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RESEARCH ARTICLE

Late Iron Age longhouse chronology. A study aimed at constructing a formal house chronology for the Late Iron Age, based on selected localities in central and eastern Jutland

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ABSTRACT

This paper presents a formalised chronological study of the longhouses of the Late Iron Age. This is based on the correspondence analysis of data relating to house ground plans recorded at a number of Iron Age settlements in central and eastern Jutland, which, as a region, has the most comprehensive relevant data set, including many constructional details. The chronology constitutes a formalisation of the house-chronological considerations undertaken to date in reference to settlements in Jutland and results in a seriable sequence, the chronological significance of which is supported by stratigraphic observations. The study demonstrates that, in general, the investigated settlements follow the same chronological development and can therefore be correlated. Moreover, it shows that the placing of each individual house in the chronology is subject to some uncertainty, due to the relatively small number and long duration of the chronological features.

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Introduction

Since the introduction of areal excavations in plan at the beginning of the 1960s, the number of known village settlements has increased explosively. Rescue excavations, not least, have played a decisive role in this respect, although, in relation to the Late Iron Age, the major research excavations of the 1970s and early 1980s continue to occupy a central position. This is true in particular of the total excavations of the localities of Vorbasse (Hvass 1988) and Nørre Snede (Hansen 1988), but sites such as Hodde (Hvass 1985) and, not least, Vendehøj (Ejstrud and Jensen 2000) have also been important for the interpretation of the structure, organisation and chronology of Early Iron Age settlement.[1]

The chronological foundation for an interpretation and understanding of these sites builds on four methodological components: house chronology, stratigraphic–architectonic analysis of the internal settlement development, typo-chronological dating of finds and radiocarbon dating, typically of plant macro-remains found in the buildings' postholes. These four methods can be considered as complementary as they have partly different areas of application and contribute information on different aspects of the chronology of these settlements.

The house chronology has been an absolutely indispensable tool in the elucidation of the development of the settlements and, consequently, the interpretation of these sites, even though it could not serve unsupported as a reference. It constituted an important foundation for both the chronological sorting of the individual sites and for correlating these in relation to each other. Its importance is due, not least, to the sparse occurrence of date-conferring finds at these sites. Increased use of radiocarbon dating has, however, begun to deliver a new chronological base. Nevertheless, it must be expected that the relative house chronology will continue to be significant due to the methodological constraints and uncertainties inherent in radiocarbon dating of settlements excavated in plan – especially those of long duration.

The major research excavations at Vorbasse and Nørre Snede have taken up a central position in the construction of the existing house-chronological models. The results have been presented in various articles and brief overviews focussing on the sites'

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longhouses (Hansen 1983, 1988, 1989; Mikkelsen 1988, 1999; Hansen *et al.* 1991, Hvass 1979, 1983, 1989, 1993; Siemen 1989). The house typology established and published in the late 1980s and early 1990s is still the most used with respect to the dating and interpretation of the longhouses of the Late Iron Age.

Already in the late 1980s, however, it was clear that the house typology for Jutland could not be applied to Iron Age sites on Zealand. The Zealand house architecture is of a different character and the settlement pattern is much more 'hamlet-like' in structure (Boye 1992, 2011, Fonnesbech-Sandberg 1992). Similarly, developments on Funen also proved to follow a separate course (Hansen 2016). In Jutland, the house typology and chronology established on the basis of Vorbasse and Nørre Snede is still employed (Hansen *et al.* 1991), supplemented by a few other observations from more general settlement publications (Ethelberg 2003).

The existing house chronology is based on a number of constructional traits that can be observed in the sites' house ground plans and which are considered to have chronological significance. Some of these traits are metric developments over time, while others are special constructional elements, deemed to belong to specific time periods. The identification of these elements was initially based upon the preliminary interpretation of the overall spatial–chronological displacement of the settlements, which in itself relied to a large extent on pottery dating, other artefact dates, and to some extent stratigraphical evidence and considerations on the possible duration of the village phases (Hvass 1989). Later, when a house typology had been established, the dating of the different house types was tested by studies of the pottery found in these buildings (Mikkelsen 1988). The house chronology is illustrated in the various publications with examples of longhouses representing the individual chronological phases (see Figure 1).

Of the metric dimensions, the width of the span of the roof-supporting posts relative to the total width of the house appears to have great and particular significance. A gradual reduction in the relative width of the span of the roof-supporting posts is evident – from 58% in the 1st and 2nd centuries AD, i.e. in the Early Roman Iron Age, to 38% in the 5–7th centuries AD, i.e. in the Late Germanic Iron

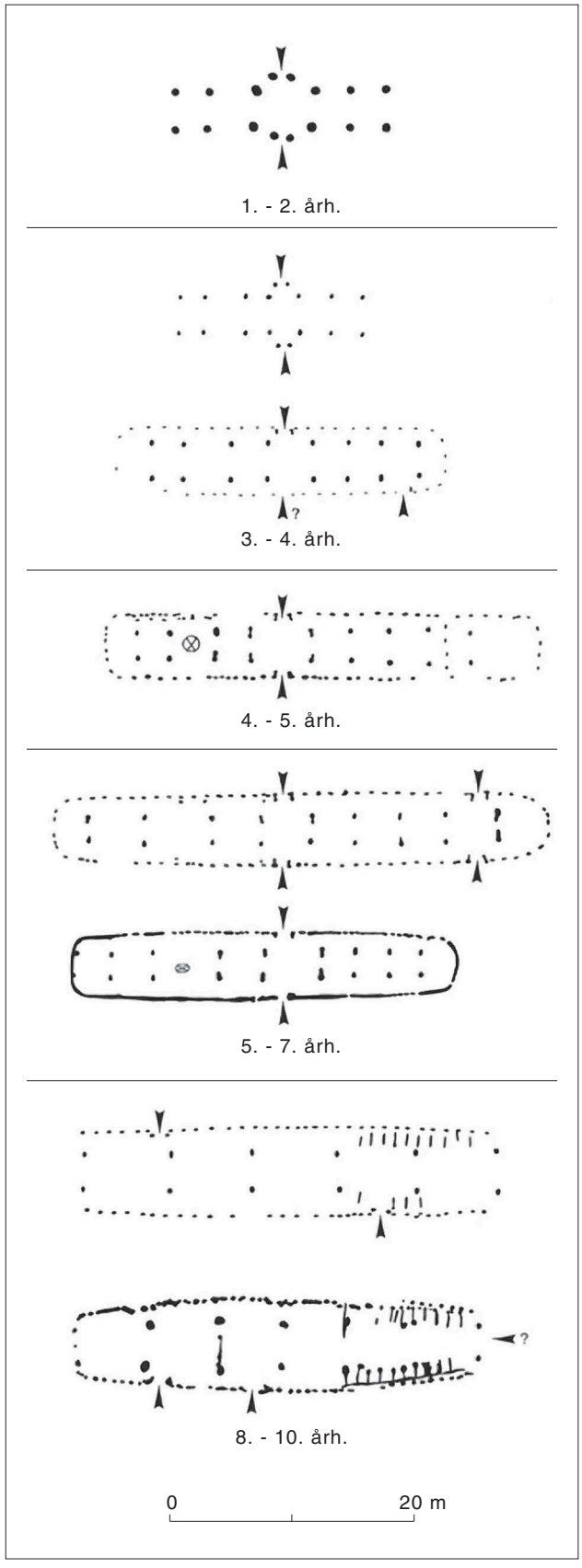

Figure 1. Chronological sequence of the longhouse types from Jutland in the Late Iron Age according to (Hansen *et al.* 1991). Drawing D. Kaldal Mikkelsen. Permission to publish obtained.

Age. The central aisle becomes very narrow, while the width of the house remains more or less unaltered. Synchronously, a development takes place in the position of the postholes, especially at the end of the house hosting the living quarters. Here, modular rooms with four sets of roof-supporting posts characterise the houses of the Late Roman Iron Age and Early Germanic Iron Age, whereas later, in the Late Germanic Iron Age, the roof-supporting posts are more evenly spaced relative to each other. In general, the relative position of the roof-supporting posts appears to be significant with regard to the dating of these longhouses (Hansen *et al.* 1991).

In the Late Germanic Iron Age, some of the houses also lack one of the roof-supporting posts in the third set from the entrance, and the final set before the gable may have a narrower span than the other sets in the building. As for the walls, their course, in particular, has been highlighted as being chronologically significant, with a development being observed from straight to curved. In addition, wall trenches have been considered a relatively late phenomenon. At the end of the Late Germanic Iron Age and in the Viking Age, the gables become straight and are reinforced with a set of roof-supporting posts, and the entrance 'hall', with opposing entrances, disappears. The curved course of the walls, and of the roof-supporting posts, also becomes more pronounced (Mikkelsen 1988, Hansen *et al.* 1991).

Despite the crucial significance of the house chronology, no formalised chronological study has yet been carried out of the data relating to these house sites. Moreover, it remains unclear to what extent the house chronology is actually relevant beyond the two sites on the basis of which it was developed: Nørre Snede and Vorbasse, cf. the evident regional differences mentioned above. There is a strong need for a formalised method enabling a correlation between sites. This will provide a better understanding of settlement structures and demographic developments.

The key role of earlier sites in the definition of the chronology to date is in part due to nature of the available published material on the subject and not necessarily an expression that they provide a comprehensive picture of the chronological development. Due to the many major Iron Age settlements excavated in recent years, there is therefore a clear need for refinement of the chronological–methodological tools for use in both the elucidation and the interpretation of these often extremely large and complex Iron Age villages. Similarly, there is a requirement to clarify the typology, and the chronology's regional and supraregional validity, as well as its strength and robustness: Just how clearly delimited and reliable are the chronological features as chronological indicators? Is it at all possible to employ the existing typology as a 'generally applicable' tool, or does in reality only represent local conditions and situations? This regional variation has increasingly come into focus in a number of other research areas, with major apparent differences in the grave record being observed between Jutland, Funen and the other islands, and with the division of the burial practices on Jutland into two main regional groups[2] (Ringtved 1988, Henriksen 2009). Similar diversity is evident in war booty deposits, which have their main distribution along the east coast of Jutland and on western Funen, while displaying a much more limited character on eastern Funen and Zealand and being completely absent from western Jutland (Iversen 2010).

The archaeological record for central Jutland does, however, in some respects constitute the most obvious point of departure for the chronological analysis. This is due partly to the previous work undertaken here, and partly to the generally good state of preservation of the building traces and the consequent comprehensive body of data, with a degree of detail that allows the identification of chronologically significant elements and stratigraphic relationships.

In the following, the results are presented of a study that had the aim of formalising the existing chronology for longhouses and testing whether this can be transferred to other sites in central and eastern Jutland. Methodologically, the study is based on correspondence analysis. Empirically, it builds on the house remains at one of the two classic settlements, i.e. Nørre Snede, combined with longhouses from a number of other selected settlements in eastern Jutland.

Selected Iron Age sites in eastern Jutland

In this house-chronological study, ground plans were employed from eight localities in eastern

Figure 2. Distribution of the locations mentioned in the text.

Jutland (see Figure 2). These were chosen on the basis of state of preservation, and within a relatively limited geographical area, for the purposes of constructing a formalised house chronology. Nørre Snede was one of the sites selected, in order to ensure a link to previous work on the subject and due to the magnitude of this site.

Nørre snede

Most of the settlement at Nørre Snede in central Jutland was excavated between 1979 and 1986, followed by a few minor, supplementary investigations. The site is dated to the Late Iron Age, *c.* AD 150–700, and is characterised generally by well-preserved building traces and no cultural layers. In total, an area of 80,000 m^2 was excavated, and the site is considered to have been almost totally excavated, with the exception of the later part, which presumably lies partially beneath the present-day town of Nørre Snede. An earlier, possible predecessor settlement has also been located to the northeast. In all, 179 longhouses were identified and distributed between about 45 farmsteads (Hansen 1988, Holst 2010). Of these, 89 were sufficiently well preserved, with characteristic constructional elements, for them to be included in this study.

The investigations at Nørre Snede were carried out as part-rescue, part-research excavation, the latter as a parallel to the contemporary investigations of the Vorbasse settlement. This role became very evident in publication terms in subsequent years, when Nørre Snede, together with Vorbasse, occupied a prominent position in descriptions of the village society of the Late Iron Age (Hedeager 1982, Hvass 1988, Hansen *et al.* 1991).

Hummelure (FHM 5147)

Between 2009 and 2012, Moesgaard Museum undertook excavations of a large Iron Age village at Hummelure near Skjoldelev, west of Aarhus. Here, were settlement traces from the Late Iron Age (*c.* AD 200–700) and the site was well preserved by eastern Jutland standards, which made it possible to undertake a major investigation of a locality at village level. The locality was already known to the museum, because in the 1980s, a couple of brief excavations was carried out here in connection with the laying of a natural gas pipeline (Jeppesen 1987). These uncovered parts of two farmsteads dating from the Late Roman Iron Age and Early Germanic Iron Age, as well as inhumation graves from the Late Roman Iron Age and Viking Age. The excavations in recent years have, together with the earlier interventions, yielded a total of 21 longhouses, some with several phases, distributed between about seven more or less coeval farmsteads. A total of 14 longhouses from Hummelure have been included in this study.

Hammel storgård (FHM 4641)

In many ways, this locality resembles the Hummelure site and it lies only about 10 km to the west. It was excavated in 2005 and 2006 in connection with the development of an approximately 20-ha area in the western part of Hammel. An area of 2.2 ha was excavated in total, revealing structures

from the Neolithic and Bronze Age, in addition to – not least – a large settlement dating from the Late Roman Iron Age and Early Germanic Iron Age (Ravn 2009). The latter consists of a few coeval farmsteads, which remained more or less fixed in a given position through several construction phases. In all, 12 construction phases were identified, distributed between three farmstead plots, of which one had as many as eight phases. The excavation led to the identification of 34 Iron Age houses, of which 18 are interpreted as longhouses. Of these, eight were found to be suitable for inclusion in this study.

Bendixminde 5 (FHM 5433)

Trial excavations in connection with the Odder Municipality's development of 54 ha of land led to the identification of a total of six areas containing prehistoric structures that were deemed worthy of further archaeological investigation. These areas had settlement traces from the Late Bronze Age, Late Pre-Roman Iron Age and both the Early and Late Roman Iron Ages (Jensen 2015). Area 5, in particular, consisted primarily of settlement from the Early and Late Roman Iron Ages and contained the best preserved houses from this period and, consequently, the houses that were also best suited to correspondence analysis. The excavation at area 5 covered a total of 2.2 ha, leading to the discovery of 16 longhouses and a further 21 smaller, three-aisled buildings and 10 four-posters. The settlement in area 5 should be viewed in the context of the results of the other excavations in the fields at Bendixminde (areas 2–6) and indicates a continuous settlement sequence extending from the end of the Late Roman Iron Age to the beginning of the Early Germanic Iron Age. Unlike at Nørre Snede, Hummelure and Hammel Storgård, there is no complex, coalesced village here, but one or two coeval farmsteads. Only three of the longhouses at Bendixminde were deemed suitable for inclusion in the study.

Tjørnagergård (FHM 5608)

This is a village settlement from the Late Roman Iron Age and Early Germanic Iron Age located on the eastern margin of Hadsten and is consequently the northernmost settlement represented here. It was relatively well preserved and comprised a minimum of two to three farms with one or two phases. The excavation, which covered an area of 4500 m^2, took place in the late summer of 2015, and was prompted by a planned, private development. The settlement that was excavated is presumed to be the outer marginal area of a large uninvestigated Iron Age village, which probably lies beneath modern buildings immediately to the east. It is therefore not possible to determine whether the remains at Tjørnagergård have the character of a major village complex on the lines of, for example, Nørre Snede or Hummelure. Only one house from Tjørnagergård has been included in this study.

Ingerslevvej (FHM 4845)

In 2007 and 2009, a major archaeological excavation was carried out on a 2.7-ha area at Tranbjerg, south of Aarhus. This focussed on an Iron Age settlement with as many as 21 longhouses, dating from the Early Roman Iron Age to the Late Germanic Iron Age. The excavation took place in advance of a large development. The settlement is characterised by three to four coeval farms with up to three phases. Interpretation of the farmsteads' mutual relations was however difficult as the preservation conditions were relatively poor. Traces of fences only survived in a few places and the wall postholes of the longhouses were badly preserved. Consequently, only one house was found suitable for inclusion in this study.

Kirstinelund (FHM 4792)

In 2006 and 2007, Moesgaard Museum undertook a rescue excavation of a 7200-m^2area on the southern margin of Harlev, approximately 15 km west of Aarhus. There were two excavation trenches encompassing two farmsteads. One of these is interpreted as a single farm with one phase, while the other is presumed to have had two to three phases. A total of five longhouses could be identified. The farms are dated to the Late Roman/Early Germanic Iron Age. Only one of the longhouses from the site was included in the study.

Haldum urebro II (FHM 5516)

Prompted by a planned development, a major archaeological excavation was undertaken in autumn 2015 of a village-like settlement at Haldum, west of Hinnerup. Moesgaard Museum had also carried out an excavation here prior to this, in 2011, in connection with the first phase of the development immediately to the east. On

this earlier occasion, settlement traces were found from the Late Bronze Age and Early Pre-Roman Iron Age. Consequently, there is no direct continuity with the remains uncovered in the most recent excavation at Haldum Urebro II, which are dated to the period from the Late Roman Iron Age to the Late Germanic Iron Age. The Late Iron Age settlement covered an area of almost 2 ha and comprised a minimum of three to four farmsteads with up to four phases. Seven longhouses could be identified, in addition to various smaller buildings and fences. The state of preservation of the settlement remains varied and only two of the longhouses were found suitable for inclusion in this study.

The selected settlements display clear similarities in their architecture, variation in settlement pattern and in duration. Nørre Snede constitutes a large village community of long duration, while Kirstinelund appears to be a single farm settlement with few phases. The Hammel Storgård and Hummelure sites are particularly similar, and the former lies only 10 km to the west of the latter. The two villages functioned at the same time over several generations, and even though Hammel Storgård does not have the same extent as Hummelure, either physically or temporally, both localities can be characterised as villages with extensive and complex settlement traces (Figures 3 and 4) extending over several centuries. There are also striking similarities between Hummelure and Haldum Urebro II. Both villages appear to have had the same organisational structure, so-called båndparceller, i.e. villages where developments over time lead to the formation of rows or bands of plots, within which the individual farmsteads can be identified – sometimes with several phases (see Figure 5).

Consequently, these were not permanent farmstead plots that remained stationary through up to seven or eight phases, as was the case at Hammel Storgård, but rather a settlement with up to three or four coeval farms arranged in a row. Ultimately, if there were numerous replacements, this could gradually lead to one single farmstead plot covering a very large area.

Method

Classification system

Based on previous studies of the longhouses of the Late Iron Age, and the various attempts to establish house typologies and chronologies, a system of classification and description was constructed for the longhouses at Nørre Snede: This was then used to classify the well-preserved examples of longhouse sites. This system attempts to include as many as possible of the previously proposed chronologically significant elements. The definitions of some elements have been modified in order to accommodate impressions gained through re-examination of which traits are chronologically significant, and some further constructional elements have also been included (Holst 1999, 2000, 2004).

A total of 83 longhouses (objects) have been included in the study, 14 from Hummelure, 53 from Nørre Snede, 8 from Hammel Storgård, 4 from Bendixminde, 2 from

Figure 3. Complete excavation plan of the Hummelure site.

Figure 4. Complete excavation plan of the Hammel Storgård site.

Haldum Urebro II, 1 from Tjørnagergård, 1 from Ingerslevvej and 1 from Kirstinelund, and 15 elements or categories were considered to be chronologically significant and thereby suitable as variables in the classification system (see Figure 6). Most of the variables are non-measurable constructional categories that can be characterised as architectural traits visible in the ground plans of the longhouses. A few of the variables are directly measurable categories, based on the width of the central aisle as a percentage of the total width of the house. This calculation was performed on the dwelling end of the house, through the first set of roof-supporting posts from the entrance section – conditional on the house having a well-defined entrance.[3] In the final analyses, two extremes were employed in the measurable size categories: narrow ≤37% and wide ≥44%. The intermediate values were not included as the preliminary analyses showed that these had no chronological significance. The roof-supporting posts in the utility section in the longhouses were classified as densely spaced if the longitudinal span between the sets was less than the transverse span between the two posts of the set. Common to all variables is that they are recorded in the table as either *present* or *absent*.

The classification of the spacing of the wall posts was based on a subjective estimate, as the metric distinction proved problematic, especially when the houses had been repaired or rebuilt in the same location, where an exact reconstruction of the walls in their entirety was not possible. The boundary between the categories is seemingly gradual, and in the majority of cases, the walls were consequently not classified, as the spacing was somewhere in between diffuse and dense. Nevertheless, even though the classification is based on a subjective estimate and the transition is gradual, the categories may very well reflect real constructional differences, for example, wattle-and-daub or stave construction of the house walls, with densely spaced posts, as opposed to bole construction, with widely spaced posts.

Similarly, the classification of the curvature of the gables also relied upon a subjective estimate, as metric distinction proved inapplicable due to variation in the state of preservation.

Correspondence analysis

The recorded data were subjected to correspondence analysis. This method is well established in archaeology as an instrument for searching for seriation as an expression of chronology (Madsen 1988, 1991; Baxter 1994). The analysis relies on recording presence/absence of a number of pre-defined categorical

Figure 5. Complete excavation plan of the Haldum Urebro site.

variables for each object included in the analysis. In this case, the variables are various architectural traits, while the objects are the longhouses. The basic principle is that a seriable data set results in a parabolic distribution of objects and variables on the plot of the 1st and 2nd axes of the correspondence analysis. In a specific analysis, the chronological significance of various variables and objects can thereby be tested in relation to the degree to which they result in a parabolic distribution. A matrix of objects and variables sorted according to the course of the parabola can then be used to evaluate the quality of the seriation. If the aim is to achieve a perfect result, expressed through a more or less faultless parabola, the data set should comprise a large number of independent variables, and consequently several possible combinations, as can be seen, for example, in chronological studies of grave finds (e.g. Bayliss *et al.* 2013). In practice, the longhouse data cannot be able to satisfy these criteria, as they only permit the identification of a relatively limited number of variables and with some degree of uncertainty in their identification. Both variables and elements must be represented by at least two occurrences for them to be included in the analysis. The variables employed were, accordingly, the end product of a process whereby some were excluded because some categories lay too close to each other typologically were too common and therefore did not have a chronological expression or, conversely, because the individual variable only had a single occurrence. Variables may also have been excluded if the category proved to have no chronological relevance and thereby only disrupted the results.

In practice, the correspondence analysis was conducted as a series of repeated analyses, with various combinations of elements, in an attempt to identify chronological structures in the data set. The resulting seriations were compared with other chronological evidence, such as the dates of the finds recovered from the houses, or stratigraphical observations, in order to test the reliability and chronological direction of the seriation.

In principle, there was no manipulation involving the exclusion of objects, i.e. the classified longhouses. However, with the varying exclusion of variables, some of the houses were characterised by less than two variables and had, consequently, to be excluded from the study.

Results and interpretation

The most distinct plot, and the matching seriation of the longhouses according to the 1st and 2nd principal axes, is presented in Figures 9 and 10. As can be seen from the plot of the correspondence analysis, the intended parabolic distribution of both variables and objects is achieved. Not surprisingly, the parabola does not describe a perfect curve. This can be attributed to the fact that the variables are generally of long duration, that there are relatively few chronologically significant variables and that the variables are, in some cases, characterised by subjective, non-measurable evaluations; this leads to some uncertainty in the identification. Nevertheless, the parabola displays an even and clear distribution of the objects (the

LIVING SECTION

Variables	Values	Examples
Lenght	/m	
Width of nave at 1st set of roofsupprting posts /m		
Width of left aisle at the 1st set of roofsupporting posts	/m	
Width of right aisle at the 1st set of roofsupporting posts	/m	
Number of sets of roofsupporting posts		
Orientation	Living section in the eastern end of the house/living section in the western end of the house	
Gable technique	Single row of posts	
	Double row of posts	
	Trench construction	
Gable Course	Round	
	Roundet	
	Straight	
Internal organisation: order to room types from the entrance and inwards	Module room-Main room-Module room	
	Module room-Main room-gable room	
	Main room-Module room-Gable room	
	Even sized rooms	
Three sets of roofsupporting posts in generel	Presence/absence	
	Atypical arrangements of roof-supportings posts	
Special features: Missing roofsupporting post ind the main room	Presence/absence	
Special features: narrow span in the last set of roofsupporting posts	Presence/absence	
Special features: Double post construktion in the walls of the main room	Presence/absence	
Special features: Extra posts in the gable in line with the roofsupporting posts	Presence/absence	

Figure 6. The system of classification and the description of the longhouses, with examples of the different categories.

longhouses) that, together with the matrix, illustrates a general seriable development.

Similarly, the seriation matrix reveals a general trend but does not provide an absolutely clear picture.

The variables have generally a relatively broad distribution and the individual entities are characterised by only a small number of them.

To sum up, the correspondence analysis revealed a distinct structure in the longhouse data set, characterised by progressive change and with limited clustering. The data set cannot, however, be described as perfectly seriated.

The next question is whether this apparent structure does in fact reflect the chronology. If the plot of the correspondence analysis is studied more closely, it becomes apparent that the variables arrange themselves in a sequence relative to one another, in which certain individual elements concur with the generally accepted chronological interpretation: For example, the categories *broad relative width of the central aisle* and *densely spaced roof-supporting posts in the utility section*, to the extreme right of the plot. Both variables are categories that have traditionally been linked with the earlier part of the period, and other categories characteristic of this time are found here too. On the opposite side of the plot, to the lower left, are categories that are associated with the end of the Late Iron Age: These include *wall trench, gable trench* and *straight gable*.[4]

ENTRANCE ROOM

Variables	Values
Entrance: Technique	Single posts
	Double posts or multi posts
	combination
Entrance: Position	Recessed
	In line
	combination

ECONOMY SECTION

Variables	Values
Length	/m
Number of sets of roofsupporting posts	
Gable: Technique	Single row of posts
	Double row of posts
	Trench construction
Gable Course	Round
	Roundet
	Straight
Internal organisation: Arrangement of roofsupporting posts	Densely Placed
	Evenly dispersed
	Irregular arrangement
Special features: Traces of stall	Presence/absence
Special features: Reduced width of the nave in the economy section compared to the remaining house	Presence/absence
Special features: narrow span in the last set of roofsupporting posts	Presence/absence
Special features: Extra posts in the gable in line with the roofsupporting posts	Presence/absence

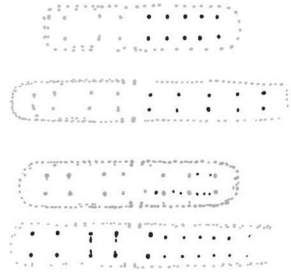

Figure 6. (Continued).

All in all, the plot can be considered as a chronological and more or less even development, which reads from right to left, and on which the known chronologically significant categories position themselves as expected. They thereby function as a kind of reference for categories that, to date, have not shown such a strong chronological expression. For example, *diffuse post positioning in the wall sides* lies in the earliest part of the plot, and this is also partly the case for *east-oriented dwelling section*. In the central part of the plot lie categories such as *densely spaced wall posts* and *double posts in the wall of the dwelling section*. Assuming that we are dealing with a chronological sequence, the spacing of the wall posts appears to have some chronological significance with widely spaced posts as a distinctly early element, while the densely spaced posts are associated with the relatively later elements, succeeded by the wall trench construction.

A couple of the other categories, such as the *east-oriented dwelling section* and *missing roof-supporting post in the hearth room*, also appear, in the light of the correspondence analysis and with the support of other categories, to have chronological significance. The missing roof-supporting post is found to belong in the middle/later part of the correspondence analysis and does not occur in longhouses that lie in the earliest phase, while *east-oriented dwelling section* is placed in the relatively early/middle group. In the data set from Nørre Snede, the proportion of longhouses with an east-oriented dwelling section is relatively high. Of the 53 Nørre Snede longhouses included in the study, more than 50% show this feature, while this applies to only about 25% of the

EXTRA SECTION

Variables	Values
Lenght	/m
Number of sets of roofsupporting	
Number of entrances	

GENERAL

Variables	Values
Roofsupporting posts: Longitudinal course of the rows of roofsuppor- ting posts (recorded for each side of the house independetly)	Diverging
	Curved
	Straight
	Converging/atypical
Walls:Longitudinal course of the rows of roofsupporting posts (recorded for each side of the house independetly)	Diverging
	Curved
	Straight
	Converging/atypical
Walls: Technique	Densely placed posts
	Dispersed posts
	Trench construction
	Differing despertion of the posts
	Combination(welldefined techniques in seperate parts of the wall

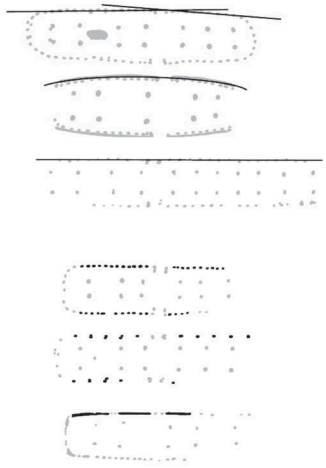

Figure 6. (Continued).

longhouses included in the analysis from the other sites. Moreover, several of the houses that had to be excluded from the study also show this trait. This is therefore not an isolated phenomenon at Nørre Snede, and it probably occurs more frequently than has generally been appreciated. At least the evidence suggests that longhouses with a 'reversed organisation' were relatively common during the Late Iron Age in eastern Jutland.

A few variables appear to have a relatively stronger chronological manifestation than others. This is true, in particular, of the measurable variables such as the *relative width of the central aisle*. But also categories such as *east-oriented dwelling section, curved walls* and *straight gables* appear more decisive relative to categories such as *missing roof-supporting post in the hearth room*, which has a slightly weaker expression. However, in combination with other elements, the latter can achieve strong significance.

Chronology and phasing

It is important to keep in mind that the results of the correspondence analysis are to be seen as indicating a general trend in the typological development of the longhouses over time. There is, accordingly, a limit to the detail of the chronological differences that can be demonstrated using the chronology. Situations must be expected to arise where the stratigraphic or other relative-chronological distinctions do not concur with the distinction in the seriation produced by the correspondence analysis. For example, there are two houses at the site of Bendixminde,[5] where one overlies the

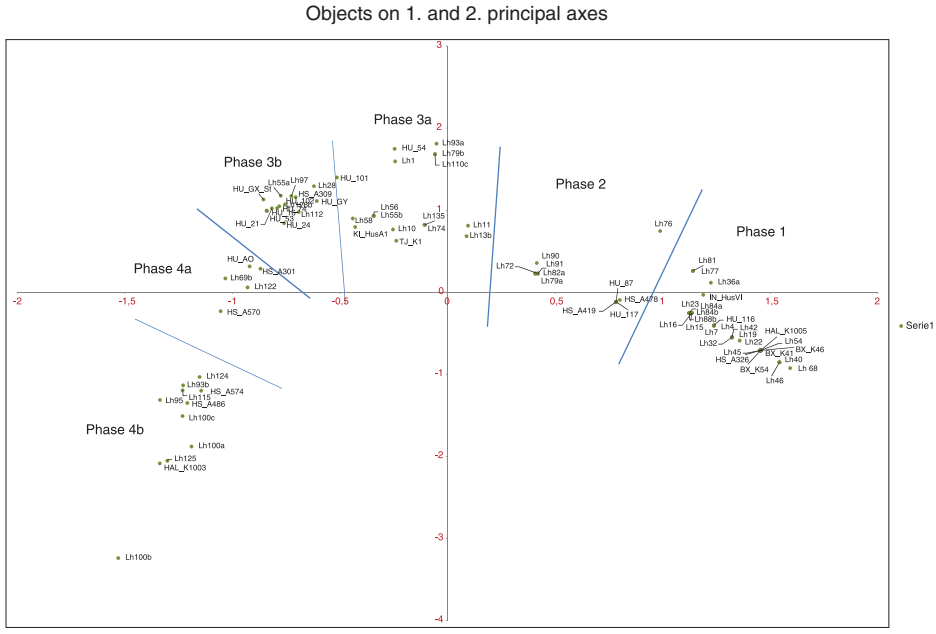

Figure 7. Plot of the distribution of the objects/longhouses on the first two axes of a correspondence analysis, with suggested phasing indicated.

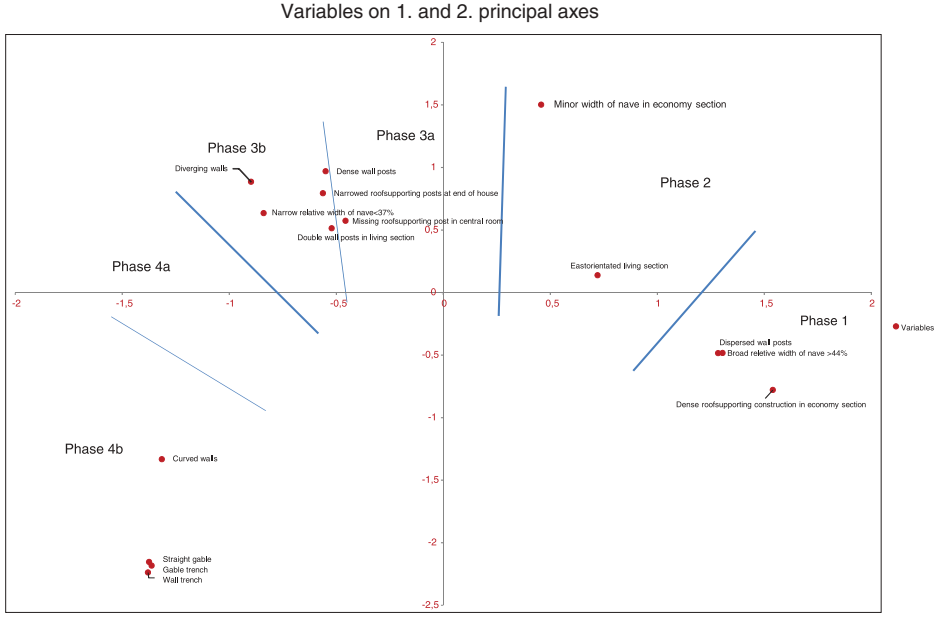

Figure 8. Plot of the distribution of the variables on the first two axes of a correspondence analysis of the longhouses.

other and is therefore stratigraphically latest. Even so, this is not evident from the correspondence analysis, as both houses only contain the same two variables. Consequently, they position themselves in precisely the same place on the parabola.

The large number of relative-chronological relations between the structural entities of the Nørre Snede and Hummelure settlements offer an efficient and totally independent way of testing the chronology. Figure 10 shows the various relations of the longhouses as revealed by the correspondence analysis. Only direct relations between the longhouses, and indirect relations of great certainty and with no more than one intermediate link, have been included. Furthermore, the list only includes directed types of relations, i.e. not those implying

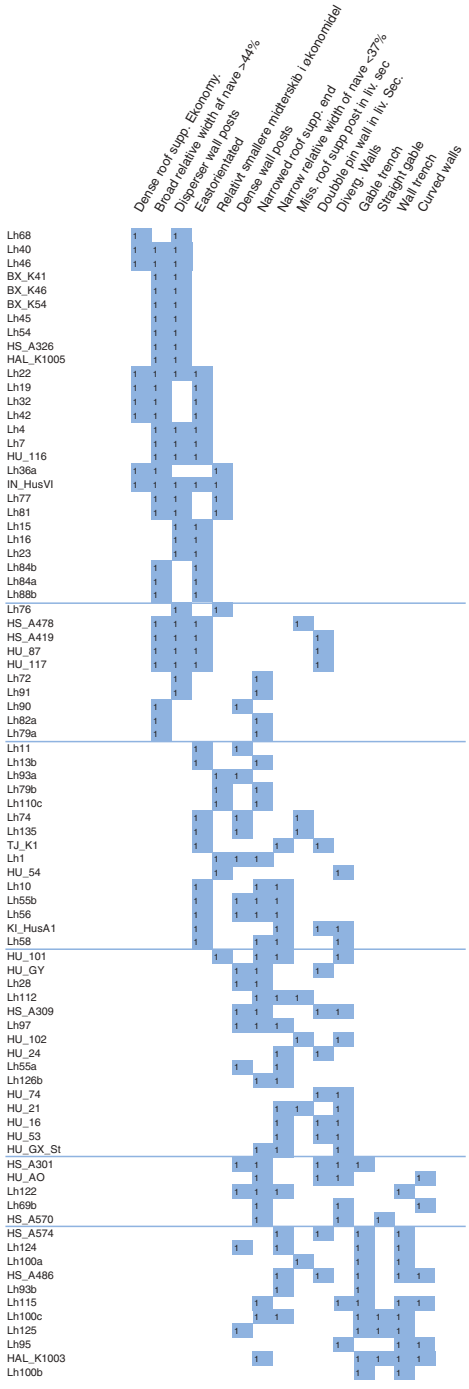

Figure 9. Matrix seriation of the longhouses.

contemporaneity or non-contemporaneity. If these relations are inserted into the correspondence analysis plot and colour-coded according to their agreement or disagreement with the presumed parabolic sequence from right to left, the graph shown in Figure 10 is the result. It is immediately apparent that the great majority of relations support the assumption of a chronological sequence. There are only three relations in disagreement with the chronological sorting and, furthermore, these relations are of relatively limited length, so the discrepancy does not challenge the overall structure.

In the cases where there is inconsistency with the stratigraphic and other relative-chronological observations, the houses in question do, however, lie within the same chronological phase/group. Relative to the chronological development, it must be considered acceptable that these inconsistencies occur between the positions of the longhouses in the results of the analysis and their relative stratigraphic positions at the individual sites as long as the houses simply occur within the same chronological phase.[6]

There are several possible explanations for these conflicting relations. First, there is some inherent uncertainty in the identification of all relative-chronological relations in the settlement analyses, even though only relatively certain relations have been included in the graph. Second, the identification of the variables in each longhouse is also associated with some uncertainty, which may result in an incorrect position for some houses. Third, and perhaps most importantly, the seriation matrix, and the correspondence analysis itself, clearly shows that the chronological sorting should not be conceived as an unequivocal and definite solution, but rather as a representation of general trends in the development of the longhouses. In other words, the relative position of the longhouses on the plot cannot be conceived as secure evidence of the relative-chronological order of the houses. As the correspondence analysis indicates a relatively gradual change in the longhouse data set, the exact delimitation of the phases is to some extent arbitrary. There are, however, certain tendencies towards clustering on the plot of the entities, and the boundaries between the phases have been drawn to respect these clusters.

It has proved possible to distinguish a total of four main phases (phases 1–4), with phases 3 and 4 each having two sub-phases (3a and 3b, 4a and 4b) (see Figure 7 and Figure 8).

In phase 1, which is clearly the largest group, a mixture is evident of houses from almost all the sites involved in the study. Three variables are particularly dominant, with the *broad central aisle* being especially characteristic of this phase. In almost all the houses, the width of the central aisle is 44% or more of the width of the house. This trait continues into phase 2, whereas there is a marked cessation at

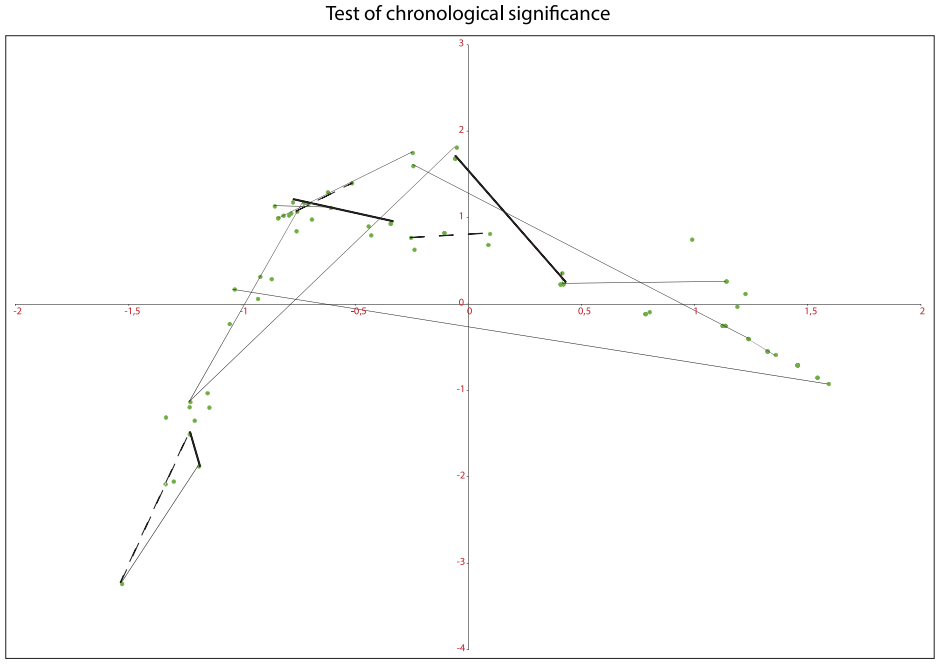

Figure 10. Test of chronological significance of the correspondence analysis of the longhouses. The relative relations have been inserted as lines on the correspondence plot. The lines represent the concordance between the direction of the relative chronological relations and the supposed chronological sequence of the elements in the correspondence analysis. Thin black line: agreement, dotted line: disagreement, thick black line: inconclusive.

the transition to phase 3a, when *diffuse post spacing in the wall side*, also prominent in phase 1, disappears too. Houses with an *east-oriented dwelling section* also lie mostly in phase 1, while this rather distinctive construction form declines in frequency in phase 2, before disappearing completely by the end of phase 3a. This trait is therefore very clearly associated with the earliest half of the longhouses, and the disappearance of the *east-oriented dwelling section* also marks the transition from phase 3a to phase 3b. These latter phases are characterised by the continuation of some traits, such as an *east-oriented dwelling section*, at least into phase 3a, and *relatively narrower central aisle in the utility section*, combined with new elements that appear during the course of phases 2 and 3a. A few new variables appear in phase 3a[7]: *densely spaced wall posts* which, combined with *east-oriented dwelling section*, the *narrow relative width of the central aisle* and *the narrow final set of roof-supporting posts*, characterise the longhouses in phase 3a. There is an even transition between phases 3a and 3b: Some of the elements from phase 3a continue, for example, the *relative narrow width of the central aisle*, which now appears very pronounced, and *diverging wall sides*, which also become more common. At the same time, houses with a dwelling section in the east disappear. There is an indication of a division in phase 3; yet, it is too vague to achieve an independent phase designation, hence the designation phase 3a and 3b.

In phase 4, further new elements appear. *Gable trench, straight gable, wall trench* and *curved walls* all emerge in the course of phase 4a, but only as single occurrences and not in combination with one another. Some traits continue from the preceding phase. Phase 4b has the same variables as phase 4a but is characterised by the combination of the new variables that were introduced at the beginning of phase 4. That is, *houses with gable trench* are seen in combination with *wall trench* or *wall trench/curved walls* or *straight gable/wall trench* or *wall trench/curved walls/straight gable* and, accordingly, never individually. Phase 4a is a transitional phase which share variables with phase 3b and new variables that become dominant features in phase 4b.

In addition to the gradual chronological development illustrated by the results of the correspondence analysis, these also indicate a degree of contemporaneity between house types and various constructional details. In Figure 11, examples of 24 longhouses have been arranged in accordance with the chronological sequence of the correspondence

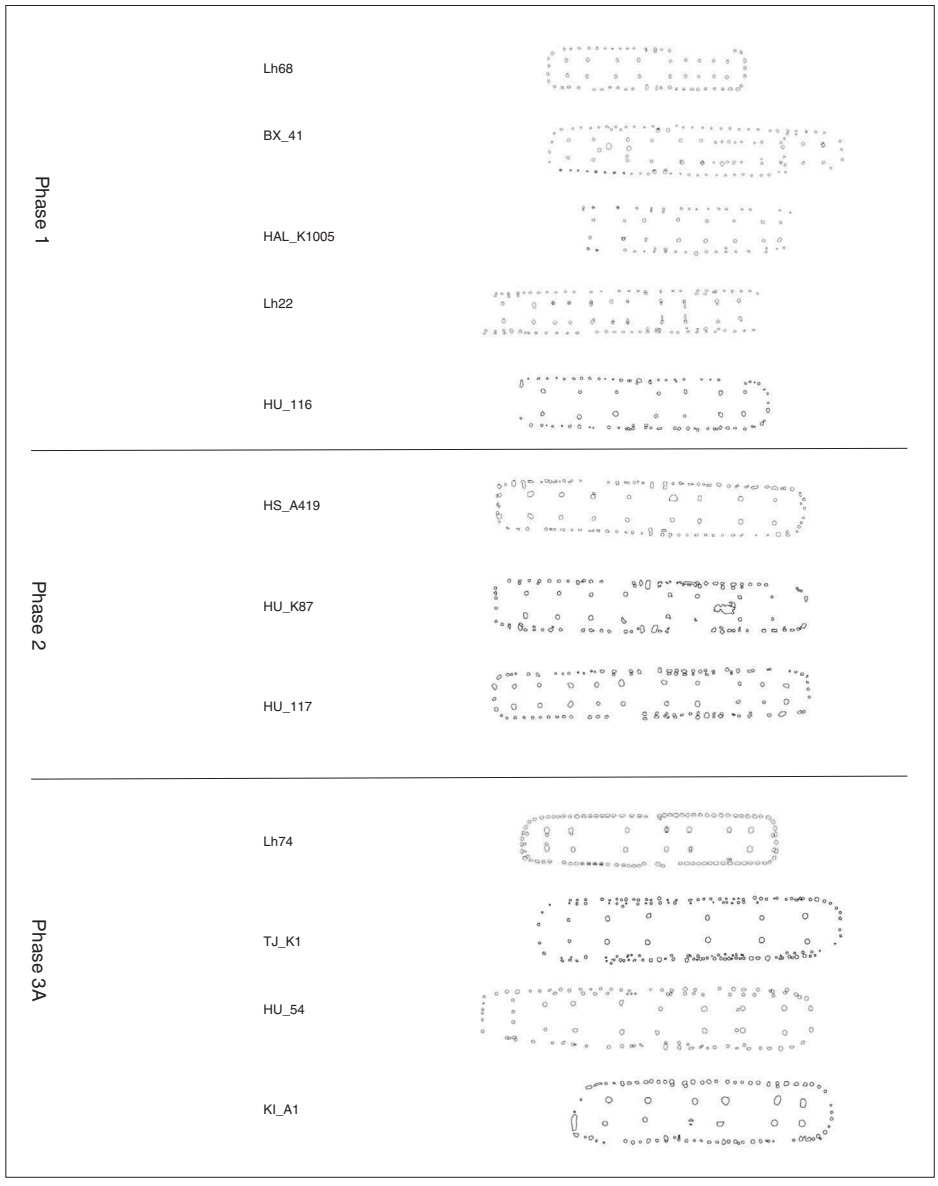

Figure 11. Chronological sorting of the longhouses exemplified. Twenty-four longhouses from the settlements arranged according to the sequence of the correspondence analysis.

analysis, with three to five houses from each chronological phase. The most obvious feature is the considerable variation in size, independent of the chronological development. Assuming that the size differences reflect, to some degree, the social and economic capacity of the household, this can be taken as an indication that the structure of the correspondence analysis is not influenced severely by social inequality. On closer examination, the examples also illustrate some important properties of the variables, which are also apparent from the seriation matrix. In addition to the long duration of the individual variables, these are also characterised by only being included in a subset of the houses during the timespan in which they are in use. This obviously complicates the chronological determination of the individual houses, and it can be seen as an indication that the typological development was not entirely uniform, and that there may have been several building traditions in operation within the settlement simultaneously.

One final aspect of the house chronology that deserves additional comment relates to the constructional variables not included in the final chronologically significant correspondence analysis. The most notable exclusion is probably those

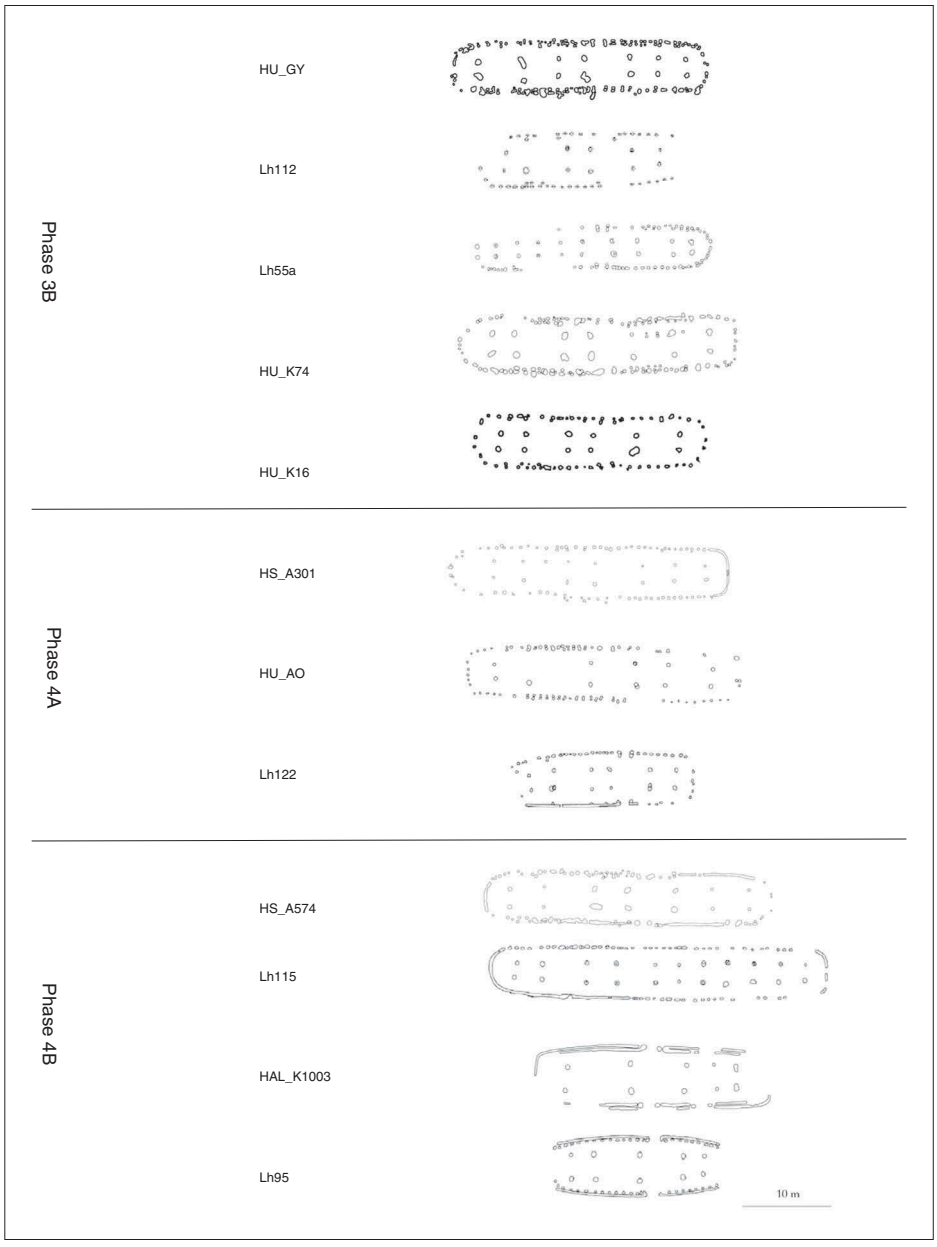

Figure 11. (Continued).

variables describing the internal arrangement of the living section. With the exception of the missing roof-supporting post in the room with the hearth, all variables characterising the arrangement of the roof-supporting posts in the living section had to be excluded. Atypical arrangements of the roof-supporting posts emerged as outliers in all analyses. This atypical arrangement is almost exclusively found in houses that either represented a rebuilding of an earlier longhouse in the same place or where the identification of the roof-supporting structure was associated with some uncertainty. Houses with regular, evenly spaced sets of roof-supporting posts, and thereby without modular arrangement in the living area, were very rare at all the settlements. They appear to belong to the latest part of the settlement and so this trait is probably chronologically significant. However, when longhouses with less than two variables were excluded in the final analysis, only one of the remaining longhouses from Nørre Snede had a construction with regularly spaced sets of roof-supporting posts, which led to the automatic exclusion of this variable. But the absolute and the relative spans between the sets of

roof-supporting posts in the living section were other elements that were omitted. When the longhouses are studied, there seems to be a tendency towards a greater frequency of relatively large spans in the room with the hearth in houses in the later settlements. However, on the whole, the size of the span appears to be more dependent on factors other than the chronology, and inclusion in the correspondence analysis apparently did not contribute to emphasising the overall chronological pattern. The other factors that are reflected in the length of the room containing the hearth are possibly of a social character. The architecturally more demanding long spans between the sets of roof-supporting posts could be connected with higher social status and constructional capacity (Herschend 1993). Similarly, the variation in the number of post sets in the living section was probably also primarily socially related, or possibly functionally determined, but it is apparently not chronologically significant.

On the whole, it has proved difficult to find chronologically significant variation in the internal architecture of the living section in the longhouses at Nørre Snede. As a consequence, the living section stands out as one of the most stable elements in the longhouse structure, emphasising the previously noted impression of a strong and maintained norm of spatial organisation throughout the pan of several centuries covered by the chronology.

Absolute chronology

When an attempt is made to attach more exact dates to the chronological house phases, some major challenges are encountered. This is generally due to the very sparse nature of the date-conferring finds recovered from the Late Iron Age settlements. In practice, this means that the pottery often has to stand alone as a reference frame for the relative house chronology (Ringtved 1988). We still lack a sound and robust foundation of radiocarbon dates, sufficient in number and extent to be used as a reliable dating base. The use of the pottery as a basis for dating is also not without its problems and weaknesses. Similarly, the robustness of the pottery chronology can justifiably be challenged when it is transferred from grave finds to the house chronology of the Late Iron Age. The existing pottery chronology is also fairly coarsely meshed and lacks the finer resolution that would be so useful in supporting the relative dating methods. Moreover, Ringtved's pottery chronology does not extend over the entire period covered by the relative longhouse chronology. Her phases a, b, c and d relate to the period from the end of the 2nd century AD until the first half of the 6th century. Consequently, the first decades of phase 1 and all of phases 4a and 4b (Figure 12) are not represented in the pottery chronology, as phase 4a begins around AD 550 and phase 4b ends towards the end of the Late Germanic Iron Age, around AD 700. Nevertheless, it has been necessary to involve the pottery chronology for confirmation and verification with respect to the four main phases evident from the results of the correspondence analysis. As the finds from many of the localities included here were either too few in number or too poorly preserved, the pottery from Nørre Snede provides the background for the dating framework. Accordingly, some adjustments have been made so that the five main phases, which resulted from the analysis of the Nørre Snede longhouses, have now been adapted to the four main phases operated with here.

This means that the chronological house phases lie within the period extending from about the middle of the 2nd century AD to about the beginning of the 8th century AD. Relative to the pottery chronology, phase 1 therefore corresponds to Ringtved's phases a and b, while phase 2 matches with her phase c. Main phase 3, which is divided into 3a and 3b, corresponds approximately to Ringtved's phase d (Ringtved 1988), while main phase 4, as mentioned above, is not covered by

Long house Cronology	Date AD	Period	Ceramical date
Phase 1	150 200 250	Late Roman Iron Age	Ringtved Phase a Ringtved Phase b
Phase 2	300 350	Late Roman iron Age/ Early Germanic period	Ringtved Phase c
Phase 3a	400 450	Early Germanic Period	Ringtved Phase d
Phase 3b	500	(late)Early Germanic Period	Ringtved Phase d
Phase 4a	550 600	Early Germanic period/ late germanic Period	
Phase 4b	650 700	Late Germanic period	

Figure 12. Absolute dates for the chronological phases.

the pottery chronology – or any other form of chronology for that matter. The dates here are based on the late houses at Nørre Snede and their relative position between the other localities included in this study. There is, therefore, despite the challenges inherent in absolute chronology in the Late Iron Age, agreement between the existing chronology and the longhouse chronology. As the relative chronology involves a gradual replacement of the variables, a degree of overlap between the individual phases is naturally to be expected, as these each cover a timespan of about a century and have a more or less equal distribution of longhouses.

While the results of the correspondence analysis make it possible to perform general house-chronological dating, at the same time, they are also testimony to the fact that there is a requirement for a more precise and thoroughly elaborated fine-resolution chronology in this respect. This could be achieved, for example, with the aid of a better artefact typology, probably in particular in the area of settlement pottery, as well as with the aid of a more systematic sampling strategy for the purposes of radiocarbon dating.

Conclusion

To sum up the results of the chronological analysis of the longhouses, it is evident that there is a chronological potential in the remains of longhouses at these Late Iron Age settlements, and at sites with a large corpus of house remains, it is possible to develop a local chronological scheme. It is, however, important to stress that the constructional elements are generally of long duration, there are relatively few chronologically significant elements and the chronologically significant changes are generally minor. At the same time, there are obviously also other factors that influence the layout of the houses, such as social differences, functionality and possibly family traditions. All in all, these characteristics reduce the potential resolution of the chronological scheme and weaken the certainty of the relative dating of the individual houses. Consequently, caution is required in the application of this house chronology.

The chronology scheme of the longhouses presented here is a regional chronology. The aim was partly to attempt to establish a formalised and systematic house chronology, and partly to investigate the degree to which an, in the first instance, very local single-locality chronology for Nørre Snede could be transferred to a regional eastern Jutland perspective. The study has shown that the chronology from Nørre Snede and, not least, the method as an approach are actually applicable. To a very great extent, the data set from Nørre Snede corresponds to those from the other localities in eastern Jutland. Accordingly, the latter reinforce the chronological sequence demonstrated by the longhouses at Nørre Snede. The study has similarly shown that the variables which proved to be chronologically significant correspond, to a great extent, to those variables that have been identified as potentially chronologically significant in general, first and foremost at Vorbasse (Mikkelsen 1988, Hansen *et al.* 1991). Finally, this study and its analyses and outcomes have confirmed that the method used could, with very few adjustments and adaptations, be applied both to an expanded data set and to a data set originating outside the actual region in focus here. Potentially, the method could have a big impact on discussions about continuity versus discontinuity, demographic developments, mobility and relations between sites. Admittedly, there is still room for discussions on the precision of correlation between sites and a better understanding of how specific changes can be identified in the archaeological record.

Notes

1. Houses from the Late Pre-Roman and Early Roman Iron Ages have, to a lesser degree than those of the Late Roman and Early Germanic Iron Ages, been the subject of detailed house-chronological studies (but see Rindel 1999, Haue 2012). This is possibly due to a greater contemporaneous variation in the record and fewer chronologically significant traits in their architecture.
2. The question is perhaps whether this is a true expression of the finds situation or rather the source material's testimonial value?
3. In general, it was a prerequisite that the ground plans of the longhouses were well-preserved and clearly defined.
4. Respectively, BX_52 and BX_46, where BX_46 is the stratigraphically later building.
5. For instance, Lh 100b in phase 4b. Its outlying position in the plot is not necessarily due to a much later date but may be explained by the phenomenon that Lh 100b is the only house in the analysis which only has the occurrence of the variables *gable trench* and *wall trench*.
6. The variable densely spaced wall posts occur in one instance in phase 2 but is otherwise only present in phases 3a, 3b and 4.

7. During the investigation of the Nørre Snede record, the pottery data were subjected to correspondence analysis. The houses in the latest part of the settlement stood out by not having a characteristic pottery assemblage.

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