Volume VI • Issue 2/2015 • Pages 161–179

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

The Rare Deposition of Neolithic (SBK) Grinding Tools and Longhouse 8 from Hrdlovka (Czech Republic): Analysis and 3D Virtual Reconstruction

Jaromír Beneš[a,b], Václav Vondrovský[a], Petr Šída[b,c], Michaela Divišová[a,b], Lenka Kovačiková[a,b], Jaromír Kovárník[b], Petr Vavrečka[d]

[a]*Institute of Archaeology, Faculty of Philosophy, University of South Bohemia, Branišovská 31a, 370 05 České Budějovice, Czech Republic*
[b]*Laboratory of Archaeobotany and Palaeoecology, Faculty of Science, University of South Bohemia, Na Zlaté stoce 3, 370 05 České Budějovice, Czech Republic*
[c]*Department of Archaeology, Faculty of Arts, University of West Bohemia in Plzeň, Sedláčkova 15, 306 14 Plzeň, Czech Republic*
[d]*Institute of Archaeology of the CAS, Letenská 4, 118 01 Praha 1, Czech Republic*

ARTICLE INFO

Article history:
Received: 23rd December 2015
Accepted: 31st December 2015

Key words:
Stroked Pottery Culture
longhouse
grinding stones
offering
starch analysis
virtual reconstruction

ABSTRACT

This paper discusses the grinding stones deposit in feature 838 from the Neolithic site of Hrdlovka, northwest Bohemia, which spatially interferes with the longhouse 8 ground plan. According to the relative chronology, based on an analysis of the ceramics recovered from feature 838, the context belongs to the Late SBK, the last phase of Neolithic occupation of this settlement. The grinding tools were subjected to starch analysis, which proved that they were used prior to their deposition, as evidenced also by macrolithic stone analysis that stated, that the grinding tools were used, broken and one was even burnt. The paper discusses the possible relationship between feature 838 and longhouse 8. The possibility of building offering, which represents a phenomenon known also from other Neolithic settlement areas, is also discussed. The paper further presents hypothetical 3D images of longhouse 8 by presenting two versions of its virtual reconstruction that emphasise the presence of the grinding stones deposit and its possible importance.

1. Introduction

The Neolithic site of Hrdlovka was situated in northwest Bohemia, Czech Republic, in the lowlands of Podkrušnohoří basin, very close to the foothills of the Krušné Hory mountains (Figure 1). The main industrial activity here is open-cast coal mining, which has substantially affected the larger part of this lowland landscape. A large proportion of the prehistoric and medieval sites were destroyed, including the Hrdlovka site itself (Beneš *et al.* 1993). The expansion of the open-cast mining during the 1960s was a stimulus for a lot of archaeological rescue actions. Field identification of the Neolithic site of Hrdlovka itself was connected with the systematic control from the approaching huge open mine of Maxim Gorkij in 1987 (Beneš 1991a; 1991b). The entire site became no more than mine spoil and today does not exist.

Hrdlovka was a polycomponent site, but most attention was paid to the Neolithic, namely the *Linienbandkeramik* – Linear Pottery Culture (LBK) and *Stichbandkeramik* – Stroke Ornamented Ware Culture (SBK) period. The area excavated reached 8.35 hectares with 59 longhouses recognized. Due to the salvage character of the excavation, some areas were only sampled; however, the area SJ was investigated in detail (Figure 2). From 2009 a team from the University of South Bohemia started to process and investigate this site as the topic of a research grant (Beneš *et al.* 2014; Vondrovský *et al.* 2015).

This contribution deals with an extraordinary deposition of grinding stones in feature 838, their analysis and possible relation of the feature to longhouse 8.

1.1 Deposition of grinding tools in feature 838 and longhouse 8

The feature 838 and longhouse 8 were situated in the northern part of the excavated area SJ (Figure 3). This area was characterized by particularly well-preserved traces of longhouse constructions. The sunken feature 838 can be described as a roughly oval settlement pit of maximum depth 50 cm with a prolonged extension towards the northwest.

*Corresponding author. E-mail: benes.jaromir@gmail.com

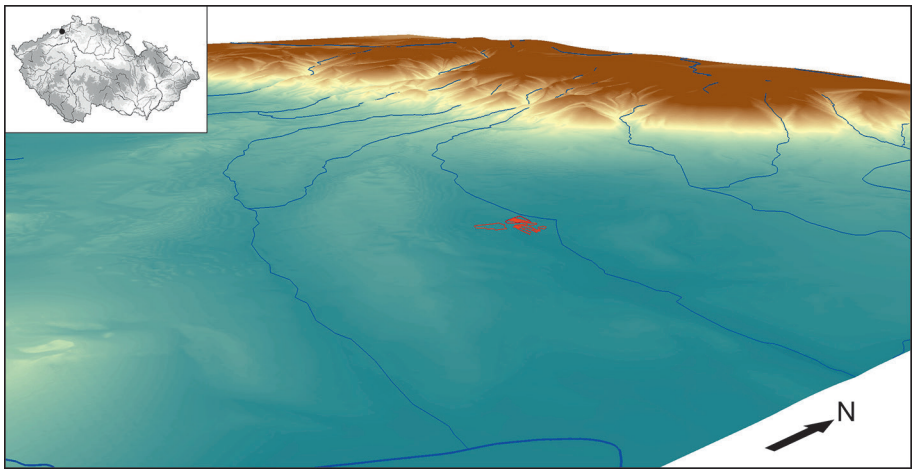


Figure 1. The 3D reconstruction of initial Podkrušnohoří basin landscape and position of the Hrdlovka site (landscape reconstruction K. Křováková).

The character of feature 838's infill could be described as a mixture of coarse yellow and dark brown gobbets. This observation contrasted with the infill of the majority of the common Neolithic features at the Hrdlovka site, which contained homogeneous fine-grained dark infill. The bottom was straight and regular; it constituted a slightly banked plane from southeast to northwest.

An extraordinary situation was noticed in its centre, where an accumulation of 35 grinding stones, and particularly their fragments, was located (Figure 4). The stones were arranged as a circular structure in one layer starting ca. 10 cm beneath the infill's upper limit and ca, 10–15 cm above the feature's bottom. During the field excavation only samples of the grinding stones were collected. They were deposited separately outside of the main artefactual assemblages, without any processing or surface cleaning. Their current identification was performed by matching individual stones with field excavation photography (Figure 4: C). Therefore, the stones are numbered in non-consecutive order as 1, 2, 4, 6, 11, 17, 24 and 31.

The deposition of grinding stones divided the feature 838 infill vertically in two contexts. The upper part and the deposition layer did not contain any finds except for one rare ceramic fragment, but the lower context differed: it contained the vast majority of finds such as ceramic fragments, animal bones, daub and a small amount of charcoal. The only structure visible in the grinding stones layer was an oval posthole, indicating a half-post situated in the eastern part of the accumulation. According to its spatial arrangement the posthole could be said to be surrounded by particular grinding stone fragments. The infill of the posthole was the typical dark soil, which differed from the rest of the infill of feature 838. According to its spatial position the posthole could be considered part of house 8's eastern wall, but the mutual relationship of both these structures will be discussed below.

House 8 was 30.5 m long with a slightly trapezoidal ground plan and an area of 242 m^2. The ground plan represented a type of house with one-row walls, dense internal rows of postholes, and exhibited signs of a three-part division of its internal space. The orientation of the house's long axis was exceptional in being towards the west-northwest, whereas its geographical inclination was 52º 37′ to the west. The southern section was relatively small (43.3 m^2) and separated from the central section by three posts, which were oriented askew to the main axes of the house. The central section (173.3 m^2) was shaped as a large robust space with irregularly-distributed postholes, whose northern cluster was aggregated within a "Y" shape. The northern section was small (24.2 m^2), and divided from the central section by three robust postholes. This part, defined by the slightly trapezoid foundation trench, was asymmetrically joined to rest of the house. Cross-sections of the trench yielded traces of a wall construction: the dark soil "shadows" of the original wooden elements (Figure 5).

The eastern wall of longhouse 8 constituted one row of postholes (931, 932, 933, 837, 836, 834, 833, 831, 1512, 1508, 1507, 1506, 1505, 1504, 1502 and 1501). Feature 838 is thus the only structure interrupting the wall's line. The standard image of house 8's ground plan is accompanied by postholes forming regular line structures. A short row parallel to house 8's eastern wall was defined by postholes 1513, 1514, 1515, 1516 and 841, 840, 839 plus 835. Other shorter structures could be traced near the western wall created by postholes 922, 923, 924, 925 and 810, 811, 812, 813. Some posthole rows could also be observed within the framework of house 8's ground plan (*e.g.* 803, 805, and 807), and therefore the association of these postholes lying within the direct vicinity of longhouse 8 and the house itself is questionable.

2. Material and methods

2.1 Artefactual analysis of ceramics

Ceramic fragments were assigned to ceramic individuals at the level of their archaeological context (layers or features). Stroked ornamented pottery was described according to the system of M. Zápotocká (1978; 1998) in some general categories and characteristics accompanied by the Bylany site description system (Květina, Pavlů 2007; Pavlů, Zápotocká 1978; Soudský 1967).

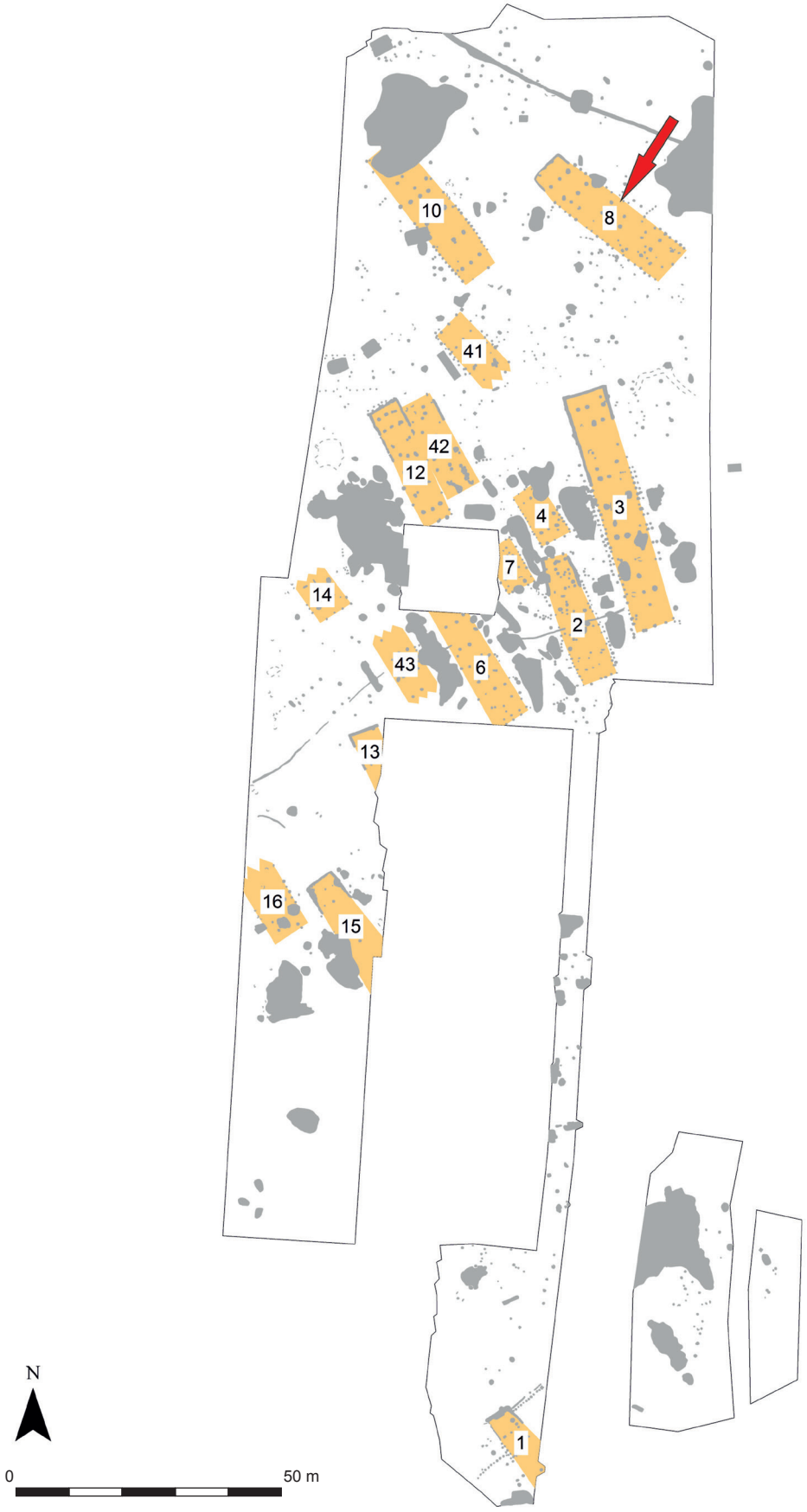


Figure 2. Area SJ ground plan. Position of house 8 is highlighted by arrow.

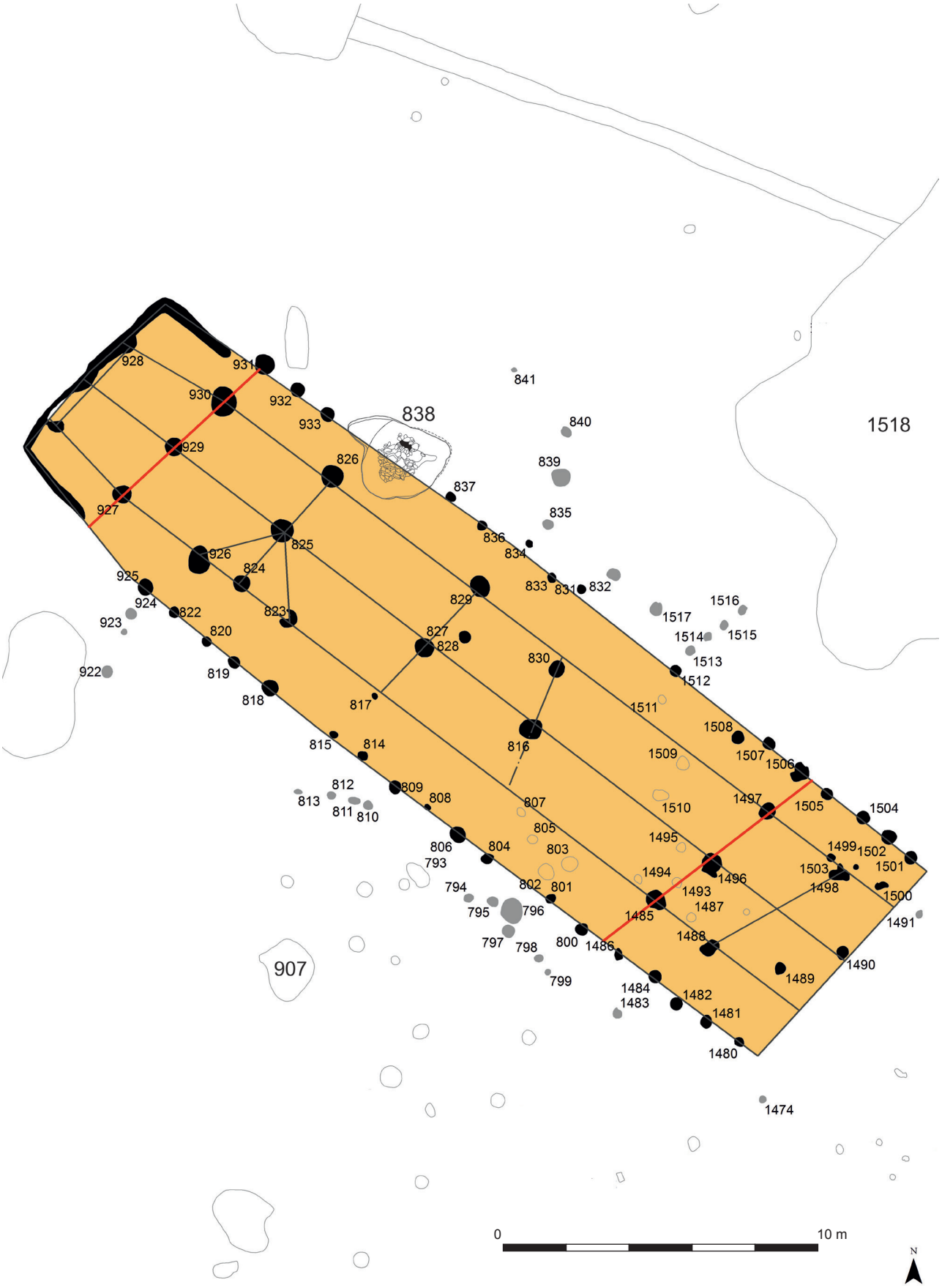


Figure 3. House 8 ground plan. Red lines display possible tripartite division of house interior. Postholes with uncertain relationship to ground plan are marked in grey.

2.2 Artefactual analysis of lithics

Lithic industry was evaluated using the method published in Šída (2007). Most attention was paid to techno-typological descriptions and raw material determination. A comprehensive description of the attributes of artefacts and other lithics was ordered in a normalized database. The main attributes of chipped industry recorded were: techno-type, raw material description, and three main physical dimensions of artefact. Other traits, such as reburning, patination and other characteristics were also recorded. Such a formalisation enables comparison with other lithics assemblages. Raw material determination was based on Přichystal (2013) and Šída, Kachlík (2009). Grinding stones were described according to the system postulated by Hamon (2008a) and Řídký and colleagues (2014), which was developed to record the morphometric attributes of grinding stones, as well as their ergonomic features and other intentional modifications.

2.3 Animal bones

All animal remains were retrieved by hand. The archaeozoological analysis was carried out at the Laboratory of Archaeobotany and Palaeoecology in České Budějovice. The analysis of archaeological faunal remains included in particular: representation of elements, taxonomic identification, anatomical features of age, and taphonomic analysis (*e.g.* evidence of weathering, gnawing, burning).

2.4 Starch analysis

Some fragments of the grinding stones, fortunately, remained unwashed; they were therefore available for starch analysis investigation. The stone surfaces were still covered by dried slip of the original sediment from deposition. For analytical treatment, only one half of an individual stone surface was chosen, the other half of the artefact surface being preserved for further possible analysis. The chosen half of the stone surface was brushed over using a clean brush. The surface's asperity, such as rills and small gaps, could still be filled with original microbiological material. These remains were then acquired by washing the chosen part in distilled water and capturing the result in a micro test tube (Fullagar *et al.* 2006). Each particular stone surface was sampled at 10 different spots. The micro test tube was filled up by alcohol in order to conserve starch grains (Therin *et al.* 1997; Entfer 2009). Samples with starch grains and small residues of soil were studied by a Nikon Eclipse 80i optical microscope under 400 x magnification (Piperno 2006; Hardy *et al.* 2009; Bemiller, Whistler 2009) in polarised and unpolarised light. The starch grains were photographed and digital images stored in a computer. The objects in the images were measured by SW NIS-Elements and identified by an atlas of starch grains (Reichert 1913) and a reference collection of starch grains (Perry 2011).

2.5 Virtual reconstruction

A virtual reconstruction can be processed and subsequently presented in several ways – depending on the required analytical and visual properties of the 3D model. A multi-image photogrammetrical and 3D-scanning method can be useful in the virtualisation of parts or entire conserved archaeological features or their negatives. 3D modelling, that is the manual process of modelling created objects, was especially useful for those parts that had not been preserved and whose appearance was only presumed (Pavlů, Vavrečka 2013; Květina *et al.* 2015). The subsequent presentation of the virtual content would begin with static images, 360° panoramas, animations and end with interactive 3D output; for example, 3D PDF files or new cloud 3D platforms such as 3D Sketchfab *(https://sketchfab.com/)*.

Due to the fact that most of the above-ground structural elements were not preserved, the Neolithic structures were modelled manually. The ground plan, for example, processed in GIS, was an essential resource for determining the size of houses and placement of postholes for most of the Neolithic houses. The position and density of postholes, occurrence of organic and inorganic refuse, artefacts and features in

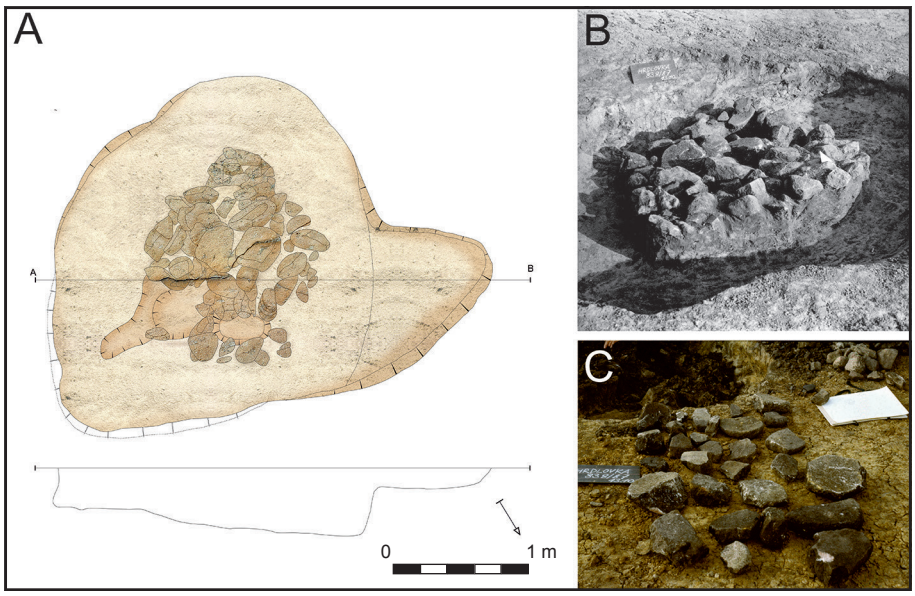


Figure 4. Grinding tools deposition in the sunken feature 838 (A), the situation before (B) and during (C) the excavation (photo J. Beneš).

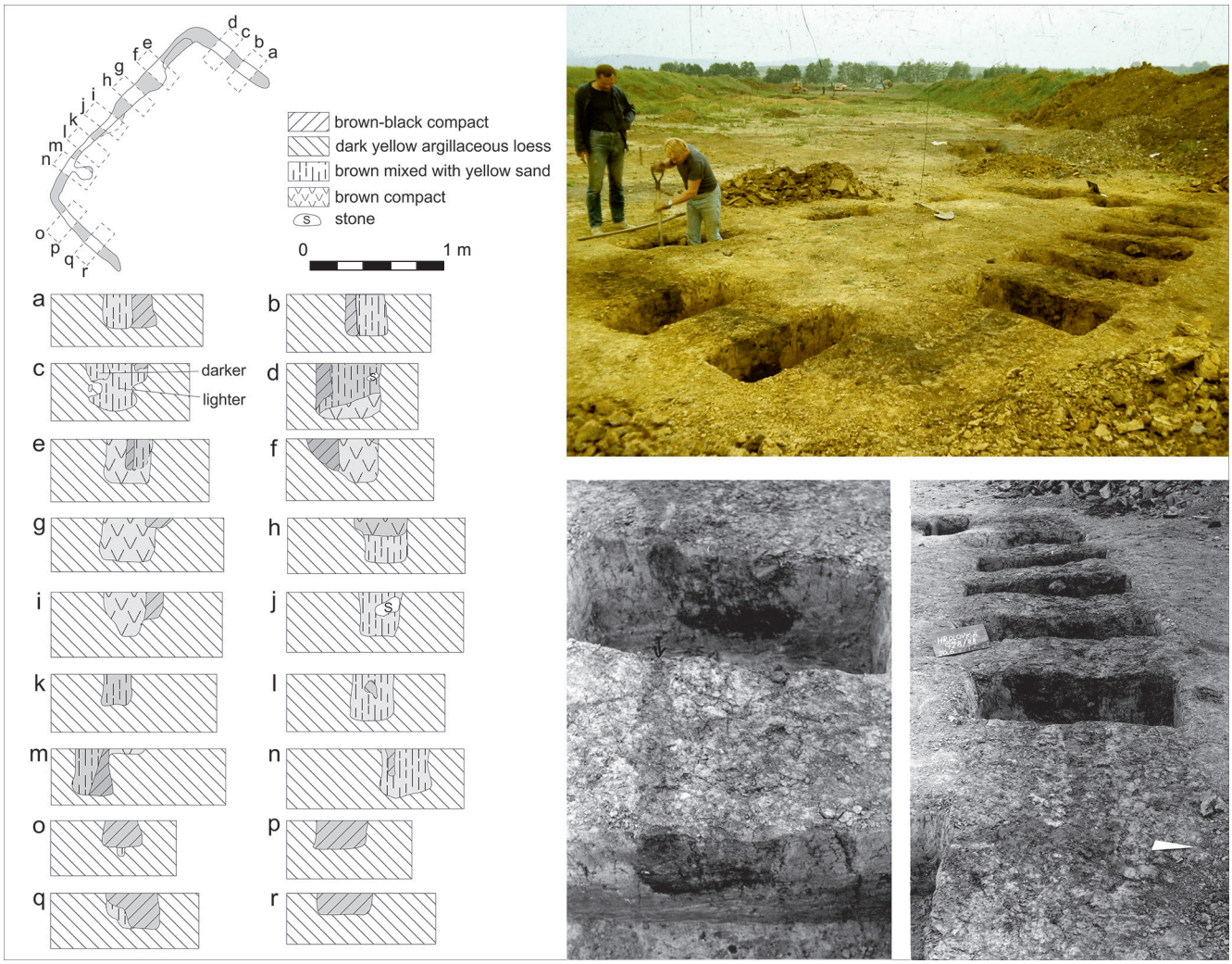


Figure 5. Cross-sections of the northern wall trench of house 8.

the interior of houses, knowledge of the statics, current archaeological findings, and hypotheses and ethnographic analogies, must also be taken into account. All these elements influence the appearance of the final model.

Virtual 3D reconstruction was built with help of the georeferenced ground plan of longhouse 8. It was converted into bitmap (raster) graphics, and therefore such visualisation could be regarded as "realistic".

Applied seamless textures on the individual kinds of material came from our own photographic database and the whole model was then exported into several formats such as Collada, FBX, 3D PDF, and OBJ.

3. Results

3.1 Ceramics and chronological position of longhouse 8

The chronological setting of the Hrdlovka settlement, which represents a large extensive mosaic of non-contemporaneous postholes and pits, is an issue extending beyond the framework of this paper. There will therefore only follow a brief overview with a focus on some particular features, without the context of the whole settlement (for more details, see Vondrovský 2015).

The feature 838 assemblage contains 74 ceramic individuals (88 fragments, 930 g). Except for one, all of them come from the stratigraphic context under the grinding stone deposition, which is crucial for the issue of chronology. The range of decorative techniques shows quite a clear image. Double-strokes made by a narrow instrument appearing since the Early SBK stage are present, but they are accompanied by techniques emerging in the Late SBK phase: wide double-strokes, multiple (three-pointed instrument) and tremolo strokes (Table 1; Figure 6). The stroked ornamentation motifs, which seem to cover the whole vessel surface, are divided by double or triple bands and by variations of bands below the vessel rim, sometimes accompanied by short perpendicular strokes or triangles. A similar chronological pattern can also be seen in the range of vessel shapes, although the possibilities of determination are limited given the fragmented assemblage. Two pear-shaped vessels with a broad bulge and an everted rim were identified. No lugs or other projections appeared on the ceramics. The above-mentioned criteria (Pavlů, Zápotocká 2013, 46–49) set the

dating of feature 838 with high certainty into the Late SBK stage, more specifically into the SBK IVa phase.

To address the chronological position of house 8, all Neolithic pits in the close vicinity should be investigated (Figure 3). First of them, the feature 1518, represents a type of large, extended loam pit with possibly long-term deposited infill and consequently a blurred chronological image (Květina, Končelová 2011, 196–198). Furthermore, due to its large extent, it was excavated only by small linear trenches, which do not give a more comprehensive overview about the artefactual content. The ceramic assemblage comprises only one fragment bearing closely indistinguishable stroked ornamentation and several rim and bottom fragments. These are poor evidence for closer chronological determination.

The next feature 907 was located ca. 7 m south of the house 8 western wall. It contained 257 ceramic individuals (314 fragments, 2522 g). No vertical contexts were distinguished during the field excavation, thus the finds will be dealt with as a homogeneous assemblage. The small, as well as wide, double-strokes, multiple strokes made by a three- or four-pointed instrument, narrow and wide tremolo strokes, represent the stroked decoration (Table 1). Apart from the stroked ornamentation, two individuals occurring in the feature 907 assemblage also bear incised line decoration. They are considered to be of an intrusive material. Focusing on the vessel shapes, the everted rims were quite common. The fully determinable vessels represent a wide and hemispherical bowl, pear-shaped with straight or everted rim and featuring lugs. The most chronologically significant seems to be a kettle-shaped vessel with profiled bulge and small double lugs beneath the rim. Rounded, as well as flat, vessel bases were distinguished. Based on this, the feature 907 assemblage can be assigned to the SBK IVa phase according to present chronological attributes (Pavlů, Zápotocká 2013, 46–49).

To summarize, there are no typical large building pits flanking the walls in the vicinity of house 8, which is typical for Late SBK settlements, when the material was more likely deposited in more remote pits (Burgert *et al.* 2014). In this respect feature 907 seems to be significant for the chronology of house 8. Furthermore, it is obvious that features 907 and 838 reveal very similar ceramic assemblages and their coexistence, more specifically contemporaneous material deposition, can be assumed. Very close patterns are observed in the fragments' metrical characteristics, suggesting that those under the grinding stone in feature 838 and the whole context of feature 907 were probably created by similar processes.

3.2 Grinding stones and chipped industry

3.2.1 Macrolithic stone industry

The collection of macrolithic artefacts from feature 838 is a specific assemblage. Most of them were fragments of used querns and grinders combined with other macrolithic artefacts (Table 2, Figure 7). There are three grinders (Figure 8; artefacts 6, 11 and 17), of which one is made from a fragment of quern. All are made from cretaceous pebble sandstone coming from the edge of a cretaceous basin (about 20 km from the site). There are four querns in the assemblage (Figure 9; artefacts 1, 2, 4 and 31). Two of them are also made from sandstone, while the remaining two are from quartz porphyry from Žernoseky (20 km from the site). All of them were used and broken and one had been burnt.

Table 1. Ceramics assemblage attributes of features 838 and 907.

Attribute		838	907
individuals		74	257
weight (g)		930	2522
decorated		27	24
stroked ornamentation	small double-strokes	4	8
	wide double-strokes	7	3
	multiple strokes	9	4
	tremolo strokes	7	7
linear ornamentation	incised line	0	2
vessel shapes	wide bowl	0	3
	hemispherical bowl	0	1
	pear-shaped vessel with broad bulge and everted rim	2	1
	kettle with profiled bulge and lugs	0	1
maximum size categories	<2 cm	3	30
	2–4 cm	38	123
	4–6 cm	21	75
	6–8 cm	10	23
	8–10 cm	2	6
fragment mean weight (g)		12.6	9.8

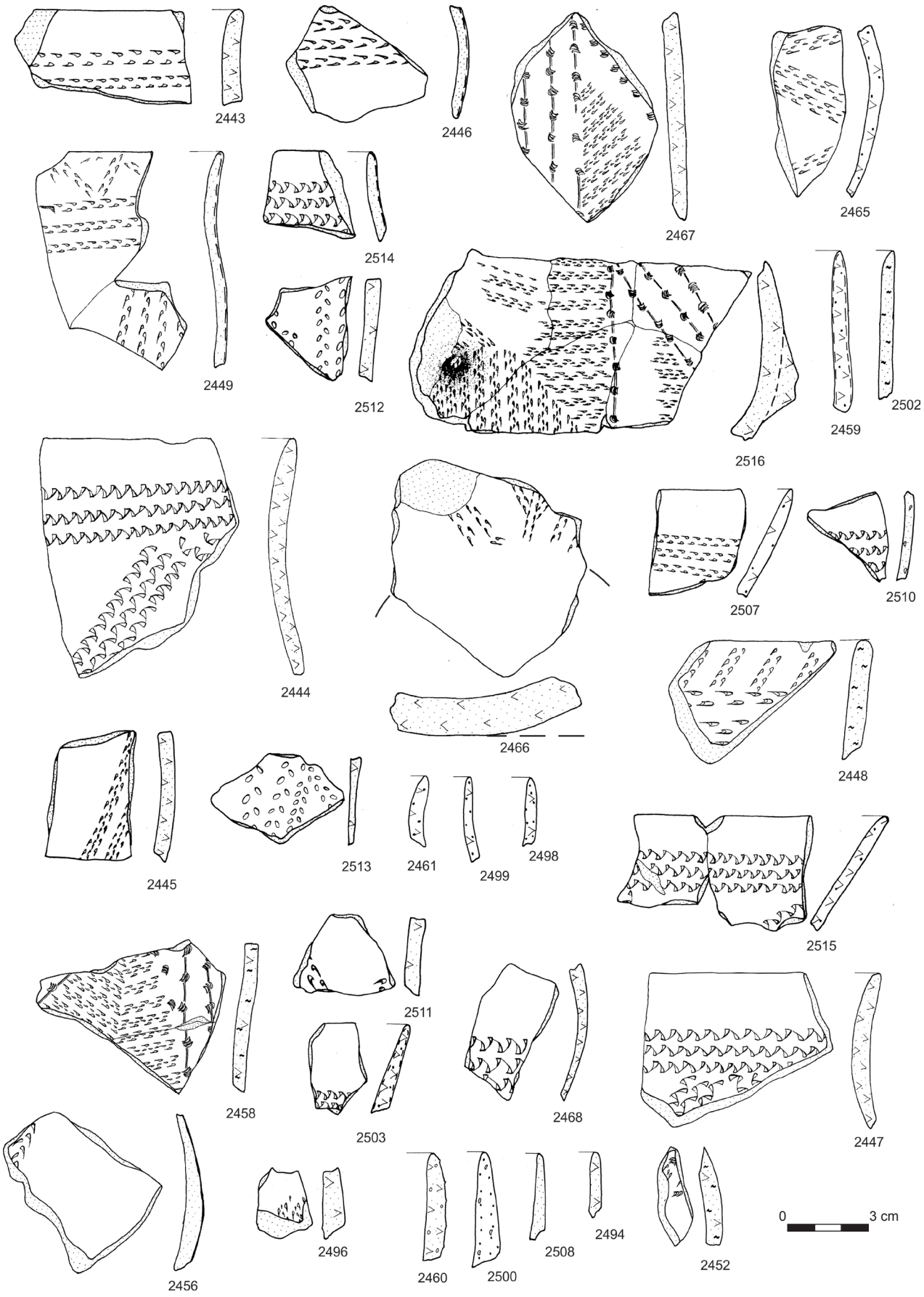


Figure 6. Selection from ceramics assemblage of feature 838 (drawing M. Divišová).

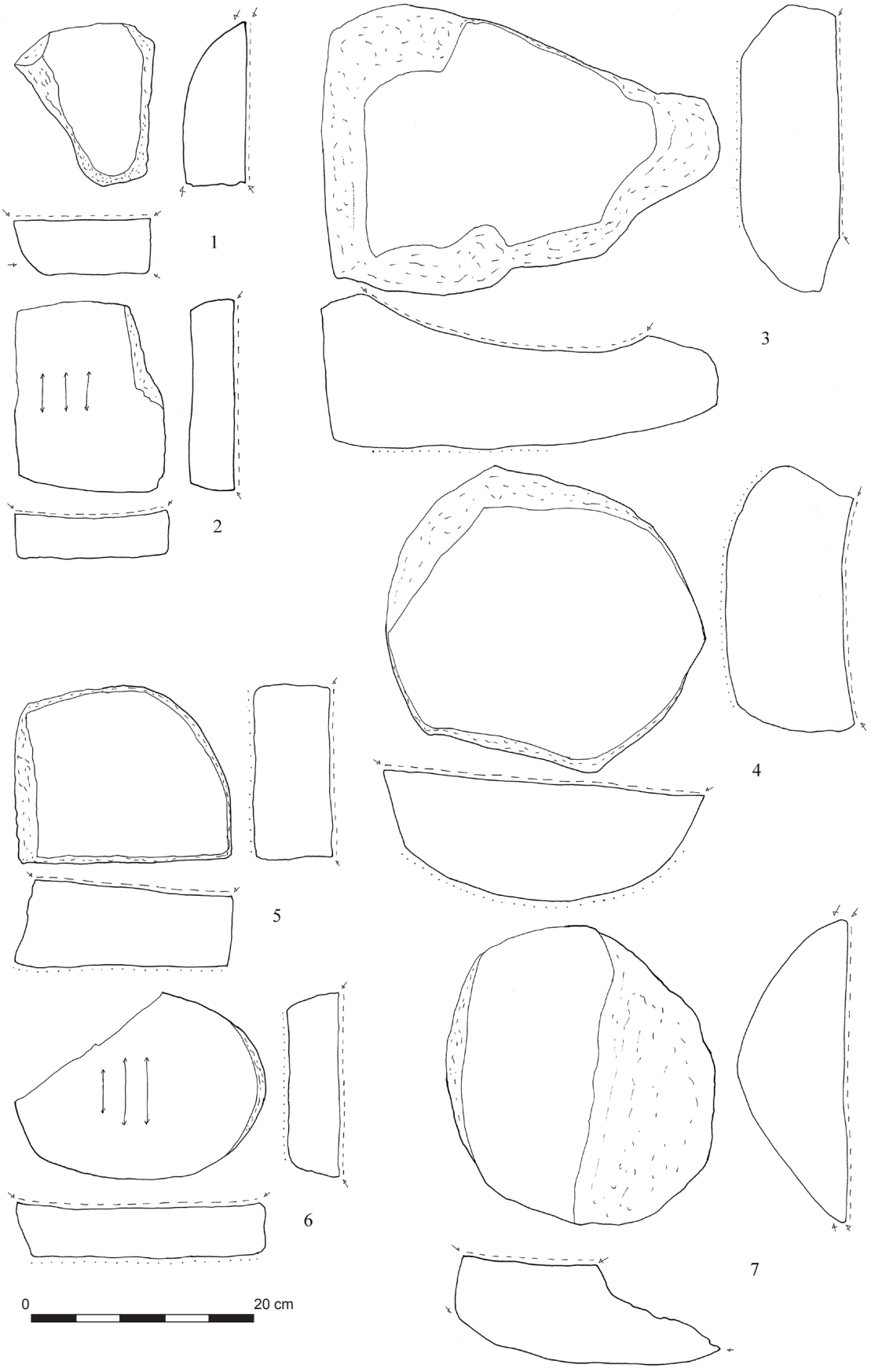


Figure 7. Sunken feature 838 macrolithic assemblage (drawing J. Beneš and P. Šída).

Figure 8. Quern 2 with one half of sampled surface (photo J. Beneš).

Figure 9. Grinder 11 with one half of sampled surface (photo J. Beneš).

One remaining artefact is a fragment of gneiss pebble broken by thermal shock. This piece was used in some kind of pyro-technological process.

3.2.2 Chipped industry

The collection of chipped stone industry relating to house 8 is not extraordinarily large, only consisting of 24 artefacts (Figure 10). All of them were deposited in sunken feature 907, situated in the area south of house 8.

In the area of house 8 local raw materials dominate. The total of 21 pieces (87.5%) were produced from local quarzites of northwest Bohemia. A type of Skršín quartzite, coming from a distance 15 km away, dominated with 20 pieces (83.3% of assemblage). Only one piece of industry is made of a Tušimice quartzite type (4.2% of assemblage) that comes from 35 km away. Only two pieces (8.3%) of chipped industry were produced from erratic flint coming from northern moraine region some 90 km away. One of them has an original raw material surface and comes from the decortification of a core. The remaining piece of chipped industry, a blade made of quartz, is probably of local origin. The use of quartz is not typical for producing blades in the

Table 2. Feature 838. Querns and grinders.

No.	Type	Artefact	Work surface length	Work surface width	Height 1	Height 2	Long profile type	Width profile type	Weight kg	Material
1	LA1	quern	290	220	120	95	LC3	LB2	9.3	quartz porphyry
2	LA3	quern	340	240 and 180	150	95	LD3	LB2	10.9	sandstone
4	LA1	quern	160	160	80	65	LC3	LB2	3.3	sandstone
6	BA2	grinder	135	170	45	40	BB3	BC3	1.9	sandstone
11	BA2	grinder	225	170	55	50	BB3	BC1	2.7	sandstone
17	BA2	grinder	120	145	58	58	BB1	BC3?	1.4	sandstone
31	LA1	quern	120	270	110	100	LC3	LD3	6.1	quartz porphyry

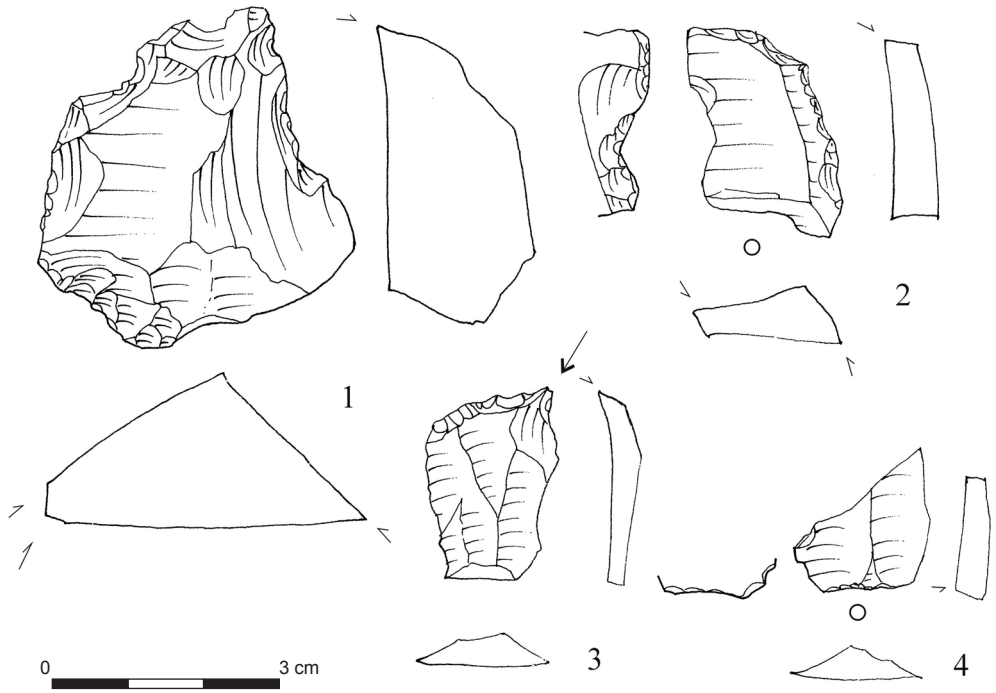


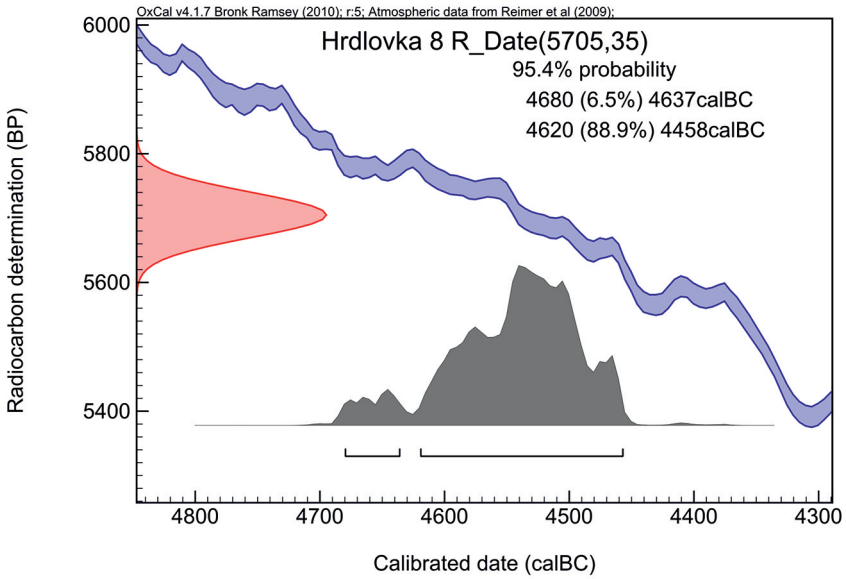
Figure 10. Selection from chipped stone industry assemblage from the sunken feature 907 (drawing P. Šída).

Bohemian Neolithic (Šída 2007) and looks to be atypical. Local raw materials absolutely dominate, constituting 91.7% of the raw material, which is not typical for the Bohemian Neolithic.

Three quarters of the collection belong to debitage; the remaining quarter are tools. This is a common proportionality between these two groups of industry and the small assemblage of feature 907 belongs to a common pattern of a non-productive character.

Debitage consists of 7 fragments (29.2% of collection, 38.9% of debitage), 5 flakes (20.8% of collection, 27.8% of debitage), 4 blades (16.7% of collection, 22.2% of debitage) and 2 cores (8.3% of collection, 11.1% of debitage). Cores are in residual form, one of them was the final flake form of a core. Special butt-type preparations were not present, only simple ones being used (one flat surface and simple-flake negative was used, two double-flake negatives, and one was a type of unrecognisable preparation). All blades are fragmentary, no unbroken blades being present. We were able to distinguish one basal fragment of blade with a fine retouched butt remaining, and twice central fragments are present and once a terminal fragment.

Figure 11. Radiocarbon data calibration of sample from sunken feature 838 (Poznań Radiocarbon Laboratory, Poz-57471).



Tools make 25% of the assemblage and consist of 6 pieces. Twice we found truncated blades in the collection (both are the basal fragments of blades, 8.3% of collection, 33.3% of tools). This type was commonly used to be a sickle blade, but we cannot find traces of sickle gloss on these two pieces. There are also two notches on fragments (8.3% of collection, 33.3% of tools) and one notch combined with an oblique retouching on the terminal part of the blade (4.2% of collection, 16.7% of tools). The remaining piece of this group is a borer made of the terminal fragment of a blade (4.2% of collection, 16.7% of tools) (Table 3).

There are only two burnt pieces in the assemblage (8.3 %). One of them is a fragment of Skršín-type quartzite and the other is a truncated blade made of the same raw material.

3.3. Animal bones

All animal remains (n=12) were deposited in the context lying under the grinding stones deposition in feature 838. An incomplete left astragalus of adult cattle (*Bos taurus*) and a fragment of molar crown of pig (*Sus* sp.) were registered among them. Apart from these, a small fragment of *caput femoris* of an immature large-mammal-sized animal was found. The remaining animal bones (9; *i.e.* 75%) remained without determination because they were greatly damaged by weathering. Of the mentioned anatomy, the modification of two bone specimens by burning and gnawing of one bone fragment by carnivores could indicate food processing and food waste. One of the unidentified long bone fragments belonging to the adult large-mammal-sized animals from the sunken feature (inv. number 171) was used for radiocarbon analysis to obtain absolute chronological data. The advantage of animal bones are the smaller time discrepancies in comparison with charcoal pieces found, for example, in postholes, where the so-called "old wood problem" can be expected (*e.g.* Schiffer 1986; Geib 2008). The life cycle of a full-grown tree is much longer than the life cycle of

Table 3. Feature 907. Technological and typological composition with the raw material composition of the assemblage.

Technotype	Skršín quartzite	Tušimice quarzite	Flint	Quartz	Total	%
Fragment	6	1			*7*	*29.2*
Blade	2		1	1	*4*	*16.7*
Core	2				*2*	*8.3*
Flake	4		1		*5*	*20.8*
Debitage	*14*	*1*	*2*	*1*	*18*	*75.0*
Truncated blades	2				*2*	*8.3*
Borer	1				*1*	*4.2*
Notch	2				*2*	*8.3*
Notch on blade combined with oblique retouching	1				*1*	*4.2*
Tools	*6*				*6*	*25.0*
Total	***20***	***1***	***2***	***1***	***24***	***100.0***
%	*83.3*	*4.2*	*8.3*	*4.2*	*100*	

Table 4. Characteristics of detected starch grains.

Grinding stone no.	Shape	Mean size (μm)	N
1	oval	26.36	1
1	oval	12.73	1
1	polygon	23.64	1
1	polygon	22.73	1
1	circular	12.09	3
1	circular	10.00	1
1	circular	10.00	8
2	circular	5.73	10
2	circular	4.09	22
6	oval	30.00	1

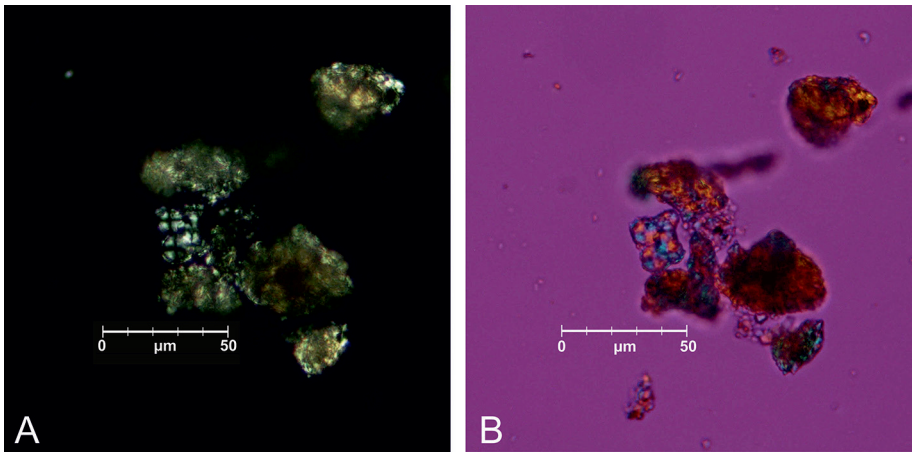


Figure 12. Starch grains of Poaceae from grinding stone 1. A and B: different filters of polarized light (photo J. Kovárník).

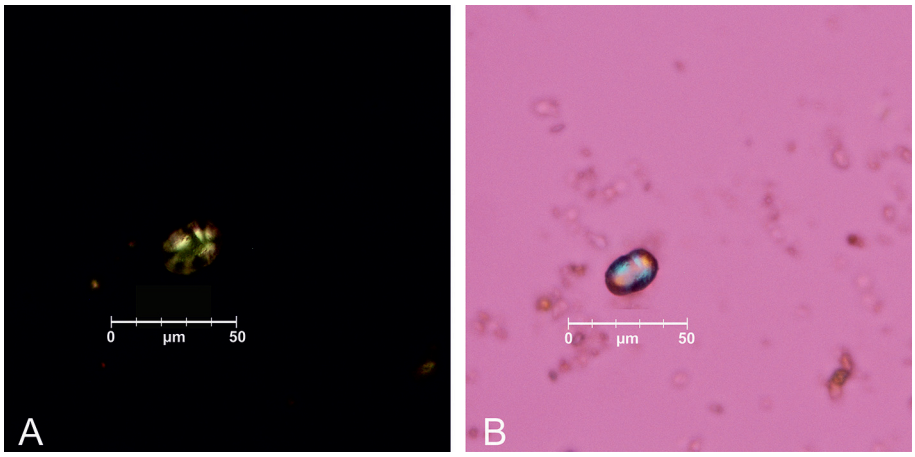


Figure 13. Starch grain of Fabaceae from grinding stone 6. A and B: different filters of polarized light (photo J. Kovárník).

domestic animals. The resulting dating is 4620–4458 cal BC (Figure 11), which corresponds with the ceramic relative chronology and dates feature 838 to the Late SBK period.

3.4 Starch analysis

Starch grains were presented only on the surface of querns 1, 2 and grinder 6 (Table 4). Altogether 49 starch grains were found during the microscopic investigation. The surface of grinding stone 1 provided 16 positive findings. Two starch grains are oval in shape, 2 grains are polygonal and 12 are circular. Quern 2 offered only 32 circular starch grains. The surface of grinder 6 provided only 1 oval-shaped starch grain. Altogether 12 circular starch grains, according to current knowledge (Reichert 1913; Piperno *et al.* 2004; Henry *et al.* 2008; 2009; 2011; Hart 2014) and after comparison with a reference collection, can be determined as belonging to plants of the family *Poaceae* (Figure 12; circular grains; n=12). Starch grains of an oval shape with a characteristic extinction cross belong to the family *Fabaceae* (Figure 13).

3.5 Virtual reconstruction of the longhouse 8: variable augmented reality

In the virtual reconstruction, the postholes were processed according to their placement and function in the house. Each of them was cut off and lowered into a space to place the 3D models of post construction. In the case of feature 838 with its grinding stones, the specific position of the half-post was taken in account. 3D models of posts which had not been captured during field excavation are distinguished by colours and their presence and placing are based on the logic of the construction. The posts are complete with the exception of the northern ditch in which the posts are halved with the straight wall from the inside part of the trench. The 3D model of the house was divided into three separate parts: northern part (927, 929, 930), central part (1485, 1496, 1497), and the further second storey was modelled in the front southern part due to the thickened occurrence of the posts in the interior. The smaller second storey has been reconstructed in the places of the posts (926, 824, 823) for the same reason, but its presence is rather hypothetical. It might have only been the strengthening of the construction in these places. The northern rear part was constructed asymmetrically and differently and is reconstructed with elements of some "loghouse" signs of carpentry work.

A saddle roof with a slightly sloping roof ridge in the southern part was chosen. For the 3D model of the roofing, the neutral shape representing thatch from oak bark, reed, straw (Sklenářová 2003) or their various combinations were chosen. The wall is made of a wattle and daub construction due to the line of postholes at regular spacing. The height of the house wall is 1.6 m so the front wall with an expected

roof pitch of 45° reaches a height of about 5 m (Pavlů 2000). The floor is made of hard-packed earth.

Here we suggest only two virtual hypothetical variations of house reconstruction, although several other possibilities remain (see Discussion). Both of the suggested versions take into account the entrance position from the long eastern wall and the same mode of material use. They also consider the internal tripartite division of the house, which in the case of longhouse 8 is obvious.

4. Discussion

The phenomenon of the hoard deposition is not exceptional in the context of the European Bandkeramik ecumene and its roots can be followed through the LBK back to the Balkan Early Neolithic (Nikolov 1989; Makkay 2002). Deposition of hoards within house interiors and their near vicinity is known from the LBK as well as the post-LBK period (Soudský 1969; Lička 1981). Focusing specifically on the grinding stones deposition, this phenomenon is particularly observed in the western zone of Bandkeramik distribution. A grinding stone hoard and a hoard of polished stone tools was connected with the ground plan of a longhouse in Goseck, Germany (Bertemes, Northe 2010, 22, Figures 17 and 22). Seven settlements of the Paris Basin and Hainaut region in Belgium have yielded grinding stone hoards of the LBK and Villeneuve-Saint-Germain-Blicquy culture dated between 5200 and 4600 BC. These hoards are always linked with domestic areas and discussed in terms of their symbolic value. The grinding stone hoards are frequently situated in lateral building pits, twice in isolated pits associated with the house and finally, in two cases, have been located inside the house. Nevertheless, the number of grinding stones in individual deposits does not exceed more than ten (Hamon 2008b). From the Czech Republic, apart from Hrdlovka, there is recorded the hoard of semi-finished grinding stones only from Holubice, Prague-west district and grinding stones with traces of use from Praha-Liboc. In contrast to Hrdlovka, no spatial relation to the house ground plan was observed (Kovačiková, Daněček 2008; Turek 2005, 171, 230).

The relationship between feature 838 and house 8 is therefore crucial in looking for further interpretation. We can outline several possibilities:

A) Feature 838 with the posthole enclosed by grinding stones is an integral part of longhouse 8, forming part of its eastern wall. In this sense, the deposition of the grinding stones is a single action made during the house's construction.
B) Feature 838 is older than house 8.
C) Feature 838 is younger than house 8.

When considering these three scenarios, one must bear in mind the following data and evidence:

- The sample of animal bone from the context under the grinding stones deposition has been radiocarbon dated to 4620–4458 cal BC, which corresponds to the relative ceramic chronology. Both these sources point to the Late SBK period.
- The ceramic assemblage recovered from the context under the grinding tools chronologically corresponds with that from feature 907, which is also in the close vicinity of longhouse 8.
- The above mentioned facts could also indicate the chronological classification of house 8. However, the house was constructed as a one-row wall structure with relatively-thick inner rows, which means in a manner rather characteristic for developed LBK architecture in the Bohemian region (*cf.* Pavlů *et al.* 1986, 383–394). On the other hand, the trapezoidal shape of the short northern rear section, which is asymmetric to the main house axis, and particularly the absence of classic larger building pits flanking the longitudinal house walls, bears witness to the Late SBK dating (Končelová, Květina 2015). In addition, Hrdlovka's longhouse 8 is not wholly exceptional. The untypical construction similarly evinces the Late SBK house 2 at the Vchynice site (Řídký *et al.* 2013, 239, Figure 1). Also, the posthole in feature 838 (despite the fact of a small asymmetry) may have its position in the eastern wall.
- Focusing on feature 838, its longitudinal axis with the northwest extension is in accordance with the eastern house-wall orientation.
- The feature's infill was different in its character from other settlement pits. The layer's mixed colouring of yellow and dark soil may be evidence of a short-term infilling process, when the material was deliberately deposited in the pit in contrast to some long-term organic waste deposition that would produce a dark homogeneous infill. On the other hand, the range of artefacts and ecofacts and their amount found under the grinding stone deposition would probably represent common settlement waste.
- Some postholes structures can be observed within the area of longhouse 8. These can be either possible outbuildings functionally connected with house 8 (most probably its entrances), or diachronic structures that are not possible to conclusively interpret. It cannot be excluded that feature 838 belongs to these structures.

To sum up, various and slightly contradictory data has been observed.

Scenario B (feature 838 older than house 8) does not seem probable. Firstly, the spatial setting does not support this notion. Moreover, feature 838 and house 8 appear to be dated contemporaneously to the Late SBK period. However, the time-span between the grinding stones deposition and house erecting could be shorter than currently recognizable chronological levels. Unfortunately, such chronological nuances are undetectable by the available chronological methods.

Scenario C (feature 838 younger than house 8) can be supported by the existence of posthole structures, which could be younger than the house and simultaneously associated with feature 838. This can be supported by a

few architectural, but not so significant, attributes shifting the longhouse 8 dating to the older period. Although this possibility cannot be excluded, there is no direct evidence for such a scenario.

The remaining scenario A (feature 838 an integral part of longhouse 8) can be supported by the vast majority of the aforementioned evidence. In this case, feature 838 is supposed to be used for common settlement waste accompanied by the unique grinding stones deposition and rather quick intentional filling. This lends itself into the idea of it being a building offering connected with the house construction event. On the other hand, the structure of the infill and its similarity with feature 907 infill does not support the uniqueness of feature 838.

With respect to the hoard itself, the number of grinding stones in feature 838 highly exceeds the amount of these

Figure 14. 3D reconstruction of house 8, version 1 (visualisation P. Vavrečka).

tools that would be expected to be used simultaneously in a single household, according to an estimation based on ethnographic parallels as being three at most (David 1998; Hamon, Le Gall 2013). Therefore, it could be supposed that the hoard is an assemblage of tools from several households, maybe all the households of the settlement in the given period. House 8 could consequently be considered as exceptional in this context, because its construction may have been reinforced by such an exceptional act. The house itself could be understood as a symbolic space that was the centre of domestic activities (living, manufacturing, processing and storing of food, *etc.*) and a feminine element. Such a house represents a specific enclosed place, which separates the household from its surroundings. The issue of ritual behaviour can be observed especially in the case of construction sacrifices connected with the birth/creation of

Figure 15. 3D reconstruction of house 8, version 2 (visualisation P. Vavrečka).

Figure 16. Dynamic 3D reconstruction, version 1 (visualisation P. Vavrečka).

a house (Hodder 1990; Bradley 2001; Naumov 2013; Beneš *et al.* 2016). The fact that the grinding tools were used, heavily fragmented, and one even burnt, may also indicate their transition from every-day use into a sacral context.

With this in mind, the two possible 3D reconstructions of the mutual house and grinding stones depositional setting were created. The two virtual-mode variations of longhouse reconstruction both regarded the position of the entrance to the house in the eastern long wall in contrast to the usually-preferred southern gable wall as key elements (*e.g.* Whittle 1996; Květina, Hrnčíř 2013; Coudart 2015). Such interpretative solutions are still uncertain, although some phosphate analyses of LBK longhouses do not exclude the simultaneous existence of both southern and lateral entrances (Stäuble, Lüning 1999). In the case of house 8, the existence of a lateral entrance is enhanced by two indirect architectural signs. First of all, this eastern-wall entrance location was chosen as a possibility on the basis of hypothetical house outbuildings associated with the eastern wall. Secondly, such an assessment of the entrance position allows the disappearance of the long flanking pits, especially in the SBK period. The above-mentioned traces of outbuildings could be either random structures belonging to another, likely non-contemporaneous, structure or to prolonged shelters associated with the entire longhouse 8. Also well-known are enclosures in the form of LBK and SBK longhouse extensions, which have the form of a stock-keeping fence (Bylany: house 912; Květina, Pavlů 2007), or a structure connecting two or more individual houses (Jaroměř: Burgert 2015; Kolín: Končelová, Květina 2015; Targowisko 12–13: Czerniak 2013). In light of the above-mentioned arguments, an association of outbuilding structures with longhouse 8 is possible.

Placing of the hoard of grinding stones and the postholes, which could have served for so-called outbuildings, is one of the significant elements for longhouse 8. For this reason two versions of the 3D reconstruction were created:

Version 1 (Figures 14 and 16) offers the conventional LBK (and post-LBK) main three-rows-of-postholes construction with walls built up by smooth daub adjustment. The grinding stones hoard is located under the eastern house wall as a building offering. After the hoard was deposited, the pit was fully covered by soil and the space was used as part of the wall's building line.

Version 2 (Figure 15) takes into consideration the ritual meaning of the entrance itself. After the hoard deposition, feature 838 was fully filled up by soil and the space used as the entrance area. The slightly asymmetrical position of the half-round posthole or rectangular trunk could form a small veranda. The interpretation of grinding stones layer as a pavement structure is tempting, but bear in mind that the grinding stones were covered by ca. 10 cm of feature infill at the level of overburden, but was originally thicker, because some erosion of the original Neolithic terrain can be presumed. Additionally, their irregular structure and orientation rule this possibility out. Thus version 2 rather emphasizes the specific role of an entrance as documented in ethnographic literature in a much later history, for example, in the medieval period (Vařeka 1994a; 1994b), where the issue of house offerings played a crucial role in rituals during new house building. Such offerings could protect the newly-adapted space of the house against "evil" powers. However, the probability of this version of reconstruction is diminished by the position of the post in the entrance area itself, although such a possibility cannot be simply excluded.

5. Conclusion

The feature 838 from Hrdlovka represents a unique deposition of grinding stones, spatially associated with longhouse 8. Chronologically, feature 838 belongs to the one of the last horizons of the site's Neolithic occupation dated to the Late SBK IVa phase. One radiocarbon date acquired from animal bone indicates that the context of feature 838 can be set to 4620–4458 cal BC.

The infill of pit 838 originally comprised 35 grinding stones or their fragments. This is an exceptional amount of deposited artefacts, which has of yet no direct analogy within the context of the Bandkeramik eucumene. The investigated grinding stone fragments expressed signs of use. Starch analysis on the grinding stone surfaces does specify that they were used for plant processing.

The relation between feature 838 and longhouse 8 remains questionable, although the evidence supports mainly a scenario that the grinding stones were deposited during a single house building event, maybe as a building offering.

Architectural features and archaeological data allowed some hypothetical variable reconstructions, which differed in their entrance location and the possible role of the grinding stone deposition.

Acknowledgement

The authors would like to thank David Válek, the first reviewer, for text corrections and a second anonymous reviewer for very useful suggestions and corrections, which helped to improve the original text. The article was supported by projects "Neolithic Houses from Hrdlovka, NW Bohemia: 'Changing Shape and Changing Meaning'" (P405/12/2173) and "Prior to the Neolithic: Contextual Analysis of Environmental Dynamics during Early Postglacial Transformation of Central Europe" (13-08169S), financed by the Czech Science Foundation.

References

BEMILLER, J., WHISTLER, R. 2009: *Starch chemistry and technology*. Third ed. Academic, London.

BENEŠ, J. 1991a: Neolitické sídliště v Hrdlovce-Lipticích. Předběžná zpráva o výzkumu v letech 1987–1989. *Archeologické rozhledy* 43(1), 29–46.

BENEŠ, J. 1991b: The Lomský-potok project: investigation of prehistoric settlements of a micro-region with large scale soil transfers. In: *Archaeology in Bohemia 1986–1990*. Institute of Archaeology of the Czechoslovak Academy of Sciences, Prague, 178–184.

BENEŠ, J., BRŮNA, V., KŘIVÁNEK, R. 1993: The changing landscape of North-West Bohemia during the last two centuries. *Památky archeologické* 84, 142–149.

BENEŠ, J., VONDROVSKÝ, V., KOVAČIKOVÁ, L. ŠÍDA, P., DIVIŠOVÁ, M. 2014: Decoding the Neolithic Building Complex: the Case of the Extraordinarily Large House III from Hrdlovka, Czech Republic. *Interdisciplinaria Archaeologica, Natural Sciences in Archaeology* V/2/2014, 99–118.

BENEŠ, J., DIVIŠOVÁ, M., VONDROVSKÝ, V. 2016: The Neolithic longhouse phenomenon at the Hrdlovka site, Czech Republic: meanings, inhabitants, and successors. In: Amkreutz, L., Hofmann, D., Haack, F., van Wijk, I. M. (Eds.): *Something out of the ordinary? Diversity and uniformity in LBK studies*, Cambridge University Press, Cambridge, 32–55.

BERTEMES, F., NORTHE, A. 2010: Goseck—neue Forschungen zum Ringheiligtum und zum Benediktinerkloster. Die Kreisgrabenanlage von Goseck. *Archäologie in Sachsen-Anhalt* 5, 9–32.

BRADLEY, R. 2001: Orientations and origins: a symbolic dimension to the long house in Neolithic Europe. *Antiquity* 75, 50–56.

BURGERT, P. 2015: "*Stabilitas loci*" of inhabitants of the Stroked Pottery site in Jaroměř (Eastern Bohemia, Czech Republic). *Anthropologie* 53(3), 473–483.

BURGERT, P., KONČELOVÁ, M., KVĚTINA, P. 2014: Neolitický dům, cesta k poznání sociální identity. In: Popelka, M., Šmidtová, R. (Eds.): *Neolitizace aneb setkání generací*. Praha: Univerzita Karlova v Praze, Filozofická fakulta, 29–57.

COUDART, A. 2015: The Bandkeramik longhouses: a material, social, and mental metaphor for small-scale sedentary societies. In: Fowler, C., Harding, J., Hofmann, D. (Eds.): *The Oxford Handbook of Neolithic Europe*. Oxford University Press, Oxford, 309–325.

CZERNIAK, L. 2013: House, household and village in the Early Neolithic of Central Europe: a case study of the LBK in Little Poland. In: Kadrow, S., Włodarczak, P. (Eds.): *Environment and subsistence: Forty years after Janusz Kruk's "Settlement studies "*. Institute of Archaeology Rzeszow University, Rzeszow, 43–68.

DAVID, N. 1998: The ethnoarchaeology of grinding at Sukur, Adamawa state, Nigeria. *African review* 15, 13–63.

ENTFER, C. J. 2009: Building a comparative starch reference collection for Indonesia and its application to palaeoenvironmental and archaeological research. In: *Archaeological science under a microscope: studies in residue and ancient DNA analysis in honour of Thomas H. Loy.* Terra Australis 30, 80–101.

FULLAGAR, R., FIELD, J., DENHAM T., LENTFER, C. 2006: Early and mid Holocene tool-use and processing of taro (*Colocasia esculenta*), yam (*Dioscorea* sp.) and other plants at Kuk Swamp in the highlands of Papua New Guinea. *Journal of Archaeological Science* 33(5), 595–614.

GEIB, P. R. 2008: Age Discrepancies with the Radiocarbon Dating of Sagebrush (*Artemisia Tridentata* Nutt.). *Radiocarbon* 50(3), 347–357.

HAMON, C. 2008a: Functional analysis of stone grinding and polishing tools from the earliest Neolithic of north-western Europe. *Journal of Archaeological Science* 35(6), 1,502–1,520.

HAMON, C. 2008b: The symbolic value of grindingstones hoards: Technical properties of Neolithic examples. In: Hamon, C., Quilliec, B. (Eds.): *Hoards from the Neolithic to the Metal Ages. Technical and codified practices*. BAR International Series 1758, 19–28.

HAMON, C., LE GALL, V. 2013: Millet and sauce: The uses and functions of querns among the minyanka (Mali). *Journal of Anthropological Archaeology* 32(1), 109–121.

HARDY, K., BLAKENEY, T., COPELAND, L., KIRKHAM, J., WRANGHAM, R., COLLINS, M. 2009: Starch granules, dental calculus and new perspectives on ancient diet. *Journal of Archaeological Science* 36(2), 248–255.

HART, T. C. 2014: Analysis of Starch Grains Produced in Select Taxa Encountered. Southwest Asia. *Ethnobiology Letters* 5, 135–145.

HENRY, A. G., BROOKS, A. S., PIPERNO, D. R. 2011: Microfossils in Calculus Demonstrate Consumption of Plants and Cooked Foods in Neanderthal Diets (Shanidar III, Iraq; Spy I and II, Belgium). *Proceedings of the National Academy of Sciences* 108, 486–491.

HENRY, A. G., HUDSON, H. F., PIPERNO, D. R. 2009: Changes in Starch Grain Morphologies from Cooking. *Journal of Archaeological Science* 36, 915–922.

HENRY, A. G., PIPERNO, D. R. 2008: Using plant microfossils from dental calculus to recover human diet: a case study from Tell alRaqā'i, Syria. *Journal of Archaeological Science* 35, 1943–1950.

HODDER, I. 1990: *The domestication of Europe. Structure and contingency in Neolithic societies*. Blackwell, Oxford.

KONČELOVÁ, M., KVĚTINA, P. 2015: Neolithic longhouse seen as a witness of cultural change in the Post-LBK. *Anthropologie* 53(3), 431–446.

KOVAČIKOVÁ, L., DANĚČEK, D. 2008: Užitkový význam hospodářských zvířat na neolitickém sídlišti v Holubicích – The utility

value of domestic animals at the Neolithic site of Holubice. In: Beneš, J., Pokorný, P. (Eds.): *Bioarcheologie v České republice – Bioarchaeology in the Czech Republic*, České Budějovice/ Praha: University of South Bohemia/Institute of Archaeology of the Academy of Sciences of the Czech Republic, 177–198.

KVĚTINA, P., HRNČÍŘ, V. 2013: Between Archaeology and Anthropology: Imagining Neolithic settlements. *Anthropologie* 51(2), 323–347.

KVĚTINA, P., KONČELOVÁ, M. 2011: Kategorie výzdobného stylu na lineární keramice z Bylan. *Archeologické rozhledy* 63(2), 195–219.

KVĚTINA, P., PAVLŮ, I. 2007: *Neolithic settlement at Bylany – essential database*. Archeologický ústav AV ČR, Praha.

KVĚTINA, P., UNGER, J., VAVREČKA, P. 2015: Presenting the invisible and unfathomable: Virtual museum and augmented reality of The Neolithic site in Bylany, Czech Republic. *Archeologické rozhledy* 67, 3–22.

LIČKA, M. 1981: Hromadný nález neolitické broušené industrie (č. 1) ze Mšena, okr. Mělník. *Archeologické rozhledy* 33, 607–621.

MAKKAY, J. 2002: Ein Opferfund der frühneolithischen Körös–Kultur mit einem Gefäß mit Schlangendarstellung. *Archeologické rozhledy* 43(1), 29–46.

NAUMOV, G. 2013: Embodied houses: the social and symbolic agency of Neolithic architecture in the Republic of Macedonia. In: Hofmann, D., Smyth, J. (Eds.): *Tracking the Neolithic house in Europe. Sedentism, architecture, and practice*. Springer, New York, 65–94.

NIKOLOV, V. 1989: Das frühneolitische Haus von Sofia–Slatina. Eine Untersuchung zur vorgeschichtlichen Bautechnik. *Germania* 67, 1–49.

PAVLŮ, I. 2000: *Life on a Neolithic site: Bylany-situational analysis of artefacts*. Archeologický ústav AV ČR, Praha.

PAVLŮ, I., RULF, J., ZÁPOTOCKÁ, M. 1986: Theses on the Neolithic site of Bylany. *Památky archeologické* 77(2), 288–412.

PAVLŮ, I., VAVREČKA, P. 2013: Rekonstrukce neolitických domů a jejich 3D zobrazení. *Živá archeologie: rekonstrukce a experiment v archeologii* 14, 82–88.

PAVLŮ I., ZÁPOTOCKÁ M., 1978: *Analysis of the Czech Neolithic Pottery: morphological and chronological structure of projections*. Archeologický ústav ČSAV, Praha.

PAVLŮ, I. (Ed.) , ZÁPOTOCKÁ, M. 2013: *The prehistory of Bohemia 2. The Neolithic*. Archeologický ústav AV ČR, Praha.

PERRY, L. L. 2011: *The International Code for Starch Nomenclature. Foundation for Archaeobotanical Research in Microfossils*. Available at: http://fossilfarm.org/ICSN/Code.html. Accessed on February 19, 2013.

PIPERNO, D. R. 2006: *Phytoliths: a comprehensive guide for archaeologists and paleoecologists*. AltaMira Press, Lanham.

PIPERNO, D. R., WEISS, E., HOLST, I., NADEL, D. 2004: Processing of wild cereal grains in the Upper Palaeolithic revealed by starch grain analysis. *Nature* 430, 670–673.

PŘICHYSTAL, A. 2013: *Lithic raw materials in prehistoric times of Eastern Central Europe.* Masaryk University, Brno.

REICHERT, E. T. 1913: *The Differentiation and Specificity of Starches in Relation to Genera, Species etc.; stereochemistry applied to protoplasmic processes and products, and as a strictly scientific basis for the classification of plants and animals.* Carnegie Institution of Washington, Washington.

ŘÍDKÝ, J., KOVAČIKOVÁ, L., PŮLPÁN, M. 2013: Chronologie mladoneolitických objektů a soubor kosterních zvířecích pozůstatků ze sídelního areálu s rondelem ve Vchynicích (okr. Litoměřice). *Archeologické rozhledy* 65, 227–284.

ŘÍDKÝ, J., PŮLPÁN, M., ŠREINOVÁ, B., ŠREIN, V., DRNOVSKÝ, V., KVĚTINA, P. 2014: „Životní cyklus“ mlecích nástrojů z mladoneolitického sídelního areálu s rondelem ve Vchynicích, okr. Litoměřice – “Life cycle” of grinding tools from the Late Neolithic settlement area with rondel at Vchynice, Northwest Bohemia. *Archeologické rozhledy* 64, 271–309.

SCHIFFER, M. B. 1986: Radiocarbon dating and the “old wood” problem: the case of the Hohokam chronology. *Journal of Archaeological Science* 13(1), 13–30.

SKLENÁŘOVÁ, Z. 2003: Možnosti a problémy rekonstrukce pravěkých a obytných staveb. In: *(Re) konstrukce a experiment v archeologii*, Ústav pro pravěk a ranou dobu dějinnou, FF UH, Praha, 11–37.

SOUDSKÝ, B. 1967: Principles of automatic data treatment applied on Neolithic pottery. MS. Deposited: Archeaological Institute CAS, Prague.

SOUDSKÝ, B. 1969: Étude de la maison néolithique. *Slovenská archeológia* 17, 5–96.

STÄUBLE, H., LÜNING, J. 1999: Phosphatenanalysen in bandkeramischen Häusern. *Archäologisches Korrespondenzblatt 29*, 169–187.

ŠÍDA, P. 2007: *Využívání kamenné suroviny v mladší a pozdní době kamenné. Dílenské areály v oblasti horního Pojizeří.* Dissertationes archaeologicae Brunenses/Pragensesque 3. Univerzita Karlova v Praze, Praha.

ŠÍDA, P., KACHLÍK, V. 2009: Geological setting, petrology and mineralogy of metabasites in a thermal aureole of Tanvald granite (northern Bohemia) used for the manufacture of Neolithic tools. *Journal of Geosciences* 54/3, 269–287.

THERIN, M., TORRENCE, R., FULLAGAR, R. 1997: Australian Museum Starch Reference Collection. *Australian Archaeology* 44, 52–53.

TUREK, J. 2005: Neolit – mladší doba kamenná. In: Lutovský, M., Smejtek, L. (Eds.): *Pravěká Praha*, Praha: Libri, 157–238.

VAŘEKA, P. 1994a: Význam obřadů a zvyklostí spojených se stavbou vesnického domu pro poznání archaických představ o krajině. In: Beneš, J., Brůna, V. (Eds.): *Archeologie a krajinná ekologie*. Most, 126–138.

VAŘEKA, P. 1994b: Customs and rites connected with the building process of a rural house and its importance for the study of archaic notions about space and landscape. Mediaevalia Archaeologica Bohemica 1993, *Památky archeologické*, Supplementum 2, 139–144.

VONDROVSKÝ, V. 2015: Neolitický sídelní areál Hrdlovka: analýza keramického materiálu. MS. Master diploma thesis. Deposited: Jihočeská univerzita, České Budějovice.

VONDROVSKÝ, V., BENEŠ, J., RAUEROVÁ, M., KOVAČIKOVÁ, L., ŠÍDA, P., DIVIŠOVÁ, M. 2015: The Neolithic sites Hrdlovka and Hrobčice in the context of Stroked Pottery Culture in Northwest Bohemia, Czech Republic. *Anthropologie* 53(3), 457–471.

WHITTLE, A. 1996: *Europe in the Neolithic: the creation of new worlds*. Cambridge University Press, Cambridge.

ZÁPOTOCKÁ, M. 1978: Ornamentace neolitické vypíchané keramiky. *Archeologické rozhledy* 30, 504–534.

ZÁPOTOCKÁ M., 1998: *Bestattungsritus des böhmischen Neolithikums (5500–4200 B.C.): Gräber und Bestattungen der Kultur mit Linear-, Stichband- und Lengyelkeramik*. Archeologický ústav AV ČR, Praha.