinguishing the upper and lower layers within this feature. A similar pattern with a 5 cm thick layer indicates feature 261. Certain rectangular shaped construction imprints provide evidence of the presence of planks made by carpentry techniques.

3.5 Chronology of the building complex

The relative chronology based on ceramics attributes from sunken features spatially associated with house III indicates its focal point between the LBK IV and SBK I periods according to the Bohemian Neolithic chronology (Pavlů, Zápotocká 2007, 27–49) (Figure 10). This result is supported by the high frequency of thin band decoration (alfa 30) and the presence of transitional techniques: a spade line accompanied by strokes and single strokes. The last mentioned mode of decoration, however, greatly exceeds in quantity the classical double strokes. Younger SBK techniques (multiple strokes arranged in an unusual curvilinear motif) and two intrusive

Table 5. Daub contains. An overview in features spatially associated with house III.

Feature	Layer	Sector	Size*	Weight (g)	Imprints**	Summary (g)
261	0–20	W sector	1, 2	1 244	no	
261	20–base	W sector	1, 2	1 400	no	3 726
261	0–base	W sector	1, 2	295	no	
261	0–base	NE sector	1, 2	787	no	
305	0–base	W sector	1, 2	455	no	455
339	0–20	W sector	1, 2, 3, 4	2 307	yes	6 325
339	0–base	E sector	1, 2, 3, 4	4 018	yes	
345	0–base	E sector	1	253	no	
345	0–base	None	1, 2	1 448	no	2 595
345	0–base	SW sector	3	214	no	
345	0–base	NW sector	1, 2	680	no	
1090 A	0–base	E sector	1	36	no	36
1090 B	0–base	E sector	1, 2	1 535	no	1 535
1090 C	0–15	W sector	1, 2	3 652	yes	4 195
1090 C	15–base	W sector	1, 2	543	yes	
1092	0–base	E sector	1, 2	514	no	653
1092	0–base	W sector	1	139	no	
					total	**19 520**

5 766

* diameter: 1 – <5 cm; 2 – 5–10 cm; 3 – 10–15 cm; 4 – 15–20 cm
**imprints of house construction components

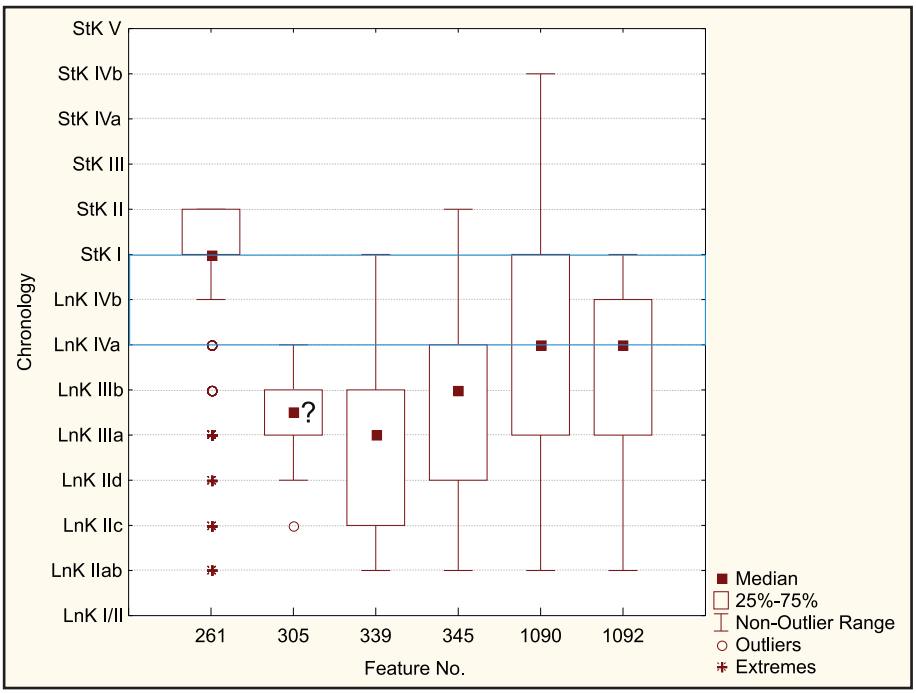

Figure 10. Chronological box and whisker plot. Chronological phases were transformed to a numeral ordinal scale. A row of numbers was assigned to each LBK or SBK decorated fragment. The frequency of the number appearance creates the base of the plot. The whiskers indicate the rather hypothetical range of styles contained in the features. The blue box represents the intersection of style ranges. Kruskal-Wallis test:
H (5; N= 1159) =539.0027 p =0.000.

La Tène fragments were also present in the upper layers of features 1090 B and C, which created a slight deviation in the overall summary. House III assemblage is nevertheless comparable with LBK IVb/SBK I assemblage at the Hrbovice-Chabařovice site distant 18 km north-east of Hrdlovka. Here the transitional phase is represented in particular by feature 31 characterized by the presence of parallel double strokes. The proportion of this technique, although significant for LBK/SBK transition, was quite low (4.7%) (Zápotocká, Muška 2007, 62). Additionally, the techniques of parallel and single strokes were observed in the transitional phase of the Dresden-Prohlis site in the Dresdener Elbtalweitung area in Saxony (Link 2012). In Hrdlovka, a mixture of stroked and linear techniques is represented by the line accompanied by single strokes on one side (Figure 14: feature 1092). In both the above-mentioned sites, these chronologically significant techniques were present in features together with late LBK elements and classical double strokes in chevron motives, multiple strokes also occasionally occur.

Feature 305 is kept aside due to its low number of ceramic individuals, its infill contained only (apart from some unspecified fragments) fragments of one vessel decorated with a wide band (alfa 20). Feature 345 is out of the horizontal stratigraphy pattern because it lies in clear superposition to

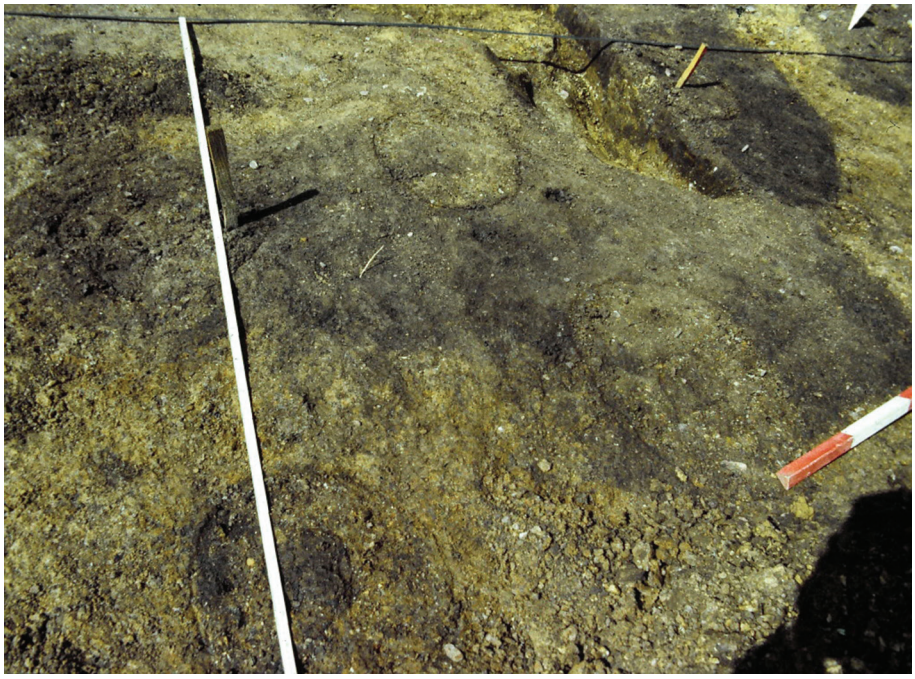

Figure 11. Colour contrasts indicate superposition of the house III postholes and feature 345 (photo J. Beneš).

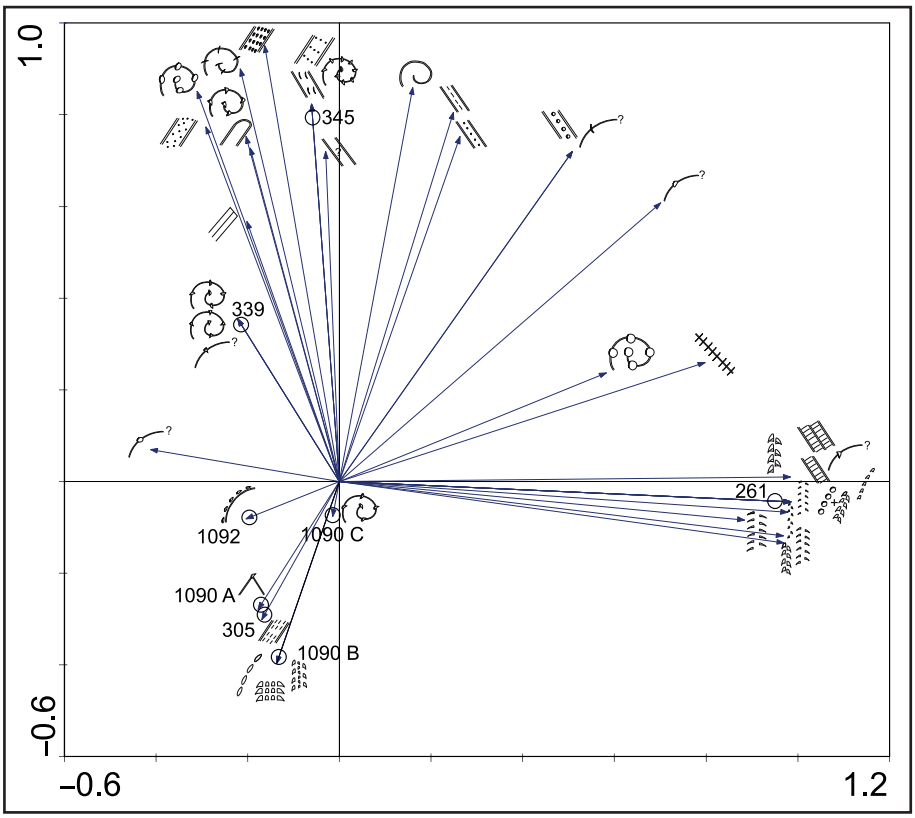

Figure 12. Species (decoration elements on ceramic individuals) and samples (features) biplot of the PCA analyses are depicted. The first and second PCA axes explained 32.7% and 28.2% of the variability in the species data, respectively. The same analysis, but in terms of decoration styles, was carried out. This analysis (Figure 13) did not demonstrate such differences among the three groups of features.

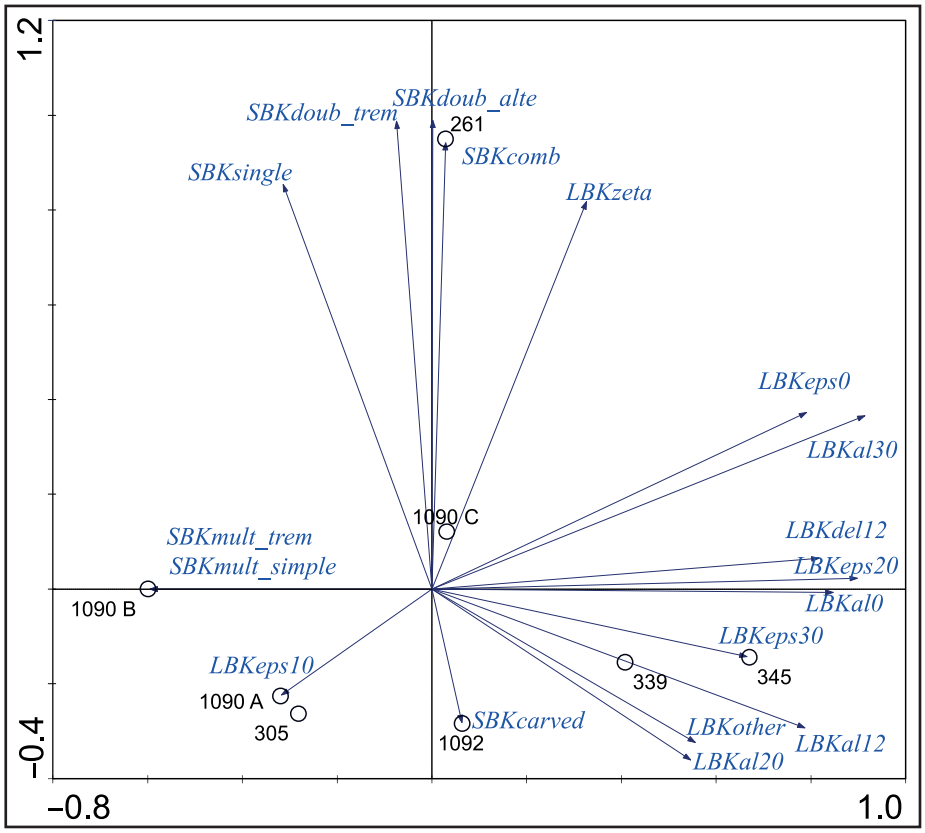

Figure 13. Species (styles of ceramic individuals) and samples (features) biplot of the PCA analyses are depicted. The first and second PCA axes explained 35.2% and 27.7% of the variability in the species data, respectively.

the ground plan of house III (Figure 11). It plays the role of control assemblage in the analyses which seems to be useful in case of feature 339. The short distance between the feature rim and the house III wall postholes might refer to the superposition (the upper parts, in which a disruption would be noticed, vanished due to overburden). However, feature 339 could also be the inner house pit. These are sometimes interpreted as cellars (Pechtl 2009b, 285, 289), which may

have been used in a slightly different way than grain silos (Pavlů 2011, 42). At the Bylany site the material from the cellars is chronologically older than the other building complex pits. It is still considered, however, a functional part of the house (Pavlů 2000, 219). Indirect evidence in case of features 339 and 345 represents the spectra of lithic raw materials. The fill of feature 339 contained, in contrast to the others, an artefact made of Bavarian chert. The spectrum of grinding stones materials also differs in feature 345 (arkosa sandstone, fine quartzite and conglomerate). These artefacts were made from local materials and complete exploitation of the sources suggests more frequent raw material change in the timespan than in the case of other lithic industry. The metric and decoration aspects of the ceramics from feature 339 were different from the rest (Table 2, Figure 8). Evidence of rather rapid filling of the feature (in the sense of processual time) is also provided. The functional affinity of feature 1093 to the house complex could not be proved or rejected based on the lack of data. The entire infill provided only one fragment of polished stone axe.

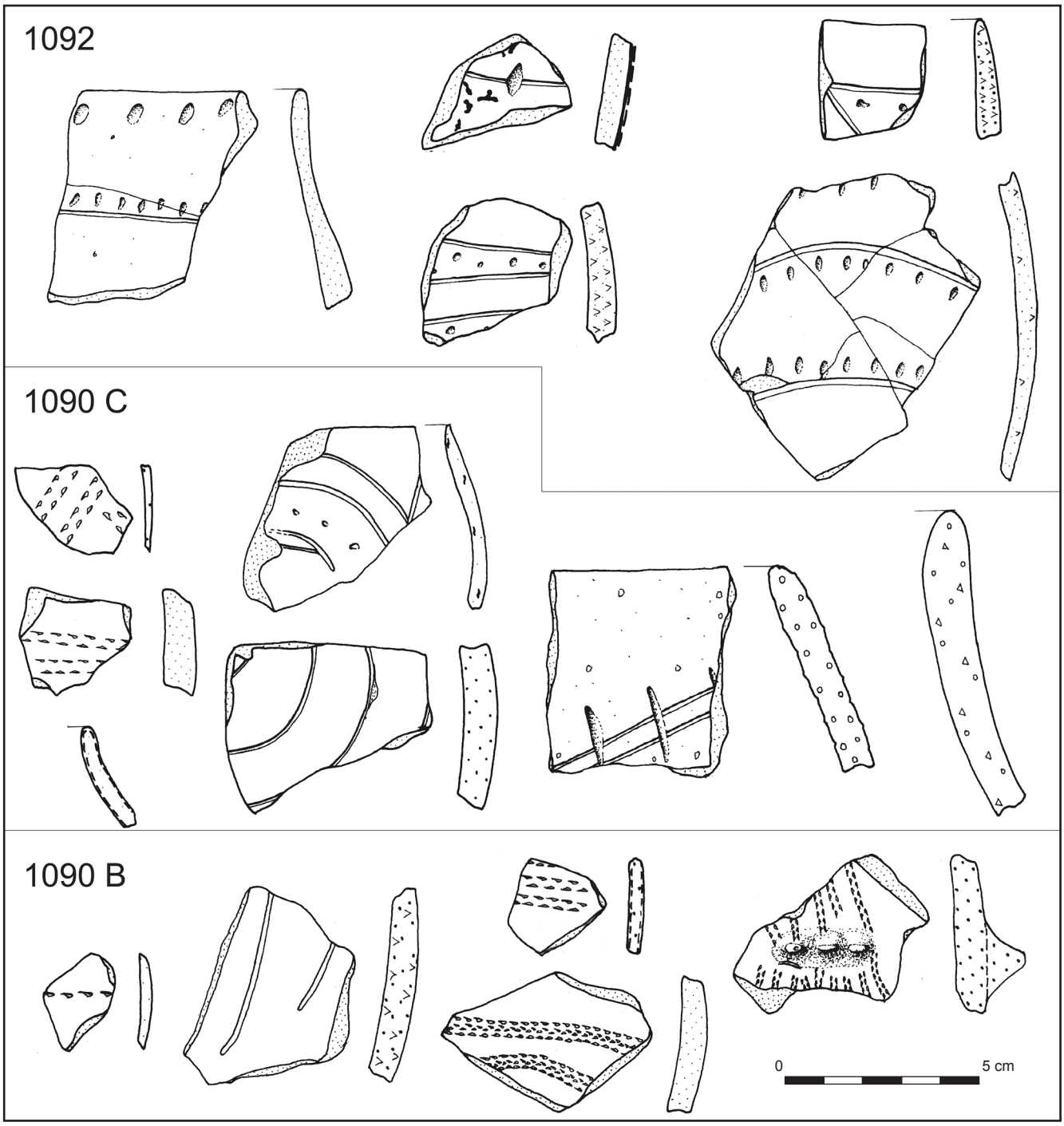

Figure 14. Examples of ceramic individuals found in the features associated with house III (drawn by M. Divišová).

The distribution of ceramics decoration in the house III surroundings was also analysed using the PCA ordination. Figure 12 indicates the distribution of ceramics on the level of decoration elements with no respect to styles (see above). Here three groupings can be observed. The chronological heterogeneity (in agreement with Figure 10) of the house III spatially associated features was confirmed, particularly in the case of features 345 and 339. In addition, feature 261 proved to be an outlier due to the high representation of stroked elements. Feature 261 could therefore be affiliated with other structure, such as the neighbouring house II, where the ceramics decoration is formed predominantly by double strokes and whose construction refers to the SBK architecture. This could also be affected, however, by the quantitative difference of SBK (183) and LBK (32) individuals. The SBK ceramic individuals are, although present in smaller fractions (weight: mean 5.54; standard deviation 5.25), compared to the LBK (weight: mean 20.24; standard deviation 57.2).

Apart from relative chronology, absolute dating of the building complex using radiocarbon data was applied. Animal bones were dated instead of charcoal in order to avoid data distortion. Unfortunately it became apparent that the majority of the bones had an insufficient amount of collagen content. Only 36% of the submitted samples were successful in the case of the entire Hrdlovka site. Another

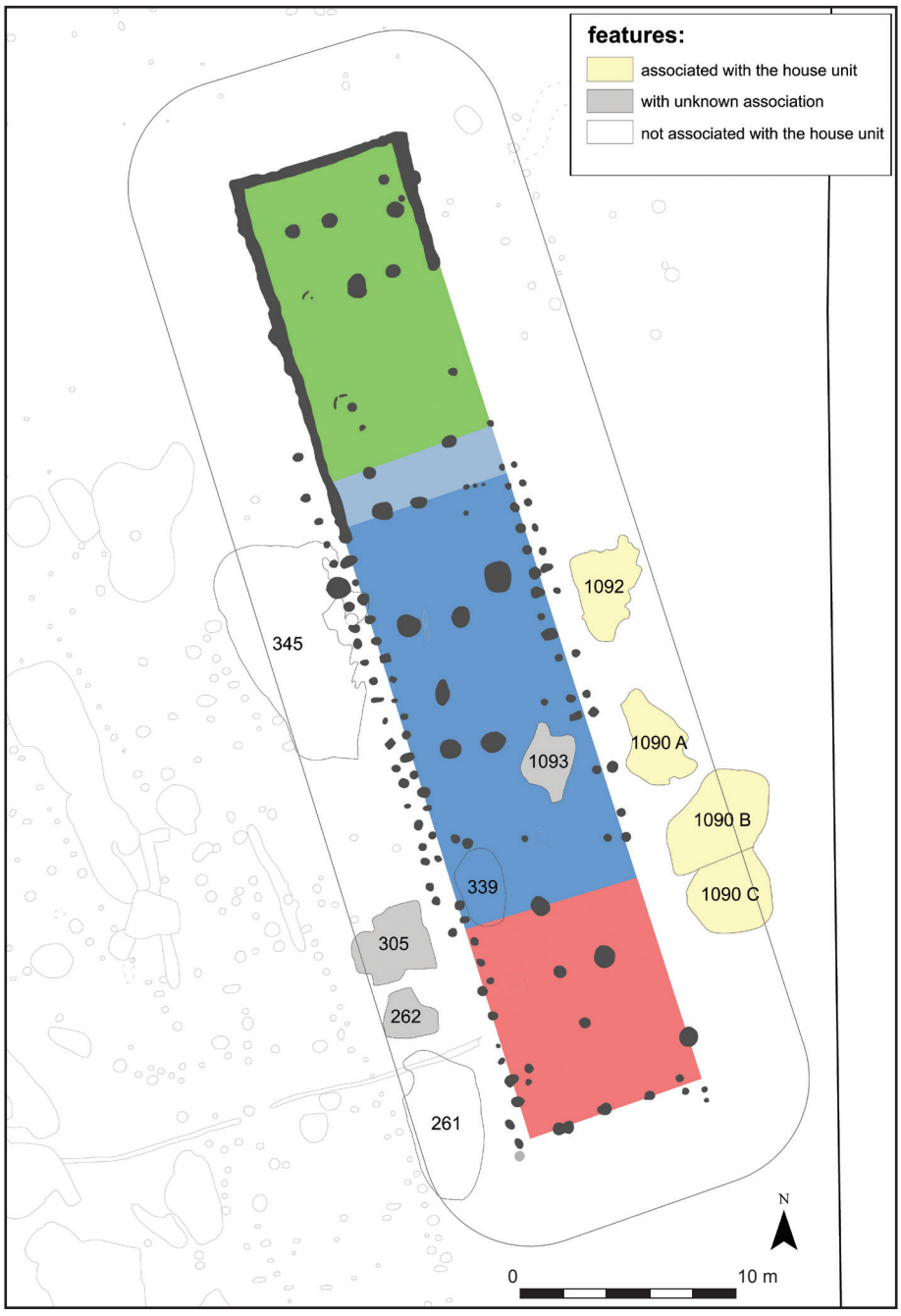

Figure 15. House III and the chronological position of the spatially related sunken features after analysis. The yellow colour indicates chronologically related features.

Table 6. Radiocarbon dates from the features spatially associated with house III.

Lab.no.	Name of sample	Feature	Location	BP	Probability	BC_cal
Poz-51265	Hrdlovka 4	261	W half; 0–20 cm	5660±40	95,4%	4596–4439
Poz-55406	Hrdlovka 1C	345	0–bottom	4960±70	95,4%	3943–3855

problem concerning radiocarbon dates in the 5 m perimeter area of house III is that no date was successfully obtained from the sunken features from the eastern part (features 1090 A, B, C; 1092). Only 2 radiocarbon data were obtained from the animal bones from the infill of other sunken features of house III area despite an effort to repeat the attempt several times (Table 6). Successful dating of the bone from feature 261 seems not to be related to house III and the early SBK house II, as indicated by relative chronology. Radiocarbon date from animal bone from feature 345 is much younger and cannot be connected with the relative chronological setting of ceramics from this sunken feature. It indicates the somewhat younger (Early Eneolithic) deposition of animal bone in the successive archaeological period.

Despite the problem described above, it can be summarized that the ceramic individuals from the sunken features along the eastern wall of house III can be classified into the LBK IV/SBK I interval (Figure 14). The material from the sunken features along the western wall cannot be related to house III. The sunken feature 345 infill is much older and the infill of feature 261 is younger and can be related to another building structure (Figure 15). The sunken features inside the house plan cannot be associated with house III (feature 339) or their relation to house III is unknown.

Based on the relative chronology we have determined that only features 1090 and 1092 are synchronous with house III. After the removal of osteological finds from features 261 and 345 from the analysis, the proportion of bones and teeth severely damaged by weathering declined by 10%. The representation of weakly weathered fragments increased by 8.8%. The above-mentioned indicates the better preservation of the assemblage. With regard to the fauna, the removed material from features 261 and 345 represents a reduction in the species spectrum, as the remains of pigs and aurochs disappeared. Only the remains of cattle and sheep/goat remained among the findings in features 1090 and 1092.

Only 12 lithic artefacts were located in these features, one of which is lost. 4 grinding stones and 7 pieces of chipped industry have survived. The grinding stones were made of quartz porphyre and coarse-grained sandstone (2 and 2 pieces). Among the chipped industry, 3 amorphous fragments (quartzite of type Skršín and Tušimice and flint), 3 blades (flint) and a scraper made of Skršín type quartzite were detected. The collection, which can be identified with house III, is extremely small and does not allow any statistical comparison. It fits into the general context of older Neolithic stone industry collections (Šída 2007). Assemblages of the older and younger Neolithic generally do not display a variability which would allow for recognizing the different phases of cultures defined by variability in ceramics.

4. Discussion

Extraordinarily large houses used to be considered focal places of social agency in settlements, a kind of club house. The argumentation was based on the fact that only one extraordinary house appeared per one settlement phase (Soudský 1969). The structure, distribution and infill of the sunken features surrounding house III evince a common pattern observable with most long houses. In this respect extremely large houses in Central Europe do not differ from ordinary ones. No correlation between the size of houses and the surrounding features size has been demonstrated (Lenneis 2013, 46), with this also being the case at the Hrdlovka site in the case of house III (in the current state of data processing). Based on this evidence, large houses did not have a special economic status, although it is questionable if sunken feature size is related in a linear way to the economic potential of the house inhabitants.

It is generally accepted that the house was the centre of social life in the Neolithic society, which was complementary joined with their beliefs and cosmology (Hofmann, Smyth 2013). In constructing extremely long houses, more emphasis was placed on the household group itself and closely associated groups, such as neighbours or relatives. Stratification of Neolithic society could therefore be observed on the level of different households. This can be seen in the erection of extremely large houses, which can be considered evidence for competition among various households within the settlement (Pechtl 2009a, 193 after Hofmann 2006, 115–118). As indicated in the analysis of the large house phenomenon, there is a concentration of extremely long houses in one region and a clustering of enclosures in other regions (Pechtl 2009a, 192–193, Figure 5 and 6). North-west Bohemia and Saxony belong to the first category of such regions, which could lead to a consideration of a similar development in these two bordering areas. Apart from our evidence from Hrdlovka, two other extremely long houses were investigated here, Březno (42.5 m, Pleinerová, Pavlů 1979) and Postoloprty (41.3 m, Soudský 1969). There is a need to test if an interrelation exceeding the Krušné hory mountains might also be observed on the basis of ceramics decoration.

Our methodology demonstrates the possibility for working with the Neolithic assemblages, which originated in the complicated feature taphonomy in the sense of an artefact or ecofact which had deposited over the long term or short term in a sunken, but extremely open feature. Our analysis indicates, despite the partial heterogeneity of the materials from the features enclosing house III, that only part of the ceramics belong to the particular Neolithic period. This means that the analytical method used here shows relevant

results in the sense of a statistically defined probability. In contrast, the radiocarbon date obtained from the animal bone (feature 345, Poz-55406) indicates a much younger age (possibly even the Late Neolithic) of a bone deposition within a still more or less open feature. Proper absolute dating of the bioarchaeological material should claim for the series of AMS data from one sunken feature. Unfortunately, the Hrdlovka site was not sampled for archaeobotanical remains, which could offer suitable biological material for AMS dating, during the excavation in the 1980s. It is a limiting factor for a more precise absolute chronology of the particular features and materials in Hrdlovka generally. A chronology based on a "traditional" methodology (adopted Bylany site system), combined with multivariate statistics, seems to be suitable and effective.

Neolithic long houses chronology is traditionally based on a so-called building complex definition (Pavlů 1977, 13–14). This approach presumes that sunken features surrounding the house were used by inhabitants as a garbage space (*e.g.* Pavlů 2000; Hachem 2000; Lenneis 2013). According to other scholars, however, the filling process began after the house was abandoned (Květina, Končelová 2011a, 214). In other words, the material from the sunken features is in *post quem* relation with the active usage of the house. It is questionable if the time-span between the house usage and its abandonment would have an impact on the archaeological material in terms of ceramics chronological sensitivity. It is important to bear in mind that the Neolithic long house life-span is estimated at usually ca. 25 years (*e.g.* Modderman 1972, 85; Stäuble 1997, 138; Lüning 2005, 153), which corresponds with one human generation. This estimation is now under criticism based on dendrochronological data (Schmidt *et al.* 2005). Higher durability of the LBK houses is assumed if we take into account the durability of oak wood usually used for their construction (Beneš 2004, 146).

The infill of sunken features is a result of human agency and waste depositing in combination with natural factors, but according to many scholars an archaeological image can arise from various different ways of human behaviour (*e.g.* Schiffer 1987). For an understanding of this process, the spatial organisation of long houses agency is crucial. Traditionally, the tripartite division of the Neolithic houses has been observed (*e.g.* Whittle 1996, 163). There is agreement that the middle part of the house is commonly affiliated with the habitat zone, in contrast to usage of the other parts which is a subject of discussion (*e.g.* Modderman 1972; Stäuble 1994; Coudart 1998). The different results for the long house surrounding space can be observed in the relevant literature. Settlement refuse analysis of the Neckenmarkt site, for example, demonstrated the southern part of the house surroundings as the focal place of human agency (Lenneis 2001, 49–78). Mold site, Lower Austria, in contrast, revealed a different pattern of activity concentrated along the house longitudinal walls (Lenneis 2013, 45). Interesting results are also brought to light by means of animal bones analysis. According to the material gained from the North European Plain region, A. Marciniak (2008) suggests a model of cattle and pig ritual consumption in places among individual houses, while goat/sheep bones distribution in house surroundings likely reflects common household consumption. Arrangement of animal bones at the Cuiry-lés-Chaudardes site indicates a spatial division of the settlement: in the north-west part boar and other wild taxa, in the south-west sheep, while cattle prevailed in other parts. This division is also reflected in the house size. This is interpreted as evidence of different family groups (Hachem 1995). Similarly, research in the Rhineland region indicates spatial trends based on family affiliation within the settlement. The suggested model also assumes the existence of house yards as a space for specific household activities (Classen 2005).

Based on the above-mentioned examples, it can be assumed that the basic "artefactual environment" was established by the LBK package although the patterns of human behaviour may differ from site to site. In the Hrdlovka case a number of the above discussed agencies can be identified. This is particularly the case of feature 261 which seems to be chronologically associated with house II, although it spatially respects the house III ground plan. These kinds of spatial relations are also observed on the Bylany site (Pavlů 2000, 295). This archaeological picture may reflect either symbolic, in terms of the house of ancestors, or functional issues such as the presence of garbage dumps or a conglomeration of abandoned and actively used houses (Květina, Končelová 2011a, 214).

With respect to the ceramic decoration, the transitional LBK/SBK phase represented by Hrdlovka house III has been compared to the east Bohemia region, namely with the Bylany site. Here, unlike Hrdlovka, where a thin band (alfa 30) predominates, late LBK phases are characterised by thick notes on pre-outlined or no line and alfa 30 is extremely rare (Květina, Pavlů 2007). The temporal onset of individual decoration elements may differ in particular regions.

5. Conclusion

House III with its length of 47.5 m is the extraordinary example of Neolithic architecture. Despite this statement, an analysis of this huge structure indicates that the building complex of house III demonstrates traits of a common ground plan layout with a typical arrangement of "loam pits" which do not diverge from comparable building complexes. This fact generally indicates no differences between extraordinarily long houses and much smaller ones.

Our approach involved a three step analysis of house III and spatially associated features based on ceramic fragments, animal bones, stone industry and daub. This methodology demonstrated a possibility for working with Neolithic assemblages, which originated in the complicated feature taphonomy in the sense of an artefact or ecofact's long term or short term deposition. The first step includes the acceptance of the hypothesis that the nearest sunken features in a perimeter of 5 m around a house ground plan

were spatially and, possibly, functionally connected with the building unit. Such a hypothesis was tested in the following step by means of artefacts and ecofacts (in this case lithics and animal bones). A correlation analysis confirmed the affiliation of the majority of the sunken features to the house III activity area, while certain sunken features were associated only spatially.

In the final step only the artefacts and ecofacts from the sunken features affiliated to the house III ground plan (feature 1090 A, B, C; 1092) should be considered, if we only evaluate "the life of house III". This demonstrates the reduction of the informative value of the building complex after the exclusion of chronologically non-related assemblages.

The chronology of ceramic individuals from certain sunken features along the eastern wall of house III determines the building unit into the LBK IV/SBK I interval, unfortunately in the case of house III without the direct support of radiocarbon data. It is apparent that the application of the Bylany site chronological system to the region of north-west Bohemia might distort the picture of the local chronology. Although the Bylany chronology reflects basic trends, a detailed relative chronology of the Hrdlovka site would need to be performed from the beginning. In spite of the fact that the distribution of lithics is well known, almost nothing is known about the spread of ceramic decoration, either in the form of artefacts or ideas. Bearing this in mind, the specific features of the Neolithic in north-west Bohemia will be the subject of our further study.

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