

Borderlands of the Linear Pottery culture landscape: A case study of the Dobřeň settlement in eastern Central Bohemia

Hranice krajiny kultury s lineární keramikou: případová studie
sídliště Dobřeň na východě středních Čech

– Daniel Pilarš*, Filip Velímský –

KEYWORDS

Linear Pottery culture (LBK) – Bohemia – periphery – chronology –
landscape – climate – 14C dating

ABSTRACT

The research focuses on the peripheries of the Elbe Lowlands in the east of Central Bohemia during the Early Neolithic, examining colonisation dynamics and the character of settlements in marginal areas. The recently discovered Linear Pottery culture (LBK; 5500–4950 BC) settlement at Dobřeň provides new insights into this issue. A rescue excavation conducted in 2024 uncovered a loosely arranged settlement consisting of four longhouses. Based on relative chronology and radiocarbon dating, the site can be placed within the classical LBK period, roughly between 5300 and 5050 BC. Other sites in the peripheral zone, such as the well-known settlement at Miskovice, may also be assigned to this period, although uneven data quality limits broader comparisons. The results indicate that the periphery of the selected part of the Elbe Lowlands was apparently not settled until after 5300 BC, i.e. several generations after the initial colonisation of the fertile lowlands. This may reflect a process of secondary densification of occupation within the region. The research also shows that most settlements in the area contain almost none of the pottery typical for the Late and Final LBK. However, available data are still insufficient for drawing firm conclusions about a possible decline or abandonment during these phases. It also remains unclear whether these sites were simply unfavourable or whether they offered Neolithic communities different advantages, such as access to resources outside the settled zone. Therefore, studying the peripheries and ‘empty’ regions outside occupied enclaves is crucial for fully understanding the Neolithic centres themselves in the future.

1. Introduction

Linear Pottery culture (LBK) settlements are some of the best-studied phenomena of prehistoric occupation in Bohemia. This is especially true for the Kutná Hora District, which is one of the best-known regions in this regard, thanks to the long-term systematic work of the Bylany expedition team (Pavlů, Rulř 1996a). Nevertheless, in 2024, a new, previously unknown LBK settlement was discovered during a rescue archaeological excavation in Dobřeň, located on the very edge of a region settled in the Early Neolithic period. This discovery sheds new light on the character of settlements in the periphery of one of the most densely populated regions of Bohemia.

From the 4th century of the 6th millennium BC, LBK communities settled in warm and fertile locations in the Bohemian Basin (Pavlů, Zápotocká 2013, 56). One of the most important areas in this process was the fertile lowlands around the Elbe, the largest river in the region. Decades of research in this region have yielded a large number of settlements, including some of the largest and most densely populated (e.g. Kolín, Velim and Bylany). However, these rich and fertile areas are bordered by mountains and hilly areas, where Neolithic settlements disappear. Higher altitudes, poor soil quality and a harsher climate clearly formed a boundary for the Neolithic way of life. Nevertheless, a transitional belt lay between the two areas that prehistoric communities repeatedly attempted to colonise. Studying these peripheries and understanding how they functioned and what their dynamics were also contributes significantly to our understanding of the centres themselves (Vondrovský et al. 2021). However, previous research has focused primarily on Elbe lowland settlement centres, while the character of peripheral sites and the dynamics of their colonisation remain comparatively poorly understood (Pavlů, Vejdělek 2014).

The newly discovered, well-preserved Neolithic settlement of Dobřeň offers us insight into life on the Elbe Lowlands periphery of this period. During a rescue excavation covering an area of 2.2 hectares, the ground plans of four longhouses and the surrounding settlement pits were uncovered. However, the settlement's character differs from that of most sites in the region. The key differences are the sparse distribution of longhouses within the settlement area and the absence of later prehistoric periods, which is uncommon in LBK settlements (Pavlů 2002). But when was this area colonised, and can these characteristics be observed at other sites in the region? This article aims to examine the colonisation dynamics of the Elbe Lowlands in eastern part of Central Bohemia, with a focus on the newly discovered settlement in Dobřeň.

* Corresponding author – E-mail address: pilar@arup.cas.cz

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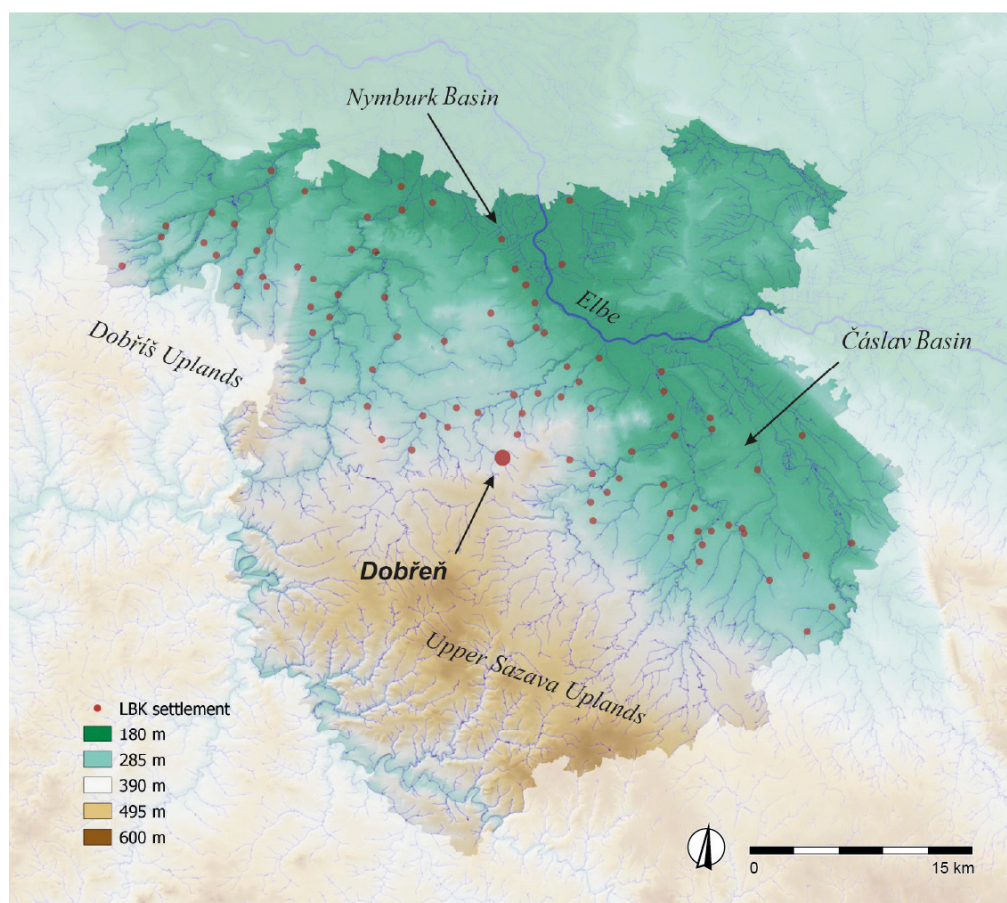


Fig. 1. Map of the studied area with key geographical units and known LBK settlements. Created from DMR 5G data © ČÚZK. Author D. Pilař.

Obr. 1. Mapa zkoumané oblasti s názvy hlavních geografických celků a známými sídlišti LBK. Podkladová mapa DMR 5G © ČÚZK. Autor D. Pilař.

2. Occupation and environment of the region

The Dobřeň site is located on the northern edge of the Upper Sázava Uplands (Fig. 1). To the north lies the Český Brod Plateau and Nymburk Basin, which forms part of the lowlands surrounding the Elbe River. To the east is the Čáslav Basin. These three fertile areas were both densely populated during the Neolithic period. The occupied area is bordered to the south by the Dobříš Uplands and the aforementioned Upper Sázava Uplands. Administratively, the site corresponds to the border between the districts of Kutná Hora and Kolín (eastern Central Bohemia), which, for the purposes of this work, will serve to spatially define the area for comparison (creating a circle of approximately 20 km around the site). This delimitation provides a representative sample of 90 settlements from different ecological zones (based on AMČR; Pavlů, Rulf 1996a; 1996b). This area is historically divided into two subregions and six micro-regions, which have already been described in detail in the past (Pavlů, Rulf 1996a; 1996b).

Most settlements were founded in fertile lowlands with favourable agricultural conditions (Pavlů, Rulf 1996a). Mild slopes near water sources were typically used, as were river floodplains (Pavlů, Zápotocká 2013, 56). Most settlements are located at 200–350 m A.S.L. Settlements are rarely found at higher altitudes (only 7% of observed sites exceed 350 m A.S.L.; see Fig. 1). The soil and subsoil of the sites also played an important role: the vast majority of settlements were built on rich brown earth and black earth. While the presence of loess subsoil was not a strict requirement for LBK settlements, most were located on it (Fig. 2).

In contrast to this fertile area, the southern part of the studied territory consists of the Upper Sázava and Dobříš Uplands, i.e. hilly areas with higher elevations (c. 300–600 m A.S.L.) and worse conditions for prehistoric agriculture. The soils in this area are poorer – consisting of pseudogley, cambisol, and luvisol.

Both areas also differ in terms of climate (Quitt 1971). The Čáslav Basin and the Elbe Lowlands are among the warmest areas in Bohemia (Fig. 2 – T2). They are characterised by long, warm summers and short, dry winters. At higher altitudes, the climate is milder (MT9 and MT10), while the coldest area is the southeast uplands (MT7). These areas have slightly longer winters, higher precipitation and shorter summers (Minářová 2011). During the LBK (early Atlantic period) the climate was different to that of the modern era – in general, it was slightly warmer and wetter than today, but differences due to the vertical structure of the landscape were still evident (Rulf 1983; Bouzek 2005). Therefore, the division of the area into warm lowlands and slightly cooler hills can also be applied to the Neolithic period. However, it is important to emphasise that, while not dramatic, the differences in climatic conditions between the two areas created constant pressure that prevented prehistoric communities from systematically occupying the hilly areas.

The aforementioned data clearly show the two basic ecological areas of the studied region. The fertile lowlands were formed by the Čáslav Basin and the Elbe Lowlands in the north and north-east, while the upland areas in the south and south-west were colder and less suitable for agriculture. The fertile lowlands were the core of occupation throughout prehistoric times, whereas the higher, upland areas were only occasionally inhabited and have only been intensively settled since the High Middle Ages. However, these areas were separated by a transitional zone, reflecting the efforts of communities settle the outskirts of the fertile lowlands. It is also important to stress that the differences in ecological conditions between the two zones in this region are not extreme. In Bohemia, there are regions where Neolithic communities inhabited areas that were even less suitable (Vondrovský et al. 2024). However, the key aspect is that in the case of the Elbe region, communities on the periphery always lived in

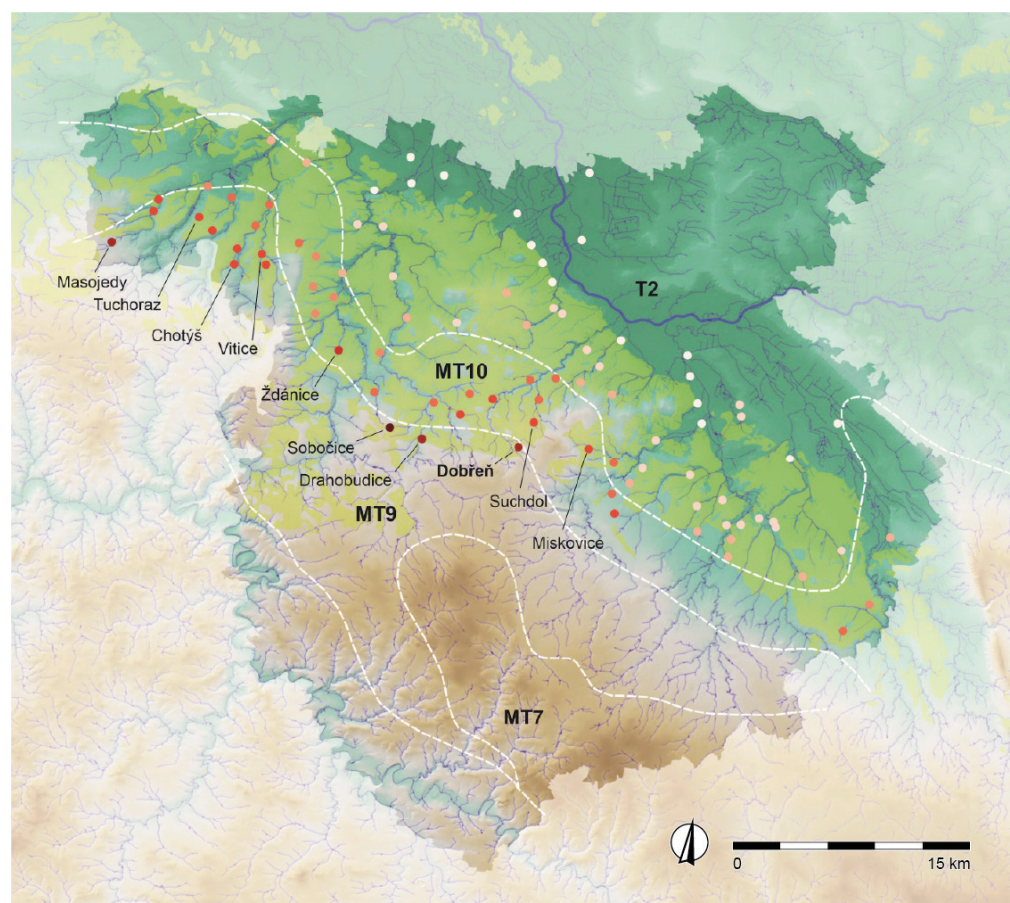


Fig. 2. Map of the studied area with marked climate zones (dashed line) and loess subsoil (yellow). LBK settlements are labelled with a colour scale according to their 'ecological suitability' (white – most suitable, red – least suitable). Created from DMR 5G data © ČÚZK. Author D. Pilař.

Obr. 2. Mapa zkoumané oblasti s vyznačenými klimatickými zónami (čárkovaná čára) a sprašovým podložím (žlutá barva). Sídliště kultury LBK jsou označeny barevnou škálou podle jejich „ekologické vhodnosti“ (bílá – nejvhodnější, červená – nejméně vhodná). Podkladová mapa DMR 5G © ČÚZK. Autor D. Pilař.

close proximity to settlements in the lowlands. Therefore, the element of deciding where to establish a new settlement was significantly different than in more remote areas, where more suitable alternatives were not available nearby.

3. Material and Method

3.1 Material

Within the selected region, all known LBK settlements were included in the analysis. The dataset was compiled based on previously published works (Pavlů, Rulf 1996a; 1996b), the archaeological database of Bohemia (Pavlů, Zápotocká 2013), and records from the Archaeological Map of the Czech Republic (AMČR). In total, the dataset comprises 90 sites.

A more detailed analysis focused on selected sites – Dobřeň, Miskovice, Suchdol near Kutná Hora, and Tucharaz. In the case of Dobřeň, primary excavation documentation from the 2024 rescue excavation was used, while for the remaining sites only published data were available. These sites are discussed in detail in the following chapter.

3.2 Method

The classification of sites was based on three main environmental variables: altitude, climatic zone, and soil type (Demján et al. 2022, 4). Altitude was treated as a continuous variable and represents the most reliable parameter in the dataset. Climatic conditions were incorporated using the classification of Quitt (1971), which was coded as an ordinal variable reflecting the general gradient from warmer lowland areas (T2) to cooler upland zones (MT9–MT10).

Soil type was included as a supplementary variable derived from available pedological maps (Tomášek 2014). Individual soil

types were grouped into broader categories and coded ordinally according to their presumed agricultural suitability. However, this classification necessarily simplifies complex soil variability. Moreover, the spatial resolution of the available soil maps is limited and does not always correspond precisely to individual archaeological sites. For these reasons, soil type was treated as a supporting variable with reduced weight in the analysis. All variables were standardised prior to further processing in order to ensure comparability.

The structure of variability within the dataset was explored by principal component analysis (PCA), which was used to identify the main environmental gradients structuring the distribution of sites. Given the ordinal nature of some variables and the heterogeneity of the dataset, the PCA results are interpreted as a heuristic tool rather than a strictly statistical model.

To derive a single comparative measure, a composite index of relative environmental marginality was calculated based on a weighted combination of principal components. The first component was given the highest weight, reflecting its dominant role in structuring variability and its clearer environmental interpretation, while the remaining components were included with lower weights as supplementary factors. This procedure produced a continuous ranking of sites along a gradient of relative environmental conditions.

A chronological analysis was carried out for the selected sites. First, a typochronological classification was established following the chronology of Pavlů and Zápotocká (2013). This approach is based on the use of a descriptive system and analysis of pottery decorative styles that are considered to be chronologically the most sensitive (Pavlů et al. 1986; Květina, Končelová 2011).

In addition, absolute dating using radiocarbon (^{14}C) analysis was conducted for two key sites – Dobřeň and Miskovice. Preference was given to short-lived and contextually reliable

materials in accordance with current methodological recommendations (e.g. Bayliss, Marshall 2022). Ideally, animal bones would have been selected; however, these were not preserved at either site. Therefore, the dating focused primarily on charred plant remains and, where necessary, charcoal. In the case of charcoal samples, an effort was made to prioritise short-lived or fast-growing taxa in order to minimise the potential impact of the old wood effect, although in some instances only the available material could be used.

The selected samples were dated using AMS at CRL, and the results were calibrated and modelled using the IntCal20 calibration curve in OxCal v.4.4 software (Bronk Ramsey 2009; Reimer et al. 2020). The data were treated as single-phase models, with the beginning and end of occupation estimated using boundary functions. For samples suspected of being affected by the old wood effect, a charcoal outlier model was applied in order to account for potential offsets in the measured dates (Ramsey 2009).

4. Results

4.1 Peripheral sites in the region

The applied classification resulted in a continuous distribution of sites along a gradient of relative environmental conditions (SUPPL 1). This gradient is primarily structured by altitude and climatic zone, while soil type contributes only secondarily. The majority of settlements cluster within the more favourable part of the spectrum, corresponding to lowland areas with warmer climatic conditions.

In contrast, a smaller group of sites occupies the less favourable end of the distribution, characterised by higher elevations and cooler climatic zones. Based on the selected threshold (85th percentile), these sites can be defined as occupying environmentally marginal positions within the studied region. This group includes, among others, Dobřeň, Sobočice, Masojedy, Drahobudice, Ždánice, Tucharaz, Suchdol, and Miskovice (Fig. 2). These peripheral sites will be examined in more detail.

Overall, the results show that while most LBK settlements were located in environmentally favourable areas, a limited number of sites systematically extend into less suitable conditions, forming a transitional zone between the core lowland settlement area and the surrounding uplands.

4.1.1 Dobřeň

LBK settlement

The site was discovered during a rescue archaeological excavation to the east of the village of Dobřeň in the Kutná Hora District (Fig. 3). During the 2024 excavation, the remains of an LBK settlement comprising the ground plans of four longhouses were found in an area covering 2.2 hectares. A total of 580 features were examined during the research, almost 4,000 artefacts were recorded, and 3,400 litres of clay were floated. The settlement was located on a mild slope between two streams at an altitude of 381 m A.S.L. The subsoil consisted of loess, over which a layer of modal brown earth had formed.

This LBK site was not previously known, even though the presence of a Neolithic settlement near the village of Dobřeň was anticipated based on previous surface finds from the



Fig. 3. Location of 2024 rescue excavation in the village of Dobřeň near Kutná Hora (left). Plan of the excavated area with discovered features. The area damaged by construction is highlighted (hatched). The only pit dated to the Late Neolithic period – Stroked Pottery culture – is highlighted in blue. Created from ZTM10 data © ČÚŽK. Author D. Pilař.

Obr. 3. Poloha záchranného archeologického výzkumu z roku 2024 v Dobřeni u Kutné Hory (vlevo). Zkoumaná plocha s dokumentovanými objekty. Plocha poškozená stavbou je zvýrazněna šrafováním. Jediná jáma datovaná do mladšího neolitu – kultura s vrypchanou keramikou – je zvýrazněna modře. Podkladová mapa ZTM10 © ČÚŽK. Autor D. Pilař.



Fig. 4. Dobřeň settlement with highlighted ground plans of longhouses. Author D. Pilař.

Obr. 4. Sídliště Dobřeň se zvýrazněnými půdorysy dlouhých domů. Autor D. Pilař.

Stroked Pottery culture (StK). Evidence of a Late Neolithic settlement was also found during the research when one StK pit was discovered on the northern edge of the investigated area (Fig. 3). Interestingly, there is no evidence of any later occupation in the excavated area or its immediate surroundings, and the Dobřeň site was not occupied again until the 14th century (Profous 1947, 401). Thanks to the absence of superpositions with later occupations, the site was highly legible from an archaeological perspective.

The most notable findings at the LBK settlement were the ground plans of longhouses (Fig. 4), four of which were identified in the southern part of the site. Thanks to their good state of preservation, it was possible to identify even small construction elements as well as the central rows of massive columns. Interestingly, the houses are loosely arranged and more than 30 m apart. This layout is unusual for settlements in the region, where houses are usually arranged in rows or groups with little space between them (e.g. Bylany – Pavlů 2000, Velim – Chlup 2017, Kolín – Šumberová, Pavlů 2017, Hlízov – Pilař et al. 2025). The individual houses differ in their construction, even though it is not always possible to describe their appearance precisely. House No. 1 was 21 m long and divided into three parts, with a row of double posts at the northern end. House No. 2 was a single-part building measuring 12 m in length, with a clearly visible groove construction at its northern end. House No. 3 and 4 cannot be clearly described, as their northern sides were destroyed during construction work. Nevertheless, in both cases they were at least two-part houses, measuring at least 13 and 20 m in length, respectively.

A number of settlement pits were also found within the excavated area. Typical lateral pits were found on the sides of the houses; some contained a high density of pottery and stone tools, including a protentional deposit of grinding stones (Hamon 2020). In addition to the lateral pits, a number of more distant isolated pits were found in the settlement area. Their spatial connection to a specific house, however, is unclear. Five

simple, single-chamber ovens were also found in these isolated pits. These ovens had been dug into the clay walls of the pits. However, no pits resembling typical storage features were identified throughout the settlement (Šumberová 1996). Nevertheless, pit number 14 – the western lateral pit of house No. 4 – is worth mentioning (Fig. 4). A layer of burnt daub was found in its fill, along with a large assemblage of burnt plant remains numbering in the thousands. This unique find plays an important role in characterising the plant remains at the site and in its dating.

In the context of the aforementioned findings, it is necessary to address the possibility of other buildings being present in the settlement. During the excavation, several locations that appeared to be possible sites of Neolithic longhouses were identified. These were mostly gaps between settlement pits with suitable dimensions and orientation, or groups of postholes arranged in a suitable manner. These locations were given increased attention, and a dedicated search was conducted for poorly visible postholes. However, additional buildings were not confirmed in any of these cases. Given the good archaeological preservation of the construction relicts of the four houses found, we consider it unlikely that there were additional houses in the excavated area. We cannot, however, comment on the possible presence of houses outside the investigated area, especially to the south and west. This will therefore be the subject of follow-up research in the future.

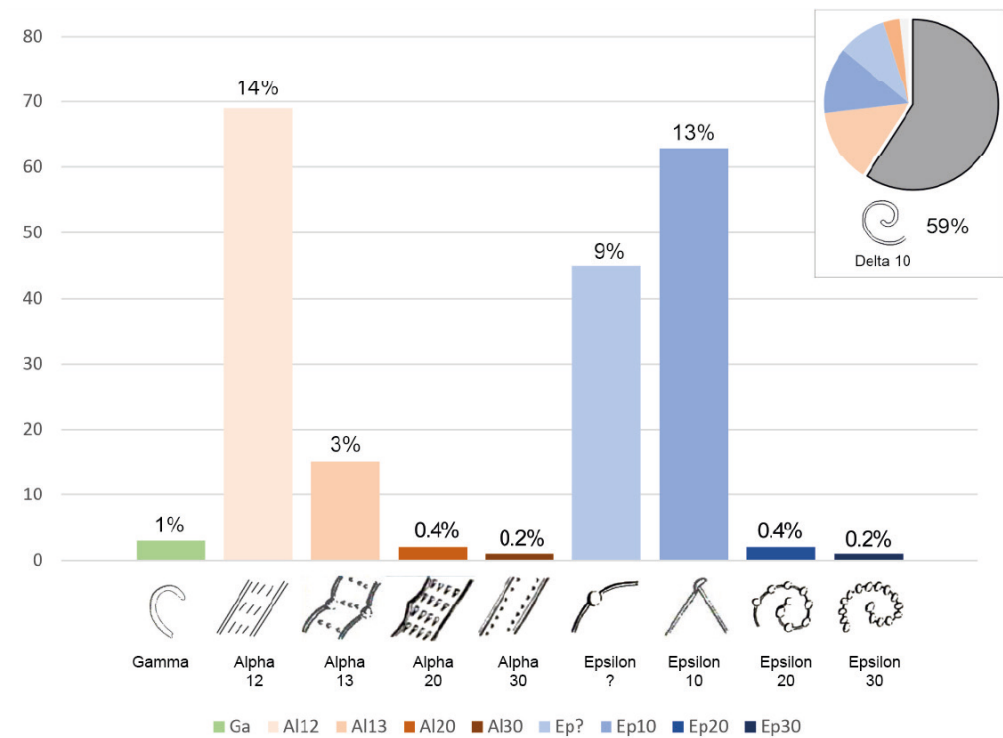
Settlement dating

The finds collected during the excavation allows us to date the settlement approximately using typochronology. Given the similar composition of pottery decoration throughout the settlement area, the pottery assemblage was examined as a single unit.

The most common decorative style found was a simple engraved line (Delta 10; n = 266), which is the most prevalent style in most LBK settlements (Pavlů et al. 1986, 350–351). However, due to its frequent occurrence, it is not very chronologically sensitive, and its representation in archaeological assemblages may be overrepresented, for example, due to fragmentation

(Pilař, Květina 2023, 35–36). Much more important in this respect are decorative styles using bands filled with strokes (Graph 1; Fig. 5). Alongside simple bands (Alpha12), more complex variants of this style were also present to a lesser extent (Alpha13, Alpha20 and Alpha30). The third largest group of styles was decoration using musical notes, consisting of punctures and nail

incisions made on an engraved line. These most often occurred at the joint of the line (Epsilon10) or were sparsely distributed along it (Epsilon?, Epsilon20). Variants of dense musical-note decoration (Epsilon30) were found only exceptionally. The final category is decoration using wide engraved grooves (Gamma), which was also found only rarely.



Graph 1. Representation of decorative styles in the Dobřeň settlement.
Graf 1. Zastoupení výzdobných stylů na sídlišti Dobřeň.

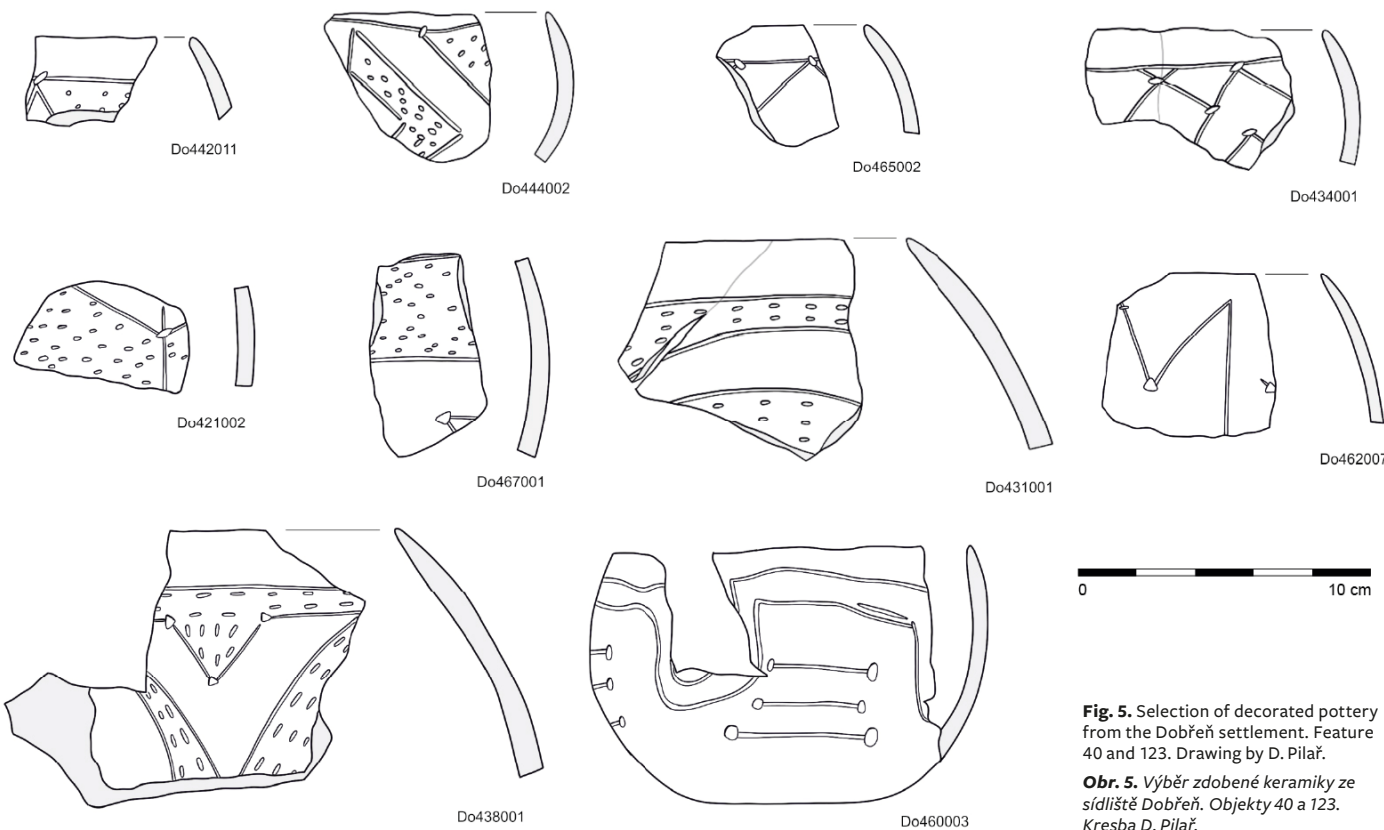


Fig. 5. Selection of decorated pottery from the Dobřeň settlement. Feature 40 and 123. Drawing by D. Pilař.
Obr. 5. Výběr zdobené keramiky ze sídliště Dobřeň. Objekty 40 a 123. Kresba D. Pilař.

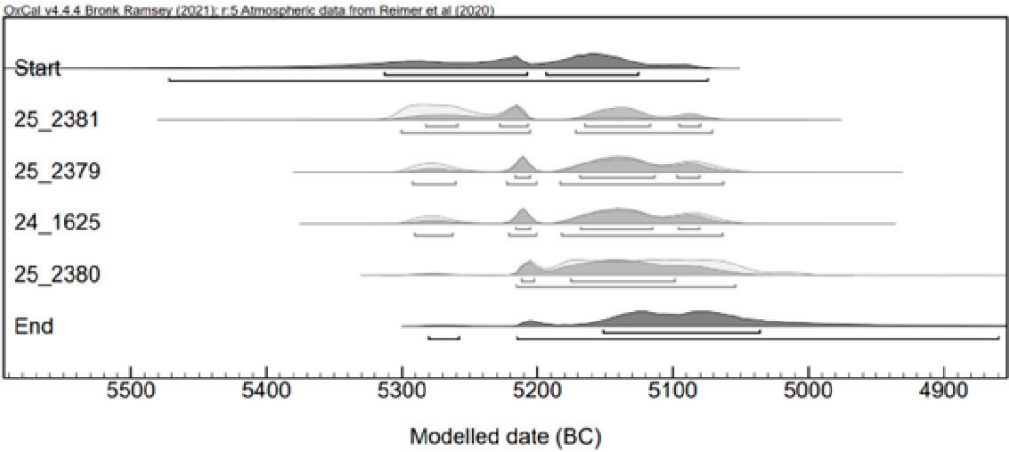


Fig. 6. Multiplot of calibrated radiocarbon measurements. Author D. Pilař.
Obr. 6. Kalibrovaná radiokarbonová měření. Autor D. Pilař.

Feature	Sample	Lab number	14C age (BP)	Cal BC (95.4%)	Modelled cal BC (95.4%)
14	Triticum dicoccum	CRL-25_2381	6261 ± 32	5315 (95.4%) 5074	5301 (95.4%) 5072
14	Triticum dicoccum	CRL-25_2379	6219 ± 28	5300 (95.4%) 5055	5293 (95.4%) 5063
14	Triticum dicoccum	CRL-24_1625	6217 ± 25	5298 (95.4%) 5057	5291 (95.4%) 5064
14	Triticum dicoccum	CRL-25_2380	6178 ± 28	5216 (95.4%) 5033	5216 (95.4%) 5055

Tab. 1. Overview of samples dated by the radiocarbon (AMS) method with modelled dates.
Tab. 1. Přehled vzorků datovaných radiokarbonovou metodou (AMS) s modelovanými daty.

In terms of relative chronology, Dobřeň clearly falls into the middle/classical stage of LBK, which is characterised by a high share of filled bands (Alpha) and simple musical note decorations (Epsilon?/10/20; Pavlů, Zápotocká 2013, 30). Styles typically associated with the Early LBK (wide grooves – Gamma) and with the Late and Final LBK (dense notational lines – Epsilon20; late filled bands – Alpha30) occur only sporadically.

This relative chronological classification was combined with the results of absolute 14C dating. No bones were preserved at the site, so a group of charred grains from pit 14 was used for dating. These samples came from a single layer consisting of a single-phase deposition of fire debris, so they can be considered taphonomically suitable. The data was modelled as a single phase, and the beginning and end of the interval were modelled using the boundary function.

The dating results indicate an interval of 5314–5036 BC¹ (68% probability; Aoverall = 84.6; Fig. 6; Tab. 1; SUPPL 2). However, the resulting interval is affected by the radiocarbon plateau in the period 5200–5000 BC. There is a noticeable time shift compared to the latest comprehensive chronology of the LBK in Bohemia (Pavlů, Zápotocká 2013, 29). This is because the original chronology assumed that the LBK began in Bohemia before 5500 BC. However, new data from recent years show that LBK settlement in Bohemia did not occur until after 5400 BC (Schindlerová 2019, 102–104; Vondrovský et al. 2024, 4). In this regard, it is necessary to reevaluate the old chronology – Pavlů, Zápotocká 2013, 29.

Dating the site to this period is important for understanding the development of the region as a whole. Classifying the Dobřeň settlement into the classical LBK phase shows that it must have been settled no earlier than about 50–100 years after the founding of the region’s oldest Neolithic settlements (such as Nové Dvory, Bylany and Kolín). Therefore, the decision to settle these areas was made by communities that had lived in and used the region for several generations.

4.1.2 Miskovice

Another site mentioned is Miskovice, which is well known in the region (Last 1998; Pavlů 1998). However, compared to Dobřeň, this settlement is located at a lower altitude (351 m A.S.L.), lies in a slightly more favourable climate zone MT10 (Fig. 2), and is also located on modal brown soils. Miskovice was archaeologically investigated in 1977–1979, when systematic research was carried out there under the leadership of Ivan Pavlů. During the research, a small LBK settlement consisting of three ground plans of houses arranged in a row was found (Fig. 7). In addition, the

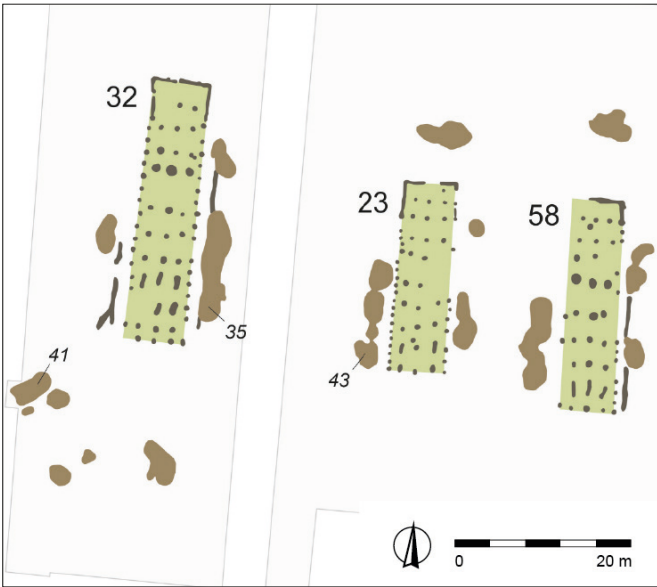


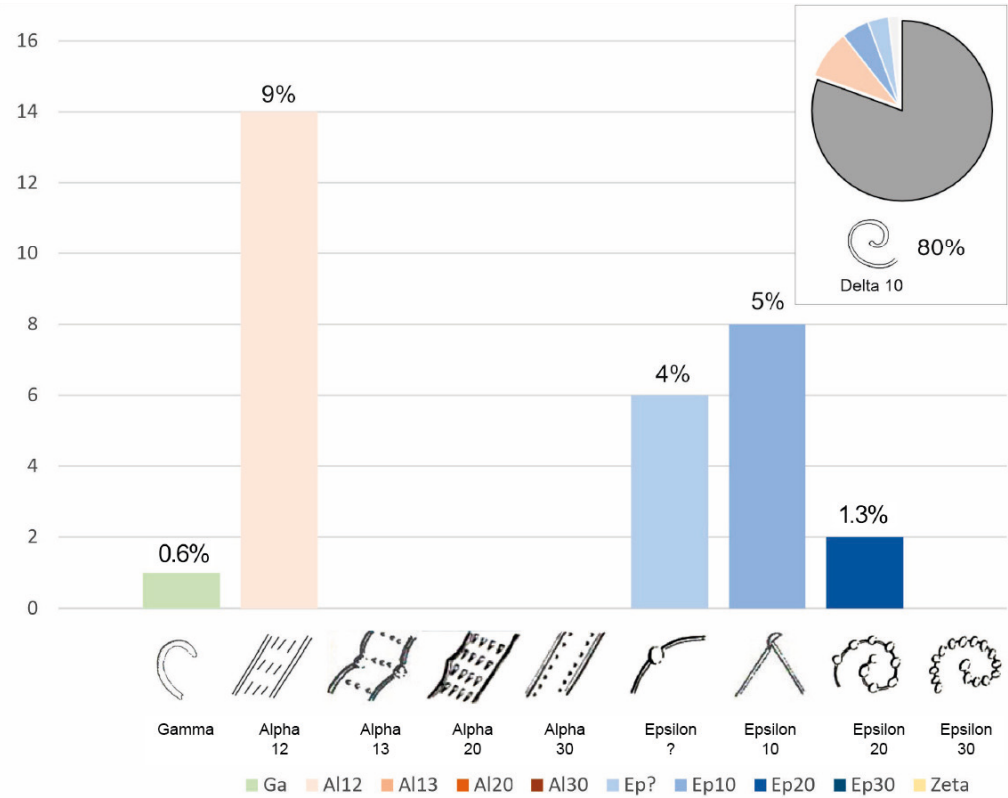
Fig. 7. Miskovice settlement with highlighted ground plans of longhouses. After Pavlů 1998, Fig. 3.
Obr. 7. Sídliště Miskovice se zvýrazněnými půdorysy dlouhých domů. Podle Pavlů 1998, Fig. 3.

most famous StK cremation burial ground in Bohemia (Zápotocká 1998, 44–79) was found in the vicinity of the houses. Due to the absence of other building relics in the vicinity, it is assumed that the settlement was explored as a whole (Pavlů 1998). Compared to the Dobřeň site, the layout of the houses in the settlement is significantly tighter and more organised. However, its structure is still looser than in the aforementioned lowland settlements.

Published in 1998, the chronological classification of the Miskovice settlement is closely linked to the chronology of Bylany (Pavlů 1998, 61–64). Individual houses and nearby pits were treated as chronological units (the house unit model was used; Pilař, Květina 2023), and decorative style representation was examined using discriminant analysis. The result is a sequence of individual houses (house No. 58 being the oldest, house No. 23

the youngest) that falls at the very end of the Early LBK and the first half of the Classical LBK (phase 7–12 in the Bylany chronology). However, the author considered this classification to be ambiguous due to the small number of decorated pottery pieces (Pavlů 1998, 62). In light of the current criticism of the methodological approach used (see Květina, Končelová 2011; Trampota, Květina 2020; Pilař, Květina 2023), it is necessary to re-examine the settlement’s dating. For the purposes of this study, we will examine the composition of pottery decoration styles as a whole, as was done for the Dobřeň site.

The most common decorative style was a simple engraved line (Delta 10; N = 129), which, however, is not very chronologically informative. The second most common was decoration with musical notes (Graph 2; Fig. 8). Another frequent occurrence



Graph 2. Representation of decorative styles in the Miskovice settlement.
Graf 2. Zastoupení výzdobných stylů na sídlišti Miskovice.

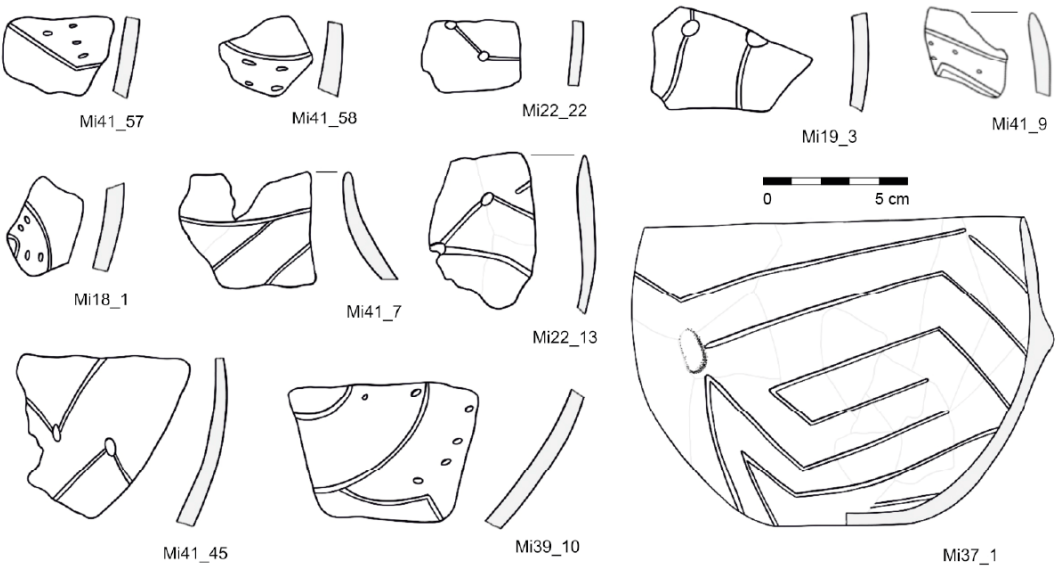


Fig. 8. Selection of decorated pottery from the Miskovice settlement. After Pavlů 1998, 70–74.
Obr. 8. Výběr zdobené keramiky ze sídliště Miskovice. Podle Pavlů 1998, 70–74.

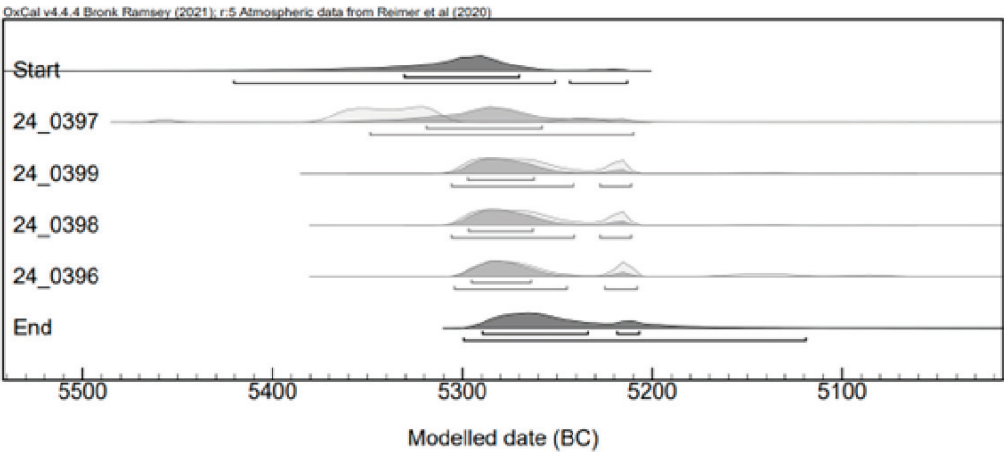


Fig. 9. Multiplot of calibrated radiocarbon measurements. Author D. Pilař.
Obr. 9. Kalibrovaná radiokarbonová měření. Autor D. Pilař.

Feature	Sample	Specification	Lab number	14C age (BP)	Cal BC (95.4%)	Modelled cal BC (95.4%)
41	Charcoal	Quercus	CRL-24_0397	6364 ± 20	5461 (95.4%) 5226	5349 (95.4%) 5211
43	Charcoal	Fraxinus	CRL-24_0399	6263 ± 20	5305 (95.4%) 5075	5304 (95.4%) 5208
41	Grain	Unidentified	CRL-24_0398	6261 ± 19	5309 (95.4%) 5208	5305 (95.4%) 5211
35	Charcoal	Corylus	CRL-24_0396	6245 ± 20	5461 (95.4%) 5226	5461 (95.4%) 5225

Tab. 2. Overview of samples dated by the radiocarbon (AMS) method with modelled dates.
Tab. 2. Přehled vzorků datovaných radiokarbonovou metodou (AMS) s modelovanými daty.

was a simple filled band (Alpha12), but without its more complex variants (i.e. Alpha3–30). Grooves (Gamma), typical of the Early LBK, appeared only marginally in the assemblage. However, this is represented by only a single shard, which considerably weakens the argument that the site was inhabited from the end of the Early LBK. Overall, the assemblage is smaller than that from Dobřeň, which makes the above-mentioned values less representative. However, it can generally be said that this is evidently a site from the Classical LBK, which is characterised by decoration using filled-in bands and simple musical notes (Pavlů, Zápotocká 2013, 30).

This relative chronological classification needs to be combined with absolute data. This was obtained from pit 35, 41 and 45, where charcoal and burnt grains were dated using 14C. Unfortunately, more suitable material for dating was not available at the site. To minimise the risk of the possible old wood effect, the charcoal was anthracologically identified and fast-growing wood species were also dated.

The majority of results of 14C dating correspond to the period between 5300 and 5200 BC (Fig. 9; Tab. 2). The only exception is sample CRL-24_0397, which was anthracologically identified as oak. However, oak is a species in which the old wood effect commonly occurs (Olsen et al. 2013; Bayliss, Marshall 2022, 36). Due to its significant deviation and the noted unreliability of species, the sample was modelled as a charcoal outlier (Ramsey 2009). The final model dates the occupation of the site to the period of 5331–5214 BC (68% probability; Aoverall = 125.6; SUPPL 2). This dating corresponds to the Dobřeň settlement, with the difference that the Miskovice interval does not continue into the plateau period after 5200 BC. However, it is possible that the Dobřeň site was not inhabited in a significantly later period, and the resulting wider range of dating is distorted by the presence of the radiocarbon plateau.

4.1.3 Suchdol near Kutná Hora

Other LBK sites in the defined peripheral zone are not nearly as well known. The first of these is the Suchdol settlement, which is located just two kilometres north of the Dobřeň site, at

an altitude of 365 m A.S.L. It is situated in the MT10 climate zone, on brown earth. Only small rescue excavations were carried out at this site in 1956 and 2007 (Steklá 1958, Šumberová 2007). The 1956 excavation, however, was more extensive, examining three settlement pits with one sunken oven. No architectural relics were found.

Based on the discovered artefacts, the excavated features can be roughly dated. The pottery was decorated mainly with simple engraved lines (Delta), and then simple lines with musical notes (Epsilon10) and relief bands (Fig. 10). The collection would thus

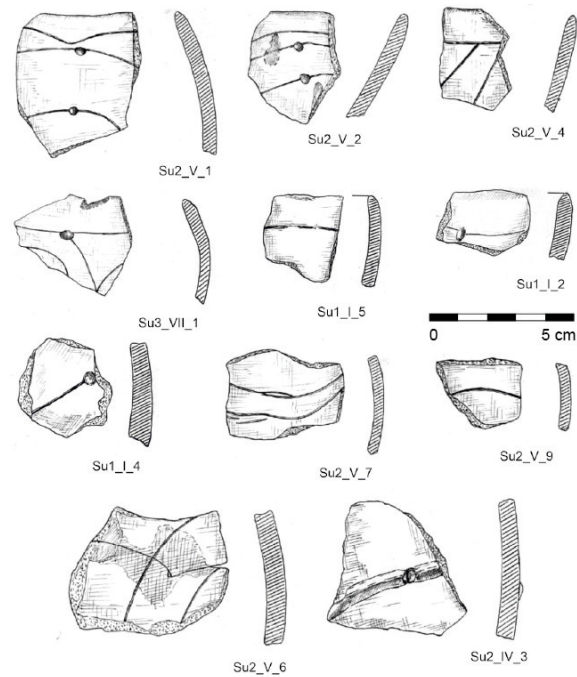


Fig. 10. Selection of decorated pottery from the Suchdol settlement. After Steklá 1958, 19–25.
Obr. 10. Výběr zdobené keramiky ze sídliště Suchdol. Podle Steklá 1958, 19–25.

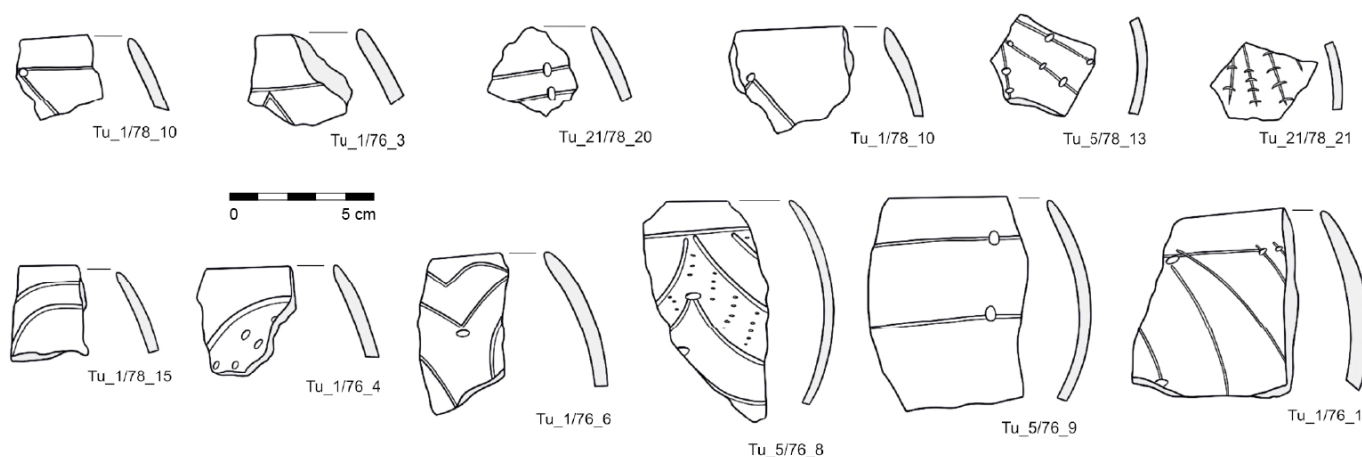


Fig. 11. Selection of decorated pottery from the Tucharaz settlement. After Pavlů, Rulf 1996b, obr. 16.

Obr. 11. Výběr zdobené keramiky ze sídliště Tucharaz. Podle Pavlů, Rulf 1996b, obr. 16.

correspond to the Classical LBK stage, but it should be emphasised that due to the size of the collection, this determination is only approximate (Only 25 decorated pottery shards have been documented). At the same time, it should be mentioned that only a small part of the settlement has been explored to date, and the possibility that there are other features from the Early or Late LBK nearby cannot be ruled out.

4.1.4 Tucharaz

The settlement was built on brown earth at an altitude of 285 m A.S.L. and in the MT9 climate zone. In the 1960s and 1970s, a series of rescue excavations were carried out on the southeastern side of the village, during which the ground plans of four long LBK houses were uncovered, but their comprehensive evaluation is still lacking (Pavlů, Rulf 1996b; Pavlů, Zápotocká 2013).

In terms of relative chronology, the settlement was classified in the Classical LBK stage (Zápotocká 1964, 629). This corresponds to the dominant occurrence of decoration of filled bands (Alpha12) or simple musical notes (Epsilon10, 20; Fig. 11). Styles associated with the younger stages of LBK were found only exceptionally (Epsilon30; Pavlů, Rulf 1996b, 135). An exact quantification of decorative styles is not possible.

4.1.5 Sites with limited archaeological evidence

For other sites where LBK settlements have been recorded, we have far less data and are usually unable to date them. Therefore, they will be mentioned only briefly here.

Chotýš

The site is located on brown earth at an altitude of 296 m A.S.L. and in the MT9 climate zone. The LBK occupation of the site is known only from surface surveys conducted by M. Vávra in the 1980s (Vávra 1987). The results of the surface collections were subsequently analysed and published by I. Pavlů and J. Rulf (1996b) and P. Burgert (Burgert et al. 2018). Variations of music-note decoration (Epsilon10, 20 and 30) and band-filled decoration (Alpha12) appear on the LBK pottery that has been found. These decorative styles correspond to the Classical and Late LBK periods. A style associated with the Early LBK period (Gamma) was found on a single shard (Burgert et al. 2018, 66–69).

Drahobudice

The site is located at an altitude of 350 m A.S.L. on modal luvisols in the MT9 climate zone. It was discovered at the beginning of the 20th century. František Dvořák mentions it in his overview of known sites in the region (Dvořák 1936). However, there have been no further records to allow for a better characterisation of the site until today (Pavlů, Rulf 1996b, 139).

Masojedy

The site is located on brown soil at an altitude of 363 m A.S.L. and in the MT9 climate zone. The site was newly discovered in 2010 during rescue exploration by M. Vávra (2010). During the research, settlement pits and an oven were found, which undoubtedly indicate the residential character of the site. However, a more detailed report on the excavation has not yet been published, so it is not possible to characterise the site in more detail.

Sobočice

The site is located on luvic brown earth at an altitude of 395 m A.S.L. and in the MT9 climate zone. It is the most elevated site in the region. The site was also discovered at the beginning of the 20th century by F. Dvořák (1936). However, it has not been further explored to date and its better characterisation is not possible (Pavlů, Rulf 1996b, 145).

Vitice

The site is located on brown soil at an altitude of 284 m A.S.L. and in the MT9 climate zone. The site has been investigated during several smaller rescue excavations and has been known from older surface surveys. The best documented excavations are those from 2015, when two pits with the typical pottery were found (Beneš 2017). A published selection from the material found shows decoration using sparse music-note lines (Epsilon10, 20) and thin bands (Alpha30). The finds should thus roughly belong to the Classical/Late LBK stage.

Ždánice

The site is located on brown soil at an altitude of 325 m A.S.L. and in the MT9 climate zone. The site was discovered at the beginning of the 20th century by F. Dvořák (1936). However, it has not been further researched to date, and its better characterisation is not possible (Pavlů, Rulf 1996b, 146).

5. Discussion

5.1 Colonisation of the peripheries

The evidence base for research on this topic in the region is clearly limited. Nevertheless, based on the presented data, it is possible to characterise the likely nature of settlements in the peripheral zone of the selected part of Elbe Lowlands. In terms of relative chronology, all the settlements mentioned were inhabited during the Classical LBK period, with almost no signs of Early LBK occupation found (only five shards bearing the characteristic decoration of this period were recorded in the entire area). This is consistent with the results of absolute dating, which indicate that settlements in this area emerged after 5300 BC. This suggests that the first Neolithic communities settled in this area only after LBK settlements had already existed in the lowlands for several generations (approximately since 5400–5350 BC; Vondrovský et al. 2024, 4). The relative chronology suggests that a similar process took place in eastern Bohemia (Pavlů, Vejčálek 2014). According to current models, this colonisation process occurred approximately 50–100 years earlier than in southern Bohemia, where more challenging settlement conditions are evident (Vondrovský et al. 2024, 4).

This process is interesting in the context of the Neolithic demographic transition and the spread of the LBK across Europe (Bocquet-Appel, Dubouloz 2004; Dubouloz 2008). Population growth in Neolithic settlements was a key factor in the rapid spread of the LBK communities. Alongside external expansion, however, there was also densification of settlements in already populated areas (Bocquet-Appel et al. 2014, 615). In the context of Bohemia, we can assume that after suitable fertile areas were initially inhabited in the Early LBK, the edges of these zones, and even the more remote inner peripheries, were colonised during the Classical and Late LBK periods (Vondrovský et al. 2024). Interestingly, there is very limited evidence of occupation in the Late and Final LBK periods in the studied area. Could this bias be caused by our current relative chronology (Pilař et al. 2026)? Or could it be due to its abandonment following a change of climate or social crisis (Gronenborn 2012; Denaire et al. 2017, 1139–1142). Or simply because nearby areas with more suitable conditions were easily accessible?

Therefore, future research should focus on improving our understanding of the chronological dynamics of settlement in this area and expanding our knowledge of other sites on the periphery. At the same time, it is necessary to investigate these sites in more detail, in order to determine whether they show signs of stress factors or of Neolithic communities adapting to poorer/different conditions (Ptáková et al. 2024).

5.2 Advantage in disadvantage

To date, the studied area has only been considered in the context of Neolithic agriculture. However, it should be noted that the locations of the settlements could offer a variety of other advantages that could compensate for their lower agricultural suitability. For example, the presence of a settlement on the edge of an occupied zone could provide access to more resources (for example, land for grazing) than locations surrounded by neighbouring settlements. These advantages and the deliberate choice of settlements in border zones are often discussed in archaeology. One such aspect is the use of ecotones, which are transitional zones between two ecological areas where the edge effect occurs, resulting in increased diversity and variety of resources (Rhoades 1978). Such zones therefore offer a greater diversity

of resources than areas surrounded by a single ecological zone and were frequently used during the Neolithic period (Pavlů, Zápotocká 2013, 58).

The same can be applied to zones that are shaped by the presence of cultural landscapes and settlements. Their edges could thus be attractive in terms of better access to uninhabited areas. At present, however, we do not fully understand what specific advantages this area could have had for Neolithic communities. The hilly woodland landscape may have offered many opportunities for hunting, gathering, grazing, or obtaining raw materials for production. This area could also have been used and perhaps even occupied seasonally. However, in this regard, we encounter a lack of data on what the territory outside the classical settled zones looked like and how it was used. The only finds are individual polished axes collected on the surface, which could have been brought to the area later. At the same time, we cannot rule out the possibility that these agriculturally unattractive zones were still used by hunter-gatherer groups, which are difficult to trace archaeologically (Vondrovský et al. 2024, 2). In this regard, research into these ‘empty’ areas and the identification of possible sources of archaeological/ecological data about their use will be crucial in the future. Without them, a full understanding of agricultural centres will never be possible.

6. Conclusion

This study examined LBK settlement in environmentally marginal areas of eastern Central Bohemia through a combination of regional analysis, and relative/absolute dating of selected sites with a focus of settlement in Dobřeň. The results show that while most settlements were located in favourable lowland environments, a smaller group occupied less suitable conditions at higher elevations and in cooler climatic zones.

Together with data from other sites (e.g. Miskovice), it is possible to characterise this peripheral zone more broadly. The available evidence indicates that LBK settlements in the area were established during the middle/classical phase, approximately around 5300 BC, as part of a process of secondary densification of the Elbe Lowlands following their initial colonisation. This development appears to precede the expansion into more environmentally challenging regions such as South Bohemia by at least several decades. While these peripheral areas were less suitable for agriculture, their position at the edge of the occupied zone may have offered new opportunities in the form of access to different resources. However, current interpretations remain limited by the lack of data from areas beyond the zone with typical LBK settlements. Further research should therefore focus on both peripheral settlements and the surrounding ‘empty’ landscapes in order to better understand the full extent of LBK land use.

Supplementary material

Detailed descriptions of the PCA analysis and radiocarbon modelling, including input data, parameters, and OxCal code, are provided in the supplementary material: <https://doi.org/10.5281/zenodo.20272947> (Pilař 2026).

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CRediT authorship contribution statement

Daniel Pilař: Conceptualisation, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Visualization, Writing – original draft, Writing – review and editing.

Filip Velímský: Resources, Writing – review and editing.

Note

- 1 The oldest date, CRL-25_2381, showed poor agreement with the model ($A = 59.6$). However, as this value was only slightly below the conventionally accepted threshold of 60, the model was still used.

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Resumé

Článek se věnuje periferním oblastem Polabí v období staršího neolitu, konkrétně zkoumá dynamiku a charakter sídlišť kultury s lineární keramikou (LBK; 5500–4950 BC) ve východní části středních Čech. Hlavní pozornost je věnována nově nalezenému sídlišti v Dobřeni u Kutné Hory, které bylo zkoumáno v roce 2024 během záchranného archeologického výzkumu. Během něj byly na ploše 2,2 ha nalezeny půdorysy čtyř dlouhých domů LBK a řada sídlištních jam (obr. 4). Unikátním rysem sídliště je volné uspořádání domů s velkými rozestupy, které jej výrazně odlišuje od ostatních lokalit v regionu (např. Bylan, Kolína, Velimi anebo Hlízova). Na základě relativní chronologie a ¹⁴C datování je možné sídliště zařadit do klasického stupně LBK, přibližně do období mezi 5300–5050 BC (obr. 6).

Toto sídliště bylo následně srovnáno s dalšími známými lokalitami v regionu, které můžeme řadit do periferie – přechodu do chladnější a méně úrodné oblasti Dobříšské a Hornosázavské pahorkatiny (obr. 2). Nejznámější z nich je sídliště v Miskovicích, které bylo zkoumáno velkoplošným odkryvem v 70. letech minulého století. Přesto, že tři dlouhé domy nalezené na sídlišti mají mezi sebou menší rozestupy než v Dobřeni, je struktura sídliště stále volnější než u zmíněných sídlišť v nížinách (obr. 7).

Po stránce relativní a absolutní chronologie jde sídliště také zařadit do klasického stupně LBK, odpovídajícího v tomto případě období 5300–5200 BC (obr. 9). Posun v absolutní dataci oproti Dobřeni je způsoben tím, že získaná ¹⁴C data nepřesahují do radiokarbonového platu v období 5200–5000 BC. Z výsledků je zjevný i lehký posun oproti původní dataci lokality i absolutní chronologii Čech (Pavlů 1998; Pavlů, Zápotocká 2013). Ten je způsoben jak současnou kritikou původní relativní chronologie (Květina, Končelová 2011; Pilař, Květina 2023), tak zastaralostí chronologie absolutní (Vondrovský et al. 2024). V případě dalších sídlišť na periferii již není zdaleka dostupné takové množství dat. Z publikovaných dat je možné rámcově datovat sídliště v Suchdole u Kutné Hory a Tuchorazi, která obě spadají do klasického stupně LBK. U zbytku lokalit můžeme pouze konstatovat přítomnost osídlení ve starším neolitu.

Výsledky jsou ovlivněny rozdílnou úrovní pramenné základny. I tak je ale možné vyslovit některé předběžné závěry k osídlení periferií v zkoumaném regionu. Oblast byla zjevně osidlována až v období klasické LBK, po 5300 BC, kdy již byly vhodnější oblasti Polabí po několik generací osídleny (Vondrovský et al. 2024). Doklady osídlení starého stupně LBK v periferní oblasti téměř chybí. Může tak jít o důsledek sekundárního zahušťování osídlení v regionu. Výzkum dále ukazuje velice nízké zastoupení znaků, které by bylo možné spojovat s mladou a pozdní LBK. V současné době ale nelze rozlišit, zda jde o důsledek současné relativní chronologické klasifikace (Pilař et al. 2026) anebo jestli mohlo dojít v závěru LBK k opuštění oblasti například z důvodu klimatické změny anebo společenského tlaku (Gronenborn 2012; Denaire et al. 2017, 1139–1142). Diskutovaný je i charakter sídlišť na periferiích. Zhoršené podmínky pro zemědělství v těchto polohách mohly být vyvažovány řadou výhod, které tento ekologický handicap kompenzovaly. Umístění sídliště na okraji osídlené zóny tak mohlo zajistit lepší možnosti lovu, sběru, pasivy nebo těžby. V tomto ohledu ale výzkum naráží na absolutní nedostatek dat mimo osídlené oblasti, který neumožňuje tyto otázky řešit. Výzkum periferií, ale i „prázdných“ oblastí mimo osídlené enklávy má tudíž klíčový význam pro plné pochopení samotných zemědělských center.

Contacts

Daniel Pilař

Czech Academy of Sciences
Institute of Archaeology, Prague
Letenská 4
118 00 Prague
Czech Republic
pilar@arup.cas.cz
ORCID: 0000-0003-2419-0139
&
Charles University, Faculty of Arts
Department of Archaeology
Jana Palacha 1/2
110 00 Prague
Czech Republic

Filip Velímský

Czech Academy of Sciences
Institute of Archaeology, Prague
Letenská 4
118 00 Prague
Czech Republic
velimsky@arup.cas.cz
ORCID: 0000-0003-0695-2064