LMR 14546, Ronæs skov (FHM 4296/86)

Analysis of a late neolithic wooden structure at Ronæs skov

Welmoed Out

Afdeling for Konservering og Naturvidenskab, Moesgaard Museum

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Introduction

Context and research aim

In 2012, O. Uldum and C. Thomsen of the Øhavmuseum (Faaborg) excavated a wooden structure consisting of wooden stakes during an underwater excavation in the Gamborg Fjord nearby Ronæs skov (UTM 32 ETRS89 551.154 E 6.144.423 N). The structure was 175 cm long and 40 cm wide and had an elongated oval shape. The distance between the individual stakes was usually only ca. few centimetres. During the excavation, the location of ca. 46 individual stakes was documented by means of GPS. The precise function of the structure is unknown. A previously collected date indicates that the structure dates to the Late Neolithic (4241±25 BP) (Uldum, 2012; pers. comm. O. Uldum).
At the time of excavation, the structure was located at 1 m below the sea water level. It is expected that the structure was located in shallow water also at the time of use. The sea bottom around the structure was covered with a thin layer that was covering blue marl, and at some locations the sea bottom was covered with brown peat. Brown peat was also found inside the structure (Uldum, 2012). One sample of this peat has been subjected to botanical macroremains analysis (Feijen, 2017).
The aim of the analysis of the wood from Ronæs skov was two-fold. A first question concerned which taxa were used. A second question concerned the exploration of indications whether the wood was obtained from managed or unmanaged wood by looking at the diameter and the number of annual rings of roundwood.

Woodland management

Woodland management refers here to pollarding or coppicing, that is, the repetitive removal of branches from trees in order to optimise the quantity and quality of the wood. When substantial quantities of long straight branches are found at prehistoric sites, it is often assumed that such quantities of straight branches can only have been obtained from managed woodlands. Direct evidence of woodland management in prehistory is however scarce. Research on modern-day trees of alder, ash, hazel and willow has shown that branches of managed trees grow faster than branches of unmanaged trees (Out *et al.*, 2013). As a result, data of branch age and diameter from archaeological assemblages can be compared with the data of modern-day trees to investigate woodland management in the past.

The data of modern-day trees that will be used as reference material in this report include one the one hand data from relatively clear, straightforward examples of unmanaged trees and clear examples managed trees (Hänninen *et al.*, 2016; Out *et al.*, in press). In addition, the data set of hazel also includes measurements from branches of unmanaged trees that are extremely straight and vertical, and that show very fast growth, and can be considered as natural spurts (see figure 1, cf. Out *et al.*, in press). Macroscopically, these branches show considerable similarity with branches of managed trees because of their straightness and the relative small number of side-branches. They should however not be confused with managed wood, since it concerns fast-growing wood of unmanaged trees. These spurts naturally occur particularly in hazel and willow, and may also occur following disturbance due to storms and the like (e.g. Christensen 1997, p. 156; Morgan 1988, pp. 85; Klooß 2014, p. 266).

Figure 1 Unmanaged hazel with straight and vertical branches (natural spurts). Location: Horsterwold. Photo: C. Vermeeren, BIAX *Consult*, the Netherlands.

Materials and methods

The analysis of the wood from Ronæs skov included 50 fragments (sample X6). It cannot be excluded that multiple fragments of single stakes have been investigated because some stakes broke during and after excavation. The wood analysis was carried out by Welmoed Out by means of a binocular microscope and a microscope at a magnification of up to 400x. The analysis concerned the taxonomic identification after Schweingruber (1990), the identification of the tree part (twig/branch/trunk), the season during which the wood was collected, the orientation of the object in a tree, working traces, and in case of roundwood the measurement of the diameter and number of annual rings. In case of flattened branches, the average of two diameters measurements from a single point were used. Drs. C. Vermeeren and Drs. K. Hänninen (BIAX Consult) kindly assisted with the counting of annual rings and the interpretation of the data. For the purpose of ^{14}C dating, 3 wood samples were collected. The dating results were not available yet at the time this report was written.

Results and discussion

General results

The preservation of the wood was very good, pointing to continuous waterlogged preservation conditions since prehistory. Bark was observed on most elements. The wood anatomy and morphology of those fragments on which the bark was not present anymore suggests that the bark may have got lost only during or after excavation. Very few remains were covered with some barnacles, or showed damage that may have been caused by molluscs.

Appendix 1 provides the results of the analysis. Most finds consisted of straight roundwood from young branches or possibly young trunks. Only two wood fragments showed clear natural bends. The analysis showed that the investigated structure consisted probably of three taxa: hazel (n=34), alder (n=14) and ash (n=2). The importance of hazel in the wood assemblage is partly the result of selective sampling (during the wood analysis) because of the restricted potential of alder for the detection of woodland management (discussed below). Alder and hazel were also identified as part of the botanical macroremains analysis (Feijen, 2017), although the precise relation between the peat and the wooden structure is not clear. Hazel (*Corylus avellana*) is a pioneer of eutrophic soils that avoids poor sandy soils and moist soils. It prefers light or half-shaded conditions and occurs as undergrowth in deciduous woodlands, riverine woodlands, and shrub vegetation at woodland edges. Alder (presumably *Alnus glutinosa*) preferably grows in moist to wet, eutrophic and humus-rich environments, for example in deciduous woodland, alder carr and riverine woodland. Ash is a tree that grows on moist, rather eutrophic soils, for example in riverine woodland, in moist deciduous woodland and along water streams. It prefers light or half-shaded conditions (Schütt et al., 2014).

The age of hazel varied between 5 and 14 years while its diameter varied between 2.5 and 4.5 cm. The age of alder varied between 2 and 7 years while its diameter varied between 2.7 and 6.5 cm. The two ash fragments were 4 and 5 years old and had a diameter of ca. 3.5 cm. The season during which the last growth ring was formed varied throughout the year for hazel and alder and was only spring for the two fragments of ash.

Evidence of wood working?

The wood shows some traces of wood working. Eight fragments of alder roundwood with relative large diameters and two fragments of hazel with a smaller diameter were split. Seven fragments were split in half over the length of the branch and three fragments displayed a tangential split (removal of less than half of the branch over the length). One stake was pointed (as a result of working). These working traces probably represent prehistoric traces.

In addition, two stakes showed cut marks, but for at least one unanalysed fragment it was concluded that the working traces concerned recent damage instead of prehistoric traces (based on the color of the wood and the shape of the traces). Various fragments showed a rounded surface that could point to working but can in the first place be explained by erosion after deposition due to the conditions under water.

Evidence of woodland management?

To investigate woodland management in the past, the branch age and diameter data of the stakes from Ronæs skov have been compared with branch age and diameter data from unmanged and managed trees from the Netherlands and Denmark. This comparison has been made for hazel and alder separately. The quantity of data from ash (N=2) did not allow a meaningful analysis of woodland management.

Figure 2 shows the age/diameter data of hazel from Ronæs skov (N=34) plotted in a graph with reference data from modern-day hazel. The blue circles indicate data from branches of unmanaged trees while the orange squares represent data from managed trees. Comparison of these unmanaged and managed trees of the same diameter shows that branches of managed trees grow faster, since they have a much lower age than branches of unmanaged trees of the same diameter. The triangles indicate data of natural spurt branches from unmanaged trees. The data from Ronæs skov overlap very well with these data of spurt branches of unmanaged hazel. This points towards the use of unmanaged hazel that grew relatively fast. Also the variation in age points towards the absence of management, although this argument would have been stronger if more measurements would have been available.

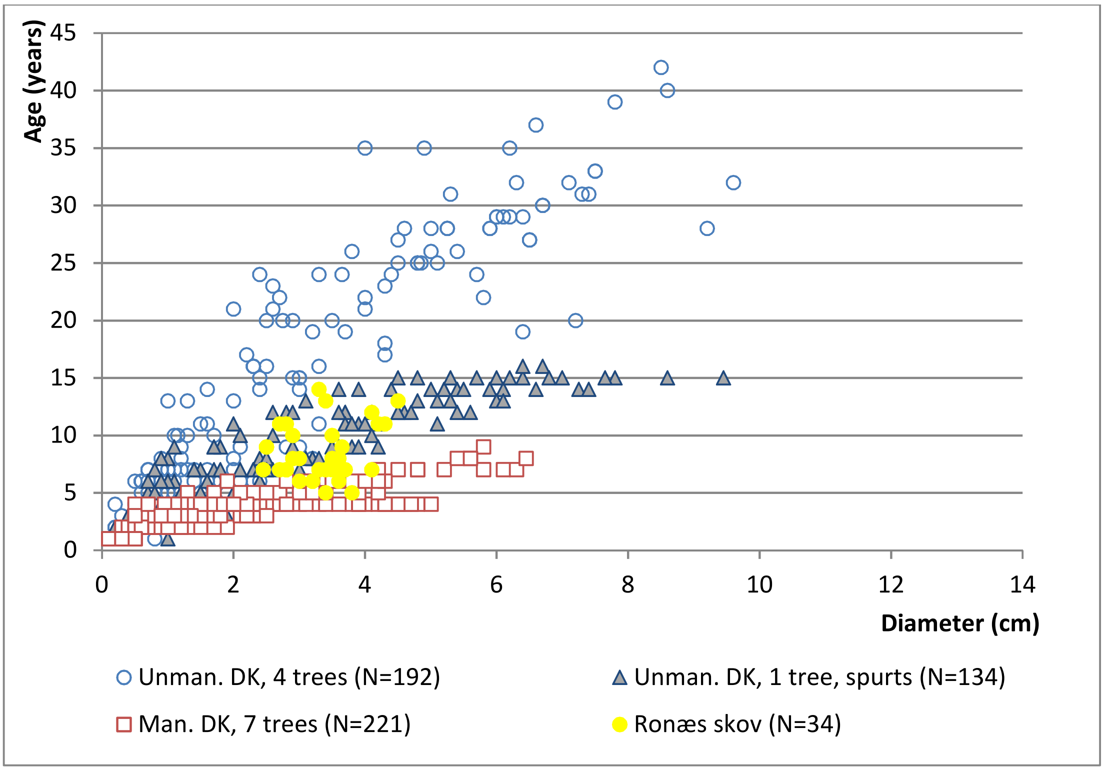

Figure 2 Branch age/diameter data of modern-day hazel (*Corylus avellana*) and data from hazel stakes from Ronæs skov.

Figure 3 shows the age/diameter data of alder from Ronæs skov (N=14) plotted in a graph with reference data from modern-day alder. The data show overlap with data of branches from managed alder trees. Recent investigations of modern-day alder trees have however shown that also unmanaged alder trees may grow as fast as manged trees (Out *et al.*, in press, figure 9 of the publication). As a result, the overlap of the alder data from Ronæs skov with branch age/diameter data of managed trees may point to three different things:
-the wood comes from managed alder;
-the wood comes from unmanaged, fast-growing alder;
-the wood comes from young, unmanaged alder that developed from seedlings growing at a very open location.
For the alder data from Ronæs skov, it is therefore not possible to conclude whether the wood was collected from managed or unmanaged wood. The small sample size of the data set of alder does not allow to look at details of the data distribution.
In addition to the age/diameter data, the variety of taxa gives indirect information about woodland management. As presented above, the investigated structure was made of at least three different taxa. This variety is an indication for collection and use of those resources that were available rather than selective use of wood or exploitation of managed woodland.

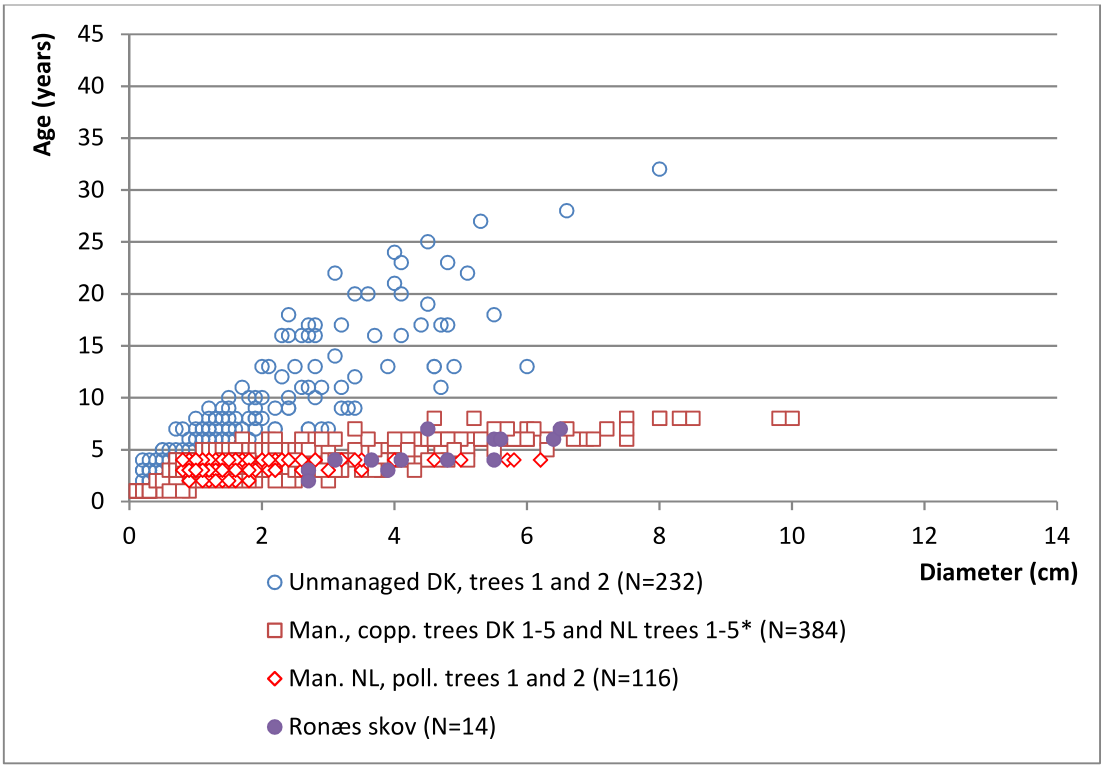

Figure 3 Branch age/diameter data of modern-day alder (*Alnus glutinosa*) and data from alder stakes from Ronæs skov.

Conclusions

At the submerged site of Ronæs skov an elongated structure consisting of uncarbonized wooden stakes was subjected to wood analysis. One stake has earlier been dated to the Late Neolithic. The structure consisted primarily of hazel and alder, with minor admixture of ash. The three species may well have been selected based on availability in the environment.

Alder may perhaps also have been selected because it remains relatively well-preserved under water.
The wood shows restricted indications of wood working: a minor quantity of stakes had been split, and one stake was pointed. The restricted indications for wood working suggest that people did not invest more energy than necessary in the construction of the investigated structure.
Analysis of the age and diameter of the stakes indicates that people used unmanaged though fast-growing stands of hazel. For alder, it was not possible to make any conclusions about woodland management. Overall, the investigated stakes do not provide evidence of woodland management.

References

Christensen, K. 1997. Wood from fish weirs – forestry in the Stone Age. In: Pedersen, L., A. Fischer, B. Aaby (eds.): *The Danish Storebælt since the Ice Age - Man, Sea and Forest*. Storebælt Fixed Link, Copenhagen, pp. 147–156.

Hänninen, K., W.A. Out, J.H. Larsen, C. Vermeeren. *Branch age and diameter to detect woodland management: new developments.* Poster and handout presented at the 17th conference of the International Work Group for Palaeoethnobotany (IWGP), 4-9 July 2016, Paris.

Feijen, F. 2017. LMR 14546, analysis of a waterlogged archaeobotanical sample, X5 from Ronæs skov (FHM 4296/86). Department of Archaeological Science and Conservation, Moesgaard Museum.

Klooß, S. 2014. They were fishing in the sea and coppicing the forest. *Bericht der Römisch-Germanischen Kommission* 92: 251–274.

Morgan, R.A. 1988. The case for wattling – what tree-ring studies could reveal. In: Murphy, P., C. French (eds.): *The Exploitation of Wetlands*. BAR BS 186, Oxford, pp. 77–91.

Out, W.A., C. Vermeeren, K. Hänninen 2013. Branch age and diameter: useful criteria for recognising woodland management in the present and past? *Journal of Archaeological Science* 40: 4083-4097.

Out, W.A., K. Hänninen, C. Vermeeren in press. Using branch age and diameter to identify woodland management: new developments. *Environmental Archaeology*. Doi: 10.1080/14614103.2017.1309805.

Schütt, P., H.J. Schuck, B. Stimm 2014. *Lexicon der Baum- und Straucharten. Das Standardwerk der Forstbotanik.* Nikon Verlag, Hamburg.

Schweingruber, F.H. 1990. *Mikroskopische Holzanatomie*. Swiss Federal Institute for Forest, Snow and Landscape Research, Birmensdorf.

Uldum, O. 2012. Ronæs skov, dokumentation og sikring af stagebygget anlæg. Rapport ØHM journ. Nr 14546, KUAS j.nr. 2012-7.26.01-0059.

Appendix 1

Nr	Taxon	Season	Diam.	Rings	Orientation	Traces of working
1	Corylus sp.	autumn/winter	3.5	8	roundwood	
2	Alnus sp.	-	6.4	6	half of a branch	split, pointed, cut mark
3	Alnus sp.	autumn/winter	4.1	4	roundwood	
4	Alnus sp.	spring	5.5	4	roundwood, worked along one side	split
5	Alnus sp.	autumn/winter	5.6	6	half of branch	split
6	Alnus sp.	spring/summer	5.5	6	quarter/half of branch	split
7	Alnus sp.	autumn/winter	5.6	6	roundwood, worked along one side / half of a branch	split
8	Corylus sp.	-	3.65	9	roundwood	
9	Alnus sp.	spring	4.5	7	roundwood, worked along one side	split
10	Corylus sp.	-	2.45	7	roundwood	
11	Corylus sp.	autumn/winter	3.3	7	roundwood	
12	Alnus sp.	autumn/winter	3.65	4	roundwood	
13	Corylus sp.	autumn/winter	4.1	7	roundwood	
14	Corylus sp.	autumn/winter	3.2	6	roundwood	damage from insects
15	Corylus sp.	spring	2.9	8	roundwood	
16	Fraxinus sp.	spring(/summer)	3.5	4	roundwood	
17	Corylus sp.	winter?	4.5	13	roundwood	fungi and damage from insects
18	Corylus sp.	spring	4.3	11	roundwood	
19	Corylus sp.	spring/summer	2.9	10	roundwood	
20	Corylus sp.	winter?	2.8	7	roundwood	
21	Corylus sp.	winter?	3.5	8	roundwood	
22	Corylus sp.	spring	3.8	5	roundwood	slightly rounded, possibly worked, or erosion
23	Corylus sp.	-	3.5	7	roundwood	slightly rounded, possibly worked, or erosion
24	Corylus sp.	autumn/winter	3.5	10	roundwood	
25	Corylus sp.	winter?	3.7	7	roundwood	slightly rounded, possibly worked, or erosion

26	Corylus sp.	spring	2.5	9	roundwood	cut mark
27	Fraxinus sp.	spring	3.4	5	roundwood	
28	Corylus sp.	winter?	2.8	7	roundwood, with natural bend	possibly worked
29	Corylus sp.	autumn/winter	3.6	8	roundwood	
30	Alnus sp.	autumn/winter	2.7	3	roundwood	
31	Corylus sp.	summer?	3	8	roundwood	
32	Corylus sp.	summer	3.2	6	roundwood	
33	Corylus sp.	spring/summer	3.4	5	roundwood	
34	Corylus sp.	autumn/winter	3.4	13	roundwood, worked along one side	possibly worked
35	Corylus sp.	autumn/winter	3	6	roundwood	bended because of pressure
36	Corylus sp.	spring	3.4	7	roundwood	
37	Corylus sp.	summer	3.6	8	roundwood	
38	Alnus sp.	spring	3.1	4	roundwood	
39	Corylus sp.	autumn/winter	2.7	7	roundwood, partly worked along one side	
40	Corylus sp.	autumn/winter	3.6	6	half of a branch	split
41	Corylus sp.	autumn/winter	3.3	14	half of a branch	split
42	Corylus sp.	summer/autumn	2.8	11	half of a branch	split
43	Corylus sp.	autumn/winter	4.1	12	roundwood	
44	Corylus sp.	autumn/winter	2.7	11	roundwood	
45	Alnus sp.	-	3.9	3	roundwood	
46	Corylus sp.	winter	4.2	11	roundwood	
47	Alnus sp.	winter	4.8	4	roundwood	
48	Alnus sp.	spring/summer	6.5	7	half of a branch	split
49	Alnus sp.	autumn/winter	2.7	2	roundwood	possibly worked
50	Corylus sp.	spring/summer	2.5	9	roundwood	

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