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STONE-PAVED CELLARS IN THE STONE AGE? ARCHAEOLOGICAL EVIDENCE FOR A NEOLITHIC SUBTERRANEAN CONSTRUCTION FROM NYGÅRDSVEJ 3, FALSTER, DENMARK

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ABSTRACT. We present the excavation results from a Middle Neolithic site associated with the Funnel Beaker Culture. Within two overlying house phases, a recessed area was recorded, which had been constructed using different sized pebbles. The arrangement and form of the feature clearly indicated anthropogenic origin and is understood as belonging to one of the house phases. Consequently, it is interpreted as a cellar. Several pits and post holes are additional features that were recorded at the site and indicate the presence of a fence structure with up to seven parallel courses. In this paper, we present radiocarbon dates from the features and an age model for the construction and use of the cellar as well as the fences. Moreover, the site Nygårdsvej 3 will be placed in its regional archaeological landscape.

KEYWORDS: excavation, features, Funnel Beaker Culture, radiocarbon dating, settlement archaeology.

INTRODUCTION

During the Neolithic of Denmark significant changes in the form and composition of settlement structures happened. The Funnel Beaker Culture or Complex (TRB) appears around 4000 cal BC in the area and represents the first archaeo-cultural entity of the Neolithic in the area. This entails agriculture and an extended array of domestic animals (e.g., sheep, goats, cattle) as a basis for the people's subsistence. While the TRB forms the archetype of the Early Neolithic in the area, it similarly shows large variations among their cultural traits, for instance, regarding houses or subsistence strategies (Furholt 2014).

Compared to the earlier Late Mesolithic, an increasing number of solid house constructions is documented for the Neolithic, but also other permanent, landscape altering features like megalithic tombs and palisade constructions became common in that period (e.g., Wunderlich et al. 2019; Sjögren and Fischer 2023). In this contribution we present the excavation and dating of a small site on the Danish island of Falster where in connection to construction driven archaeology (cf. Brinch 2019), a house feature with two phases and a stone-built sunken floor was excavated. Additionally, seven partially parallel rows of postholes were excavated that are subsequently interpreted as remains of fences. This contribution will provide an overview over the archaeological features and their dating, thereby showing that even potentially mixed bulk sediment samples can be used for developing adequate chronological models.

The site Nygårdsvej 3 (MLF01848) was excavated in the context of an extension and electrification of a railway line. The site is located about 600 m from the northern limits of the village of Eskilstrup in a hilly moraine landscape (N 54.864446, E 11.886003 WGS84). About 300 m east of the site is a large bog complex called Maglemosen, which has a small outlet in its western part. From there, a small stream passes about 140 m north of the site. During the occupation period, the outlet of the bog was likely in the same area, with a small extension of the bog north of the site (Figure 1).

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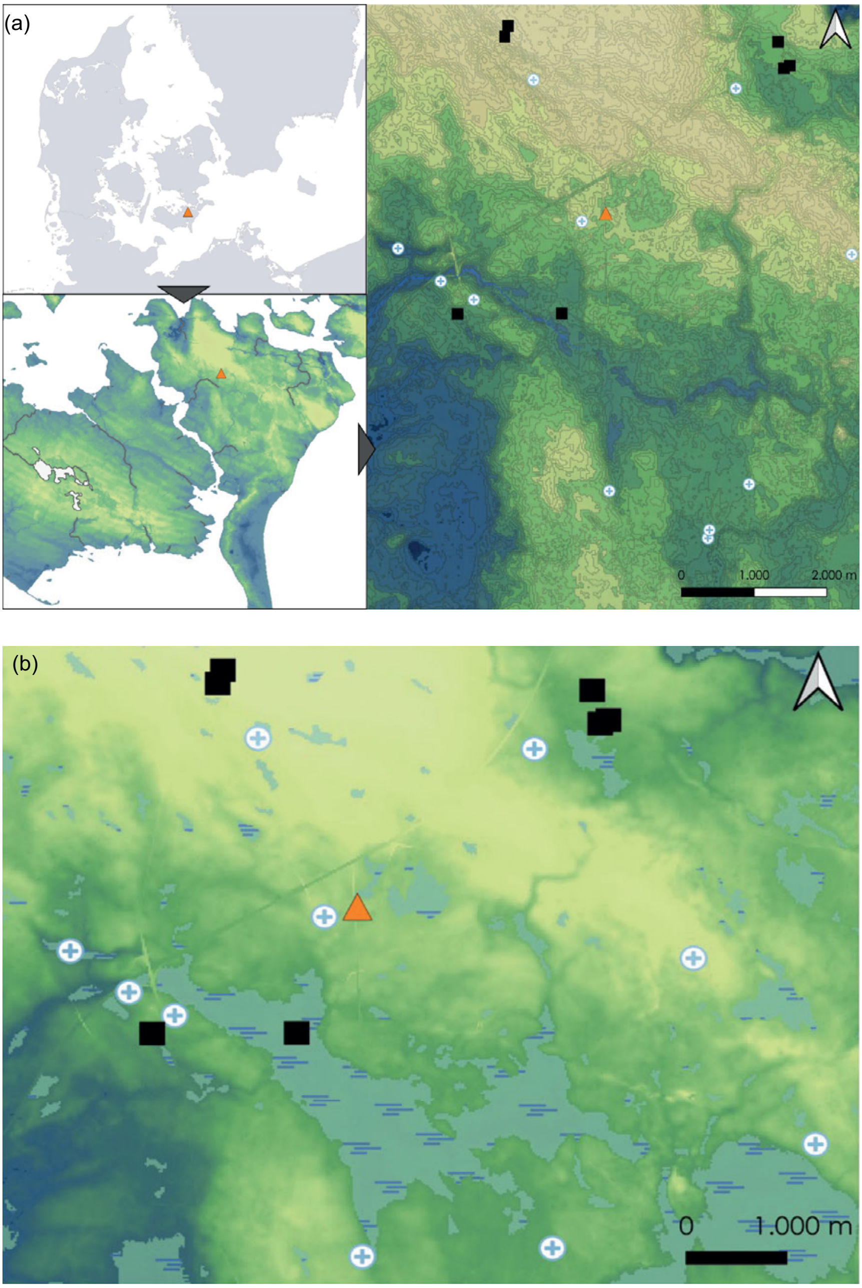

Figure 1 (a) Location of the site (orange triangle), other Neolithic settlements (black squares) and graves (blue crosses). The heights are marked in blue for lower and yellow for higher areas, ranging from ca. –5 to 50 m asl. Note that the DHM shows the modern surface and therefore contains anthropogenic features like railroads and streets, as visible northwest of the site. (b) Nygårdsvej 3 in its surrounding landscape. Valleys and basins are filled to highlight the potential situation during the occupation period. Black squares: Neolithic settlement sites; blue crosses: Neolithic graves.

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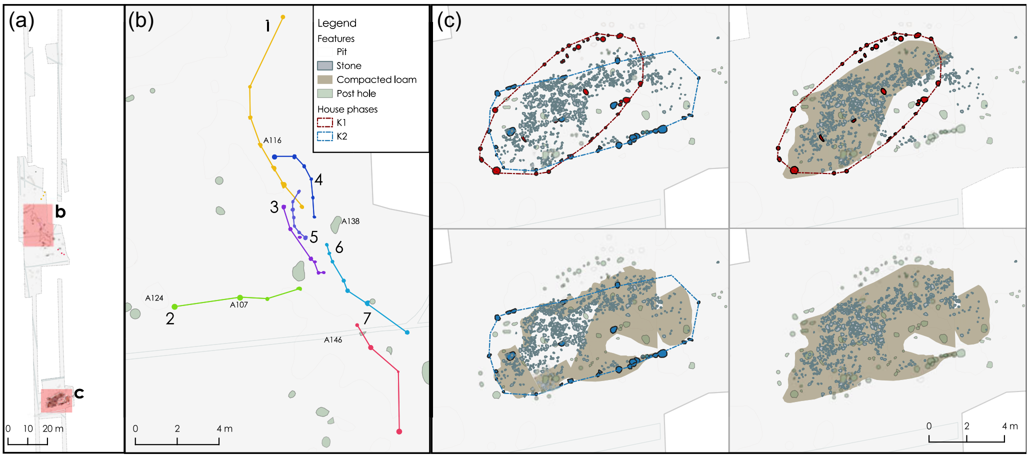

Figure 2 (a) Overview over the excavation. The northern trench (trench 2) and the southern trench (trench 1) are marked with rectangles. (b) Trench 2 with pits and palisade lines 1-7. Dated features are shaded and indicated by their feature-numbers. (c) Trench 1 with the two house phases. K1 is displayed in red, K2 in blue. The separated house outlines show the compacted loam floors (orange shading). In the drawing of the stone paved feature, stones located in a lower position (presumably the cellar floor) are displayed in a lighter color.

Features

A total of 189 features was recorded at the site. Among these are 141 postholes and 21 pits. Several post holes are forming the wall and central posts of two houses (termed K1 and K2) that were built in the same spot. Both houses have rounded apexes and a double-span layout. Additionally, a floor layer in the form of compacted loam was preserved in the houses. In total, 38 postholes are attributed to K1, hereof two were identified as remainders of central, roof bearing posts. The northern wall shows a double row of posts, and the whole house is ca. 10 m long and 4.8 m wide. K2 encompasses 35 postholes, whereof three form roof bearing posts. The house is not clearly limited in the eastern part, but measures at least 11.5 m in length and 4.2 m in width.

Figure 2c shows the superimposed post holes of the houses and their positions in relation to the floor layer. The archaeological data argues for K1 being built first. The construction follows the northern shape and boundary of the floor. This is not entirely the case with the younger phase K2, which instead seems to delimit the southern part of the floor layer fairly well, while the northern edge is extending slightly outside the house. It is therefore possible that the houses were built immediately after each other while the floor layers were still partially preserved. No clear fireplaces/hearths were identified within the houses or outside the features.

Stone-Paved Feature

Within K1 a high number of pebbles was found which were set in a way that indicated deliberate placement. This stone packing appeared immediately beneath the upper limit of the flooring. The feature was delineated in relation to the flooring and particularly within the northern part of this layer. Along the edge of the eastern wall, several larger stones were found in original position, possibly indicating a rectangular course of the wall (Figure 3). The southern and western wall courses met at an angle of almost 90°, but the opposite corner was disturbed during preliminary investigations. The northern wall appeared to meet the

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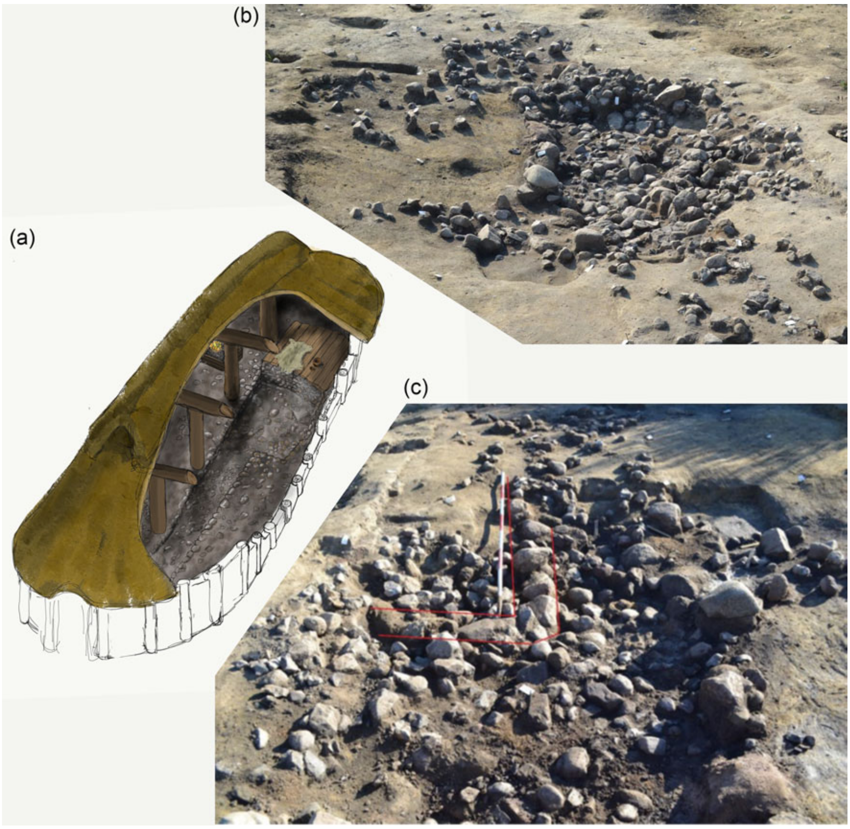

Figure 3 (a) Reconstruction drawing of the house. (b) Overview photo of the cellar feature (seen from the east, about the same orientation as the reconstruction drawing). (c) Detail photo of the cellar wall, marked by red lines, seen from the west. Drawing and photos: Museum Lolland-Falster.

eastern and western wall in a curved form, creating the overall impression of a trapezoidal or D-shape (Figure 3b). Additional features of the construction were not very pronounced; however, larger stones have been used as foundations of wall in the southern segment, while fist-sized stones were generally used as wall fill. The floor of the feature was paved with stones.

A cross-section through the recess showed that ground level was ca. 40 cm lower than the surrounding area, so the difference in level between the prehistoric floor levels is probably around 50 cm or more. It is also noteworthy that the eastern area is sloping and rises gradually. This area might therefore be interpreted as an entrance or access way. The dimensions of the feature are ca. 2×1.5 m from wall to wall.

Floor

The floor layer can be subdivided into two phases that follow either phase of the house (K1 and K2), respectively (Figure 2c). It is very likely that the floor was put in place already during the use of K1. Based on its shape and extent it is also very likely contemporaneous with the use phase of the stone paved feature. The limits of the floor are not very well preserved. In the eastern part of the houses, they are disturbed by agricultural activity, making them extend beyond the house constructions (cf. Figure 2c).

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Fences

Around 80 m north of the houses, seven rows of small posts (Ø 12–28 cm) are recorded (Figure 2b) with a general north–south orientation. In the central part of the trench, where they stand most closely, the distance between the different posts ranges between ca. 60–100 cm, while they are further apart in the outer areas. In the northern and southern segments the distance between the post is up to 4.9 m, possibly indicating a gateway or entrance in the southern segment, where pits and larger posts allow for a 2.7 m wide passage. The northernmost (1) and southernmost (7) rows form an arc in an easterly direction and the general length of the feature from north to south complex is about 33 m. It presumably continues beyond the excavated areas, so that the total extent must have been significantly larger.

As the posts are not located directly next to each other, it should not be interpreted as a palisade. The features do, however, clearly resemble fence structures. Granting the rather difficult feature visibility during the excavation, it cannot fully be ruled out that some posts have left no visible traces or were not documented. This is supported by the fact that courses 3, 4 and 5 as well as part of 1 and 6 have relatively close-standing posts (Figure 2b). Due to the limited extend of the excavation, it was not possible to uncover the complete course of the fence. On the western side of the fence structure, several irregularly shaped pits are documented. They are rather shallow, with depths around 15 cm, and seem to have been open when the posts were placed.

The fence rows roughly follow the natural terrain and might have enclosed a low hilltop. The limited extent of the excavation was not able to trace the features further, so that it is not clear, whether the hill was completely surrounded or if the features represent only smaller fences. As the currently available data does not allow further interpretations on whether the features are part of some causewayed enclosure (cf. Andersen 1997), this must remain a subject for future investigations.

Finds

A total of 1216 finds were recorded, including flint tools and debitage, pottery, fire-cracked flint, a small number of burnt bone fragments and one piece of modern clinker. Additionally, two petrified sea urchins were uncovered in the floor layer.

None of the pottery sherds could be assembled into whole vessels, and it is therefore not possible to say how many vessels are represented in the assemblage. Fingernail imprints and line ornamentation on eight sherds resemble Neolithic Funnel Beaker ceramics but allow no further typo-chronological classification. One sherd was found in the post hole of a roof bearing post of K1. As the find was already deposited as a fragment, it can be interpreted as pars-pro-toto or some form of votiv when erecting the building. Additional finds from within the houses are fragments of two ceramic discs, usually interpreted as lids or baking plates (e.g., Davidsen 1978: 103–104).

All lithic artifacts are clearly concentrated in the centre of the stone paved feature as well as in the eastern parts of the houses. A total of 117 pieces of burnt flint were found, but without a clear spatial clustering. The typo-chronological placement of the flint artifacts, mainly scrapers and fragments from three polished flint axes, is consistent with the house-type and the radiocarbon dating (see below), placing the assemblage in the Middle Neolithic Funnel Beaker Culture.

The finds clearly concentrate in and around the stone paved feature. This can, however, be possibly related to the recess acting as a sediment trap, which created a natural concentration of finds.

METHODS

Nygårdsvej 3 was excavated in two trenches—one southern (trench 1) and one northern (trench 2) segment. The topsoil was removed in both trenches by a mechanical digger. In trench 1, the features relating to the houses (K1 and K2) were layer-wise excavated with trowel and brush in a coordinate system with square meter fields (Q1–Q63). The sediments from each square were kept layer separated and wet-sieved so that specific bulk samples were obtained. All artifacts were recorded 3-dimensionally by GPS.

Dating

31 radiocarbon samples were analysed by Beta Analytic (for methods see www.radiocarbon.com/pretreatment-carbon-dating.htm [accessed: 23.01.2024]; Lab-IDs Beta-.). Charcoal fragments from quadrants within the house phases (feature numbers Q.) and samples from features (feature numbers A.) were selected. Based on a preliminary chronological model, four additional samples from the basement layers were selected for radiocarbon dating at the Aarhus AMS Centre (Lab-IDs AAR-.). These four samples were subjected to a standard warm (80°C) Acid (1M HCl) – Base (1M NaOH) – Acid (1M HCl room temperature) ABA-pretreatment procedure (e.g., Fischer and Olsen 2021). Graphitization followed the H_2 reduction method with iron as a catalyst (e.g., Vogel et al. 1984). Measurements were made using the AARAMS 1 MV Tandetron accelerator (Olsen et al. 2017).

The radiocarbon ages are reported as BP ages (uncalibrated years before present) with a reference year of 1950 AD (Stuiver and Polach 1977). Ages and standard deviations of samples analysed by Beta Analytic are rounded to the nearest 10 years. All calibration is done with OxCal online 4.4 (Bronk Ramsey 2009a) using IntCal20 (Reimer et al. 2020).

Due to the lack of short-lived organic material, mostly charcoal was used for dating purposes. This comes with the known limitations, e.g., old-wood-effects or intrusive material, and was therefore chosen meticulously before submitting for dating. Some samples from postholes almost exclusively contained charcoal of oak trunks, so this species could not be avoided for radiocarbon dating. However, this charcoal could represent remains of the original posts and thus be a suitable material for dating after all (pers. comm. Karen Vandkrog Salvig, Moesgård Museum).

The old-wood-effect refers to the phenomenon where organic samples that contain older, reworked or recycled wood material can produce misleadingly old radiocarbon dates. This effect occurs when an artifact or sample incorporates older, pre-existing carbon from sources such as older wooden structures or charcoal (Schiffer 1986; Kim et al. 2019; Cook and Comstock 2014). The presence of this "old wood" can result in inaccurate dating if not properly identified and accounted for during the radiocarbon dating process, e.g., through outlier modeling. Many samples are thus problematic because of a high risk of an old wood effect. The samples from the uppermost mixed fill layers bear the additional risk of too old ages due to redeposition. Therefore, we used the charcoal outlier model in OxCal as the contexts dated in this study bear a high risk of an old wood effect (Outlier_Model("Charcoal",Exp(1,-10,0), U(0,3),"t"); [Bronk Ramsey 2009b]) with a very high prior outlier probability of 50%. The OxCal code is provided at the end of this paper.

Landscape Reconstruction

Understanding the location of the settlement in the landscape is a relevant aspect to evaluate its function and potential role in communication and resource control. The spatial analyses were done in QGIS 3.20 (QGIS Development Team 2021) and based on a digital elevation model (DEM) with a pixel size of 20x20 m (compiled and resampled by Sonny, https://data.opendataportal.at/dataset/dtm-denmark [CC BY 4.0]). The lake reconstructions were done by using the SAGA-GIS Fill Sinks module (2007 by Wichmann (Wang and Liu 2006); minimum slope degree: 0.01) and subtracting the resulting raster from the DEM. The resulting layer represents all depressions in the landscape with values ≤ 0 that may have represented wetlands, valleys, and lakes. The threshold for displaying was set to –0,1 to reduce noise and the result was subsequently vectorized and filtered, so that small depressions (arbitrarily set to ≤ 5000 m^2) were removed.

RESULTS

A total of 35 samples were extracted for radiocarbon dating. Most samples were taken in and on top of the stone paved feature in trench 1, the remainder from pits and the fence constructions in trench 2.

For the age model stone paved feature, we arranged the samples in phases according to the archaeological layer in which they were found (layers 1 to 4) and built a sequence model. As mentioned above, an outlier model was necessary due to partly mixed contexts and the risk of an old wood effect, e.g., when charcoal from charred posts was dated. The OxCal code is provided in the Appendix.

We expect the outlier posterior probabilities to be highest for charcoal of long-lived wood from mixed fill layers, intermediate for charcoal of long-lived wood from fairly well-defined layers, and lowest for charcoal of shorter-lived samples from well-defined layers. The posterior outlier probabilities are given in table 1. As expected, the average posterior outlier probability is very high, 65+/–37%.

For the ten samples from mixed and unknown layers, the average posterior outlier probability is 85+/–28%. These values are on average lower for the samples from fairly well-defined layers (average and standard deviation):

layer 1 (n=6): 54 ± 35%
layer 2 (n=2): 76 ± 34%
layer 3 (n=3): 34 ± 57%
layer 4 (n=3): 44 ± 38%

These numbers confirm the archaeological observation that the lower layers 3 and 4 are related to the construction of the feature, whereas layers 1 and 2 are infill layers with higher outlier probabilities. The outlier probabilities of the lower layers 3 and 4 are still high, most probably

Table 1 Radiocarbon dates from Nygårdsvej 3 (MLF01848).

Lab ID	Sample ID	Feature number	Sampled material	Uncal. ^{14}C age	Cal. age BC (unmodeled, 95.4%)	Cal. age BC (modeled, 95.4%)	Posterior outlier probability (%)
Trench 2, pits							
Beta-490103	MLF01848_P61	A183	Charcoal (deciduous wood, not oak)	4030 ± 30 BP	2625–2469		
Beta-490102	MLF01848_P60	A157	Charcoal (cf. *Alnus* sp.)	4960 ± 30 BP	3795–3649		
Beta-490101	MLF01848_P58	A150	Charcoal (*Alnus* sp.)	4660 ± 30 BP	3516–3368		
Beta-490100	MLF01848_P57	A146	Charcoal (*Alnus* sp.)	4600 ± 30 BP	3509–3135		
Beta-490099	MLF01848_P54	A124	Charcoal (*Fraxinus* sp.)	3830 ± 30 BP	2453–2148		
Trench 2, fences							
Beta-490098	MLF01848_P53	A116b snit 2	Charcoal (*Corylus* sp.)	4780 ± 30 BP	3640–3518	3634–3527	
Beta-490097	MLF01848_P52	A116a snit 1	Charcoal (*Fraxinus* sp.)	4780 ± 30 BP	3640–3518	3634–3527	
Beta-490096	MLF01848_P50	A107	Charcoal (cf. *Quercus* sp.)	4160 ± 30 BP	2879–2631		
Trench 1, postholes							
Beta-467781	MLF01848J3 P65	A3008	Charcoal (*Quercus* sp., trunk/branch)	3990 ± 30 BP	2577–2460		
Beta-467780	MLF01848J2 P64	A3002	Charcoal (*Quercus* sp., trunk/branch)	4620 ± 30 BP	3514–3348		
Beta-467779	MLF01848J1 P49	A43	Charcoal (*Quercus* sp., trunk/branch)	4450 ± 30 BP	3336–2937		
Trench 1, basement layers							
Beta-490095	MLF01848_P48	Q62 layer 1	Charcoal (*Ulmus* sp.)	3680 ± 30 BP	2192–1961	2196–1925	21
Beta-490094	MLF01848_P47	Q61 layer 1	Charcoal (deciduous wood, not oak)	4210 ± 30 BP	2900–2675	2894–2109	52
Beta-490093	MLF01848_P43	Q57 layer 1	Charred grain (Cerealia indet.)	3610 ± 30 BP	2115–1887	2134–1887	11
Beta-490092	MLF01848_P42	Q56 layer 1	Charcoal (deciduous wood, not oak)	4210 ± 30 BP	2900–2675	2894–2123	52

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Table 1 (*Continued*)

Lab ID	Sample ID	Feature number	Sampled material	Uncal. ^{14}C age	Cal. age BC (unmodeled, 95.4%)	Cal. age BC (modeled, 95.4%)	Posterior outlier probability (%)
Beta-490091	MLF01848_P26	Q40 unknown layer	Charcoal (cf. *Fraxinus* sp.)	4290 ± 30 BP	3011–2876	2906–2074	93
Beta-490090	MLF01848_P20	Q34 unknown layer	Charcoal (cf. *Fraxinus* sp.)	3730 ± 30 BP	2272–2032	2278–1931	26
Beta-490089	MLF01848_P15	Q29 layer 1 and 2	Charcoal (*Fraxinus* sp.)	4460 ± 30 BP	3337–3021	2896–2071	100
Beta-490088	MLF01848_P14	Q28 layer 1 and 2	Charcoal (Maloideae)	4280 ± 30 BP	3008–2783	2906–2110	89
Beta-490087	MLF01848_P13b	Q27 layer 1, 2 and 3	Charcoal (*Fraxinus* sp., young trunk)	4380 ± 30 BP	3093–2911	2897–2069	100
Beta-490086	MLF01848_P13a	Q27 layer 1, 2 and 3	Charcoal (deciduous wood, not oak, branch or trunk)	4410 ± 30 BP	3315–2916	2896–2060	100
Beta-490085	MLF01848_P12b	Q26 layer 4	Charcoal (*Alnus* sp./ *Betula* sp., young trunk)	4800 ± 30 BP	3641–3526	3640–2932	85
Beta-490084	MLF01848_P12a	Q26 layer 3	Charcoal (*Fraxinus* sp.)	4610 ± 30 BP	3513–3197	3081–2790	100
Beta-490083	MLF01848_P9b	Q23 layer 2	Charcoal (cf. *Fraxinus* sp.)	4480 ± 30 BP	3341–3031	2896–2073	100
Beta-490082	MLF01848_P9a	Q23 layer 1	Charcoal (cf. *Fraxinus* sp.)	4420 ± 30 BP	3322–2921	2896–2077	100
Beta-490081	MLF01848_P8b	Q22 layer 2	Charcoal (*Alnus* sp./ *Betula* sp.)	4210 ± 30 BP	2900–2675	2894–2122	52
Beta-490080	MLF01848_P8a	Q22 layer 1	Charcoal (*Alnus* sp./ *Betula* sp.)	4280 ± 30 BP	3008–2783	2906–2027	89

(*Continued*)

Table 1 (*Continued*)

Lab ID	Sample ID	Feature number	Sampled material	Uncal. ^{14}C age	Cal. age BC (unmodeled, 95.4%)	Cal. age BC (modeled, 95.4%)	Posterior outlier probability (%)
Beta-490079	MLF01848_P7	Q21 layer 1 and 2	Charcoal (*Alnus* sp.)	3930 ± 30 BP	2561–2299	2564–2002	41
Beta-467784	MLF01848J6 P24	Q38 layer 1, 2 and 3	Charcoal (*Quercus* sp., trunk/branch)	4460 ± 30 BP	3513–3197	3081–2790	100
Beta-467783	MLF01848J5 P25	Q39 layer 1, 2 and 4	Charcoal (*Quercus* sp., trunk/branch)	4370 ± 30 BP	3091–2906	2896–2069	100
Beta-467782	MLF01848J4A P19	Q33 layer 1, 2 and 3	Charcoal (*Corylus* sp., trunk/branch)	4470 ± 30 BP	3340–3026	2896–2063	100
AAR-35062	MLF01814	Q33 layer 3	Charcoal (*Alnus* sp., 3 treerings of branch/ trunk)	4263 ± 35 BP	3005–2702	3003–2783	2
AAR-35063	MLF01814	Q38 layer 3	Charcoal (*Fraxinus* sp., 3 treerings of branch/ trunk)	4209 ± 38 BP	2904–2640	2916–2781	1
AAR-35064	MLF01814	Q39 layer 4	Charcoal (*Quercus*, 3 treerings of branch/ trunk)	4485 ± 35 BP	3348–3031	3338–2962	37
AAR-35065	MLF01814	Q39 layer 4	Charcoal (*Fraxinus*, 2 treerings of branch/ trunk)	4453 ± 39 BP	3339–2935	3333–2953	10

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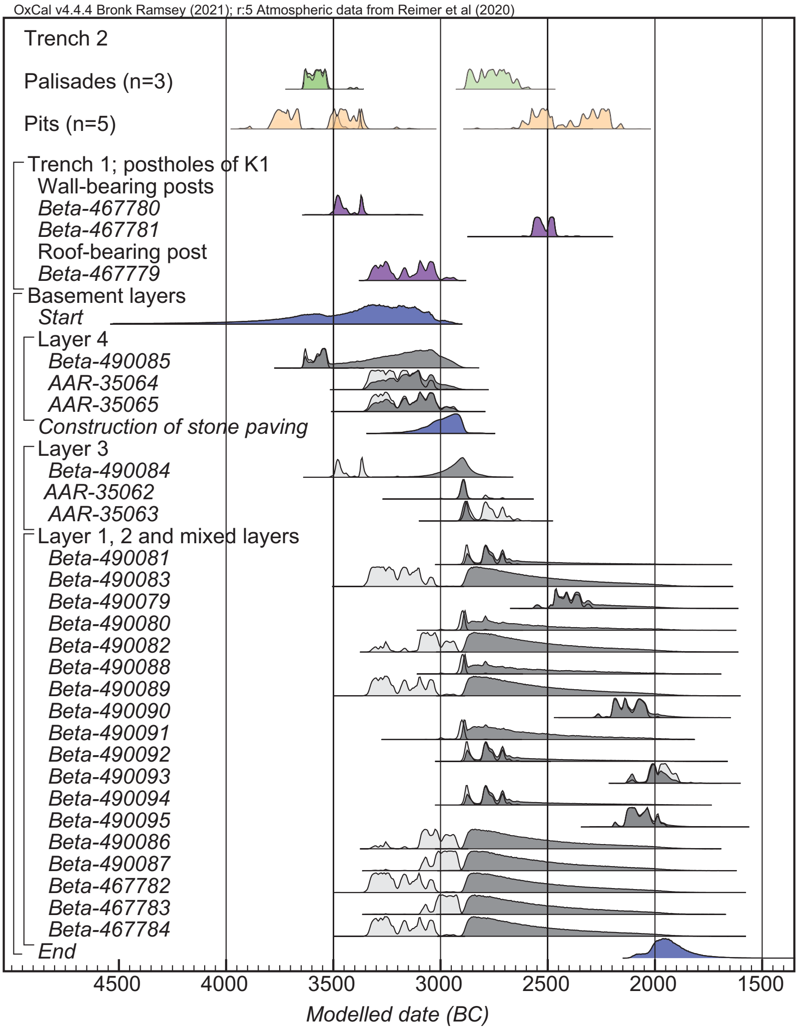

Figure 4 Calibration results of the radiocarbon dates.

caused by the old wood effect. The most probable construction date for the stone paved feature is around 3000 cal BC (Figure 4).

The dates span nearly 2000 years, making it difficult to say how intensive the use of the site has been over time and whether the different features were continuously in use (Figure 4).

Our model dates the fences to around 3600–3500 cal BC and thus significantly older than the houses but contemporaneous with several pits at the site. Consequently, we can either expect two phases of Neolithic occupation or a rather long chronology at the site.

DISCUSSION

An increasing number of studies underlines significant changes in the Middle Neolithic in Denmark (e.g., Iversen 2015) and point to a total restructuring of society. For instance,

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increasing numbers of conflicts are visible in the archaeological record and the need for more pronounced claims of land arose. This might be reflected in the construction of the fences at Nygårdsvej 3 and in that way demarcating the settlement. Before discussing the chronological order of construction, we will first go into more detail regarding specific constructional elements at the site in the following.

The “Cellar” Feature

Stone paved sunken floors are so far not known from Neolithic Denmark so that the presented feature represents one-of-a-kind. Therefore, other possible interpretations of this feature need to be considered. It resembles in parts the layout of chamber graves or dolmens, with a prolonged entryway and a recessed chamber. While it is possible that the inspiration for the construction was taken from the widespread grave type, it can be ruled out that the houses were simply built on top of a (destroyed or dismantled) megalithic grave, as no remains of such (e.g., stones or stone negatives/depressions) could be observed.

Large stone constructions are not an unprecedented phenomenon in the Neolithic, as documented by the thousands of megalithic graves. And also stone pavings are, for instance, known from Jutland (Fabricius et al. 1996), southern Zealand (Ellerødgård I [Nielsen 1987]), Langeland (Stengade [Skaarup 1975]) and Scania, Sweden (e.g., Elinelund 2B [Sarnäs et al. 2001]). In most cases, however, the stonework has been interpreted as an expression of burial or ritual sites. Contrary to the features at Nygårdsvej 3, the stone pavings of graves, are usually located within the upper levels of the filling and on the grave. Also, they are commonly oriented along the central axis, while avoiding the edges of the grave pits.

More closely related to settlement activities, the parallels for stone pavings are scarcer. The documented artifacts at Nygårdsvej 3 point in the direction of common settlement activities. The two fossilised sea urchins and the deposited sherd may be interpreted as votives but further finds or features that indicate or underline ritual activities are not present. As there are also no reasons to interpret the stone paved sunken floor in the context of ritual activities, understanding it as a “profane construction” has to be preferred. The feature reliably relates to one or both house phases and only contained a few fragments of burnt bone, but these are sparse and thus may just as well represent meal remains or “settlement noise.” Hence, we interpret the stone paved sunken floor in a more profane way: that of a cellar.

This connects the site closer to the aforementioned site Stengade, where stones were used for the foundation of a house, or so-called cult houses which also show stone foundations and sometimes floors (Fabricius et al. 1996). Both houses at Nygårdsvej 3 can be attributed to the Mossby-type, characterised by the rounded apexes. It is a typical form in the north group of the Funnel Beaker Culture (e.g., Molin and Stenvall 2010; Müller 2012).

Due to the limited number of finds from the cellar itself, its function can only be surmised. As an actualist comparison is not too far-fetched, storage and cooling are likely functions for such a feature, especially since different approaches to food preservation are proven for the Neolithic (e.g., Brozio et al. 2014). As has been shown above, there is no reasonable evidence that the flooring could relate to another construction and can therefore be understood as an original building element of the houses. While soil cellars from the Neolithic are a well-known phenomenon in Denmark (Sparrevohn et al. 2019: *passim;* cf. Ethelberg and Pedersen 2019: 378–379), only one paved cellar from a younger prehistoric period (Bronze Age) is known on Falster (https://www.kulturarv.dk/fundogfortidsminder/Lokalitet/171717/).

The Fences

North of the houses a landscape structuring element had been established in the form of a multi-row fence structure. Elaborate fencings and palisades are known from several Neolithic sites, predominantly connected to enclosures (Andersen 1997; Larsson 2012). At the Sarup II enclosure comparable features have been revealed and interpreted as a surrounding fence, with similarly sized posts. There, they partly appeared in several, parallel associations (Andersen 1997: 65–66).

The features at Nygårdsvej 3 are not as numerous as at Sarup and only a small section of the feature has been excavated. With respect to its estimated direction and taking the landscape into account, it may be assumed that the fences functioned as a spatial separation of a small west of them and the southern part of the plateau where the houses were located. As the fences roughly follow the natural terrain, they might have encircled a low hilltop. Due to the limited extent of the excavation, it was not possible to trace the features further, so that it is not clear, whether the hill was fully surrounded or if the features represent only smaller fences. Consequently, the currently available data does not allow further interpretations on whether the features are part of some causewayed enclosure or comparable constructions (cf. Andersen 1997).

In a wider perspective, the location of Nygårdsvej 3 makes it possible to control the access to a spur in the landscape. The southern river valley enfolds an area of approximately 3.5 km2 that can only be accessed through two ways on land: via a land bridge in the south-east at the village and by crossing a small valley in the west (Fig 1b). The settlement was protected from the north by a bog, and from the south by a larger river valley. Whether the southern valley has constantly provided open water, was seasonally flooded, or just swamp or marshland, is subject to future investigations. But we can assume that the area was difficult to cross and therefore formed a natural barrier. The settlement is located on a small hill and hence not subject to flooding as the overflow of the bog in the north is lower than the site. Consequently, the fences may have functioned together with the landscape as space structuring elements.

The Chronological Model

The filling of the cellar and the mixed dating results can possibly be explained by either the fact that it was standing open for a longer time and subsequently used as a waste pit and slowly filled in by natural processes, or that the house plateau was levelled during the building of house K2 and in this course the cellar was filled in with surrounding material. As this would have contained several fragments of charcoal and grains of different ages, intermixed chronological layers would have been the result. This underlines the relevance of thorough sample selection when dealing with features of such kind. Best results for the construction date are expected from samples that are closely related to the structure and beneath it, while the infilling itself is prone to provide spurious results due to the possible intermixture of younger and/or older material.

The first phase of the house (K1) and the cellar were constructed between 3080 and 2780 cal BC. When the second house phase (K2) was established, the cellar was filled in, sometime after 2800 cal BC. This ending of this phase is not well constrained and might date as late as the end of the Neolithic or Early Bronze Age (2100–1700 cal BC).

Interestingly, the radiocarbon dates of the features in trench 2 are not contemporaneous with the modeled construction date of the cellar. The pits and postholes, which are connected to the fence, date to one phase prior to the cellar construction, i.e. 3800–3350 cal BC, and one phase after, about 2900–2200 cal BC. As already outlined, the primary function of the fence is

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unclear. However, since the radiocarbon dates from trench 2 reflect activities during two phases, we can either assume that the structure is a palimpsest or was maintained and present when the house was built, possibly marking the start and end points of the settlement.

As is generally known, reliable radiocarbon dates can only be obtained from secure contexts. This needs to be stressed especially in the context of construction driven archaeology, where sometimes abundance is prioritized over quality of sample material. As a conclusion we suggest avoiding infill layers, even though they might provide abundant sample material, and rather focus on less material but more precise contexts.

CONCLUSIONS

The results from Nygårdsvej 3 demonstrate that useful knowledge can be gained from radiocarbon dating of single constructions, even if the individual sample might not be ideal. Outlier analysis shows that the greatest risk for radiocarbon outliers occurs in the case of mixed layers, especially fill layers, and charcoal of potentially long-lived tree specimens, such as oak. We therefore suggest using one of the following strategies for radiocarbon dating in the context of construction driven or rescue archaeology: 1) limit the number of samples and focus only on ideal samples, i.e. short-lived samples from secure contexts or 2) if perfect samples cannot be found, date a large number of samples and use outlier models such as the charcoal outlier model.

The archaeological results from Nygårdsvej 3 show an important insight into the constructions and features of Neolithic Denmark. The fact that a subterranean construction has been present at the site underlines how each site can extend our knowledge about the Stone Age.

Whether the fences at Nygårdsvej 3 have been part of a larger fortification or enclosure cannot be fully answered due to the limited trench size. However, its location made the site suitable as a central place in the Neolithic of the area. The possible longevity of activity at the site might be an indicator for this.

In general, fortified settlements have probably functioned as gathering places where the inhabitants of the area could meet, exchange goods, form alliances and/or relationships (see summary in Hage 2016: 216–264). Such settlements will have served as focal points for the region's inhabitants and perhaps also for travellers from afar. Whether the site at Nygårdsvej 3 should be seen in this context, or whether a completely different interpretation should be given, will have to be determined by further research.

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CREDIT AUTHOR STATEMENT

MB is responsible for investigation, project administration, formal analysis of data, visualization, and writing (original draft); BP is responsible for formal analysis of data, visualisation, and writing (original draft, review and editing); DG is responsible for writing (original draft, review and editing), conceptualisation, supervision, formal analysis, and visualisation; MK is responsible for formal analysis of data, resources and writing (review and editing).

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APPENDIX

OxCAL Code

```
Plot()

{

Outlier_Model("Charcoal",Exp(1,-10,0),U(0,3),"t");

Phase("Trench 1; postholes of K1")

{

Label("Wall-bearing posts");

Label("P64 A3002 Trunk/branch of oak");

R_Date("Beta-467780 MLF01848J2", 4620, 30)

{

latitude=54.866918;

longitude=11.885953;

};

Label("P65 A3008 Trunk/branch of oak");

R_Date("Beta-467781 MLF01848J3", 3990, 30)

{

latitude=54.866982;

longitude=11.88604;

};

Label("Roof-bearing post");
```

```
Label("P49 A43 Trunk/branch of oak");
R_Date("Beta-467779 MLF01848J1", 4450, 30)
{
latitude=54.866956;
longitude=11.886037;
};
};
Sequence("Basement layers")
{
Boundary("Start");
Phase("Layer 4")
{
R_Date("Beta-490085 P12b Q26_lag 4 Alnus sp./Betula sp., young trunk
(3 treerings)", 4800, 30)
{
Outlier("Charcoal",0.50);
latitude=54.866952;
longitude=11.885987;
};
R_Date("AAR-35064 Q39_lag4:1 Quercus charcoal, 3 treerings of branch/
trunk", 4485, 35)
{
Outlier("Charcoal",0.50);
latitude=54.866952;
longitude=11.886022;
};
R_Date("AAR-35065 Q39_lag4:2 Fraxinus charcoal, 2 treerings of branch/
trunk", 4453, 39)
{
```

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```
Outlier("Charcoal",0.50);

latitude=54.866952;

longitude=11.886022;

};

};

Boundary("Construction of stone paving");

Phase("Layer 3")

{

R_Date("Beta-490084 P12a Q26 lag 3 Fraxinus sp., young trunk (3 treerings)", 4610, 30)

{

Outlier("Charcoal",0.50);

latitude=54.866952;

longitude=11.885987;

};

R_Date("AAR-35062 Q33 Alnus charcoal, 3 treerings of branch/trunk", 4263, 35)

{

Outlier("Charcoal",0.50);

latitude=54.866948;

longitude=11.886008;

};

R_Date("AAR-35063 Q38 Fraxinus charcoal, 3 treerings of branch/trunk", 4209, 38)

{

Outlier("Charcoal",0.50);

latitude=54.86696;

longitude=11.886016;

};
```

```
};
Phase("Layer 1, layer 2 and mixed layers")
{
Label("P8b Q22 lag 2 Alnus sp./Betula sp., trunk (2 treerings)");
R_Date("Beta-490081 MLF01848_P8b", 4210, 30)
{
Outlier("Charcoal",0.50);
latitude=54.866932;
longitude=11.885988;
};
Label("P9b Q23 lag 2 cf. Fraxinus sp. trunk (3 treerings)");
R_Date("Beta-490083 MLF01848_P9b", 4480, 30)
{
Outlier("Charcoal",0.50);
latitude=54.866924;
longitude=11.885995;
};
Label("P7 Q21 layer 1 and 2 mixed");
R_Date("Beta-490079 MLF01848_P7 Alnus, small trunk (7 treerings)",
3930, 30)
{
Outlier("Charcoal",0.50);
latitude=54.86694;
longitude=11.88598;
};
Label("P8a Q22 lag 1");
R_Date("Beta-490080 MLF01848_P8a Alnus sp./Betula sp., branch/trunk
(4 treerings)", 4280, 30)
{
```

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```
Outlier("Charcoal",0.50);

latitude=54.866932;

longitude=11.885988;

};

Label("P9a Q23 lag 1");

R_Date("Beta-490082 MLF01848_P9a cf. Fraxinus sp., branch (7 treerings)",
4420, 30)

{

Outlier("Charcoal",0.50);

latitude=54.866924;

longitude=11.885995;

};

Label("P14 Q28 Layer 1 and 2, Maloideae, trunk (7-10 treerings)");

R_Date("Beta-490088 MLF01848_P14 ", 4280, 30)

{

Outlier("Charcoal",0.50);

latitude=54.866937;

longitude=11.886001;

};

Label("P15 Q29 Layer 1 and 2, Fraxinus sp., young trunk (3 treerings)");

R_Date("Beta-490089 MLF01848_P15", 4460, 30)

{

Outlier("Charcoal",0.50);

latitude=54.866928;

longitude=11.886009;

};

Label("P20 Q34 unknown layer, cf. Alnus sp., trunk (5 treerings)");

R_Date("Beta-490090 MLF01848_P20", 3730, 30)
```

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```
{
Outlier("Charcoal",0.50);
latitude=54.86694;
longitude=11.886016;
};
Label("P26 Q40 unknown layer, cf. Alnus sp., branch/trunk (5 treerings)");
R_Date("Beta-490091 MLF01848_P26", 4290, 30)
{
Outlier("Charcoal",0.50);
latitude=54.866944;
longitude=11.88603;
};
Label("P42 Q56 Lag 1 deciduous wood, not oak, branch/trunk (5-8 treerings)");
R_Date("Beta-490092 MLF01848_P42", 4210, 30)
{
Outlier("Charcoal",0.50);
latitude=54.866972;
longitude=11.886057;
};
Label("P43 Q57 layer 1, Cerealia indet.");
R_Date("Beta-490093 MLF01848_P43", 3610, 30)
{
Outlier("Charcoal",0.50);
latitude=54.866964;
longitude=11.886065;
};
Label("P47 Q61 layer 1, deciduous wood, not oak, branch/trunk (8 treerings)");
```

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```
R_Date("Beta-490094 MLF01848_P47", 4210, 30)
{
Outlier("Charcoal",0.50);
latitude=54.866976;
longitude=11.886071;
};
Label("P48 Q62 layer 1, Ulmus sp., young trunk (3 treerings)");
R_Date("Beta-490095 MLF01848_P48", 3680, 30)
{
Outlier("Charcoal",0.50);
latitude=54.866967;
longitude=11.886078;
};
Label("P13 Submitted April 2017 - new resultats in 2018");
R_Date("Beta-490086 MLF01848_P13a Q27 layer 1,2 and 3; deciduous wood,
not oak, branch/trunk (1 treering)", 4410, 30)
{
Outlier("Charcoal",0.50);
latitude=54.866944;
longitude=11.885995;
};
R_Date("Beta-490087 MLF01848_P13b Q27 layer 1,2 and 3; Fraxinus sp.,
young trunk (3 treerings)", 4380, 30)
{
Outlier("Charcoal",0.50);
latitude=54.866944;
longitude=11.885995;
};
Label("P19 Q33 layer 1, 2 and 3; Trunk/branch of hazel");
```

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```
R_Date("Beta-467782 MLF01848J4A", 4470, 30)
{
Outlier("Charcoal",0.50);
latitude=54.866948;
longitude=11.886008;
};
Label("P25 Q39 layer 1, 2 and 4; Trunk/branch of oak");
R_Date("Beta-467783 MLF01848J5", 4370, 30)
{
Outlier("Charcoal",0.50);
latitude=54.866952;
longitude=11.886022;
};
Label("P24 Q38 layer 1, 2 and 3; Trunk/branch of oak");
R_Date("Beta-467784 MLF01848J6", 4460, 30)
{
Outlier("Charcoal",0.50);
latitude=54.86696;
longitude=11.886016;
};
};
Boundary("End");
};
Page();
Phase("Trench 2; palisade/posthole rows")
{
Label("P50 A107 cf. Quercus sp., unknown part of the tree (few treerings)");
```

```
R_Date("Beta-490096 MLF01848_P50", 4160, 30)
{
latitude=54.867716;
longitude=11.885908;
};
Combine("P52 and P53, A116a and A116b, cut 1 and 2")
{
R_Date("Beta-490097 MLF01848_P52 Fraxinus sp., young trunk (1 treering)", 4780, 30)
{
latitude=54.867781;
longitude=11.885928;
};
R_Date("Beta-490098 MLF01848_P53 Corylus sp., branch/trunk (4 treerings)", 4780, 30)
{
latitude=54.867781;
longitude=11.885928;
};
};
};
Phase("Trench 2; pits")
{
Label("P54 A124 Fraxinus sp., young trunk (4 treerings)");
R_Date("Beta-490099 MLF01848_P54", 3830, 30)
{
latitude=54.867718;
longitude=11.885845;
};
```

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```
Label("P57 A146 pit next to palisade; Alnus sp., young trunk
(5 treerings)");

R_Date("Beta-490100 MLF01848_P57", 4600, 30)

{

latitude = 54.867695;

longitude = 11.885983;

};

Label("P58 A150 Alnus sp., trunk (4 treerings)");

R_Date("Beta-490101 MLF01848_P58", 4660, 30)

{

latitude = 54.867639;

longitude = 11.885992;

};

Label("P60 A157 cf. Alnus sp., unknown part of the tree (3 treerings)");

R_Date("Beta-490102 MLF01848_P60", 4960, 30)

{

latitude = 54.867605;

longitude = 11.885991;

};

Label("P61 A183 deciduous wood, not oak, unknown part of the tree
(8 treerings)");

R_Date("Beta-490103 MLF01848_P61", 4030, 30)

{

latitude = 54.867746;

longitude = 11.885982;

};

};

};
```

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