Ex B

Theoretical Approaches to Artefacts, Settlement and Society

Studies in honour of Mats P. Malmer

edited by

Göran Burenhult, Anders Carlsson,
Åke Hyenstrand and Torstein Sjøvold

Part i

BAR International Series 366(i)
1987

"OAK AND WILLOW": ACTIVE AND PASSIVE PERIODS AT ALVASTRA PILE DWELLING.
A Result of Dendrochronological and Wood Anatomical Investigations

By Thomas Bartholin

Laboratory of Quaternary Biology. University of Lund.
Tornav. 13. S-223 63 Lund, Sweden.

When the first piles, all that remained of the previous excavations of 1908-1919 and 1928-1930, were rediscovered in 1976 after Professor Mats P. Malmer reopened the excavations at Alvastra, there was little hope that dendrochronology could be successfully employed to determine the usage periods of the neolithic Alvastra Pile Dwelling. The poles were very small and contained very few tree rings, and it was impossible at that time to discern any systematic pattern in their placement which could assist in dating them relative to each other. The oak piles (203 of the 856 excavated poles), the likely basis of any successful attempt at dating, were also apparently scattered unsystematically throughout the material (fig. 1). Professor Malmer nevertheless desired that a thorough sampling for a dendrochronological analysis should take place, although the financial costs promised to be substantial and the likelihood of positive results was very small.

This decision proved to be of extraordinary importance for the eventual success of the excavation. The dendrochronological examination of the oak poles unexpectedly revealed a comprehensive picture of the development of the entire dwelling. The results of this examination have been previously published (Bartholin 1983a), and will therefore be only briefly described at this time.

The unexpected success of the dendrochronological investigation depended upon the extraordinary fact that the oaks were originally taken from one source, a local forest with homogenous growth conditions (Bartholin 1978, 1983b). The poles therefore revealed similar growth patterns, and it was possible to relatively date the resultant curves by eye, without the standard statistical correlations normally required. Moreover, a statistical evaluation is often extremely difficult in cases, such as this example, where the samples have very few tree rings (30 to 70 years).

The initial work on the curves was performed without knowledge of the *in situ* position of the individual poles in the pile construction. The successive development of the site, as revealed by the relative dating of the oak piles, can therefore be said to be objective, since the internal relationships were not allowed to influence the interpretation (see figures 2-10). Furthermore, because only about 10 of the oak piles (of 203) were undateable the results represent the entire chronological evolution of the site, assuming that the few undated samples are examples of non-representative growth rather than exceptions in time of cutting and use.

An earlier proposal that there existed an activity period during (relative) Years 8-9 (Bartholin 1978, 1983b) was rejected after a later review of the material confirmed only one dating from that year. A new activity phase is instead represented by a few piles felled during the spring of Year 18, as well as some piles felled during the spring of Year 17. These latter piles were apparently stored until the construction period of the following year (18), as evidenced by the larva tunnels found under their bark (Bartholin 1983b). Developments within the construction until Year 18 are concentrated to within the boundaries of the original structure. Later activity, in Years 40-42, falls outside of this pattern (fig. 10).

In addition to providing material for a dendrochronological investigation, the large number of excavated poles were intended to be used in a study of the construction techniques employed in building the pile dwelling, and to allow interpretation of condition and exploitation of the local forest. To support this research a demanding analysis was performed on the huge amounts of wooden remains found in the culture layers of the areas excavated during 1976-1980 under the direction of Professor Malmer (fig. 1). The wood anatomical analysis of this extensive collection is still incomplete, but it can already be proven that the three separate sample groups (poles, twigs, and charcoal), each have a very different specific composition, thereby indicating human activities and forest exploitation of completely different types.

About 2000 wood samples were studied from each of the northwestern and southeastern excavation fields. These analyses were done with great emphasis on detail because of the unique character of the material, and because of the difficulty in preserving the remains from the decay which would quickly reduce its value as objects of study. This work included microscopic anatomical determination of the species, counting the tree rings in the stem/branch, microscopic evaluation of the outermost ring to ascertain the season of felling, measurement of the diameter, etc.

A complete study of such data requires extensive computer analysis, but unfortunately the necessary systems are not yet available. However, even these conditional studies can give surprizing and important results if the excavation is planned and performed with the necessary awareness of the possibilities of present and future investigation.

An excellent illustration of the contribution of dendrological analysis to the understanding of the various activity periods is the example of the many branches and stumps of willow (*Salix* sp., probably *Salix cinerea*), which constituted approximately 25% of the investigated wooden remains from the culture layers of the long excavation field to the NW and the shorter field to the SE (673 samples in the NW and 352 samples in the SE). The willow material is exceptional because it exists both as branches and as stumps, the latter found *in situ*.

It should be noted that it is extremely likely that after the initial building phase the NW corner of the pile dwelling was abandoned or left fallow until about Year 15, and the SE corner until about Year 11, and that both sectors during this time became overgrown with a very tight thicket of willow. Moreover, there is evidence that the southern sector was once again abandoned to regrowth during a 4-year period between Years 12 and 15.

Figures 12 and 13 show the vertical spread of the layer containing branches and stumps of willow, together with the other tree species. The much smaller layer to the NW reflects to a great degree the natural lay of the landscape, since judging by the culture layer the amount of activity in this section must have been limited. Furthermore, a pre-condition for the occurrence of willow in the environment is the presence of topsoil, or at least the compression of the original and apparently very thick vegetation of cut-sedge *(Cladium mariscus)*. The willow layer in the SE is sandwiched by the under- and over-lying culture layer.

The horizontal spread of the stump system is illustrated in figures 14 and 11. Figures 15 and 16 show the felling time of the branches and stumps, as well as their age at cutting. Figure 17 shows the diameter of the branches and stumps in relation to the number of tree rings.

The occurrence of willow is restricted to a particular section of the culture layer. The spread in age of the stumps and branches, the time of felling, and the diameter all indicate a definite inter-relationship. In the SE there is a concentration of branches 3 to 4 years old that cannot be explained as the normal production of bushes up to 10 years old. Compare, for instance, the distribution patterns in the NW. It should be expected that many young, thin branches with few tree rings will be found, since these are the most common on bushes, but they are subject to easy decay and disappear quickly under usual circumstances.

The thickets must have been felled in the spring or summer. Only a few branches have a complete outer ring, an indication that cutting took place in the winter period or very early spring, before the new year's growth had started. It seems from the diameter relationships between the thickest branches and stumps that some of the branches must have been removed, burned, decayed, etc. The thicket in the NW has been completely overgrown, with up to 24 bushes per m^2, as further indicated by the very slow increase in diameter. In the SE the thicket has not been nearly as tight, but the bushes have been much more vigorous. After 10 years growth the branches here were twice as thick and the stumps three times as thick as those in the NW.

There is nothing to indicate that the stumps began to send up new shoots after the thickets were cut down. They were apparently covered and suffocated by their own leaf-bearing branches and other "culture layer" deposits.

The many 3-4 year old twigs in the SE are mixed in the layer of willow branches, and it is difficult to discern and interpret their horizontal spread (figure 14). This does not necessarily mean that they have been added later, but they apparently have not grown at the location, since no matching stumps have been discovered. It may be that they have grown in an area outside of the excavation, either as seedlings or as shoots, beginning their growth 3-4 years earlier. Since these thickets have grown in place and were a hindrance for any regular activity, it is reasonable to assume that they grew in the years between the activity periods of the first 18 years of the pile dwelling.

By combining the dendrochronlogical datings of the oak piles from the entire pile dwelling with the analysis of the branches and stumps of willow from a limited part of the excavation, we can construct the following activity phase model for the usage of the site:

Phase I	-	Relative Year 0- 3	Active Period
Phase II	-	Relative Year 3-11	Passive Period
Phase III	-	Relative Year 11-12	Active Period
Phase IV	-	Relative Year 12-15	Passive Period ?
Phase V	-	Relative Year 15-18	Active Period
Phase VI	-	Relative Year 18-40	?
Phase VII	-	Relative Year 40-42 (?)	Active Period

In the NW activity is perhaps restricted to Year 1 alone, possibly to Year 17 alone.

Additional analysis and discussion is required in order to clarify and develop these proposals.

References

Bartholin, T.S., 1978. Alvastra Pile Dwelling: Tree studies. The dating and the Landscape. Preliminary results. *Fornvännen 73,* 213-219.
- 1983a. Træet i Alvastra. *Skalk 83:4,* 22-27.
- 1983b. The combined application of dendrochronology and wood anatomy. *Mitt. Bundesforschungsanstalt f. Forst- und Holzwirtsch. 141,* 79-92.

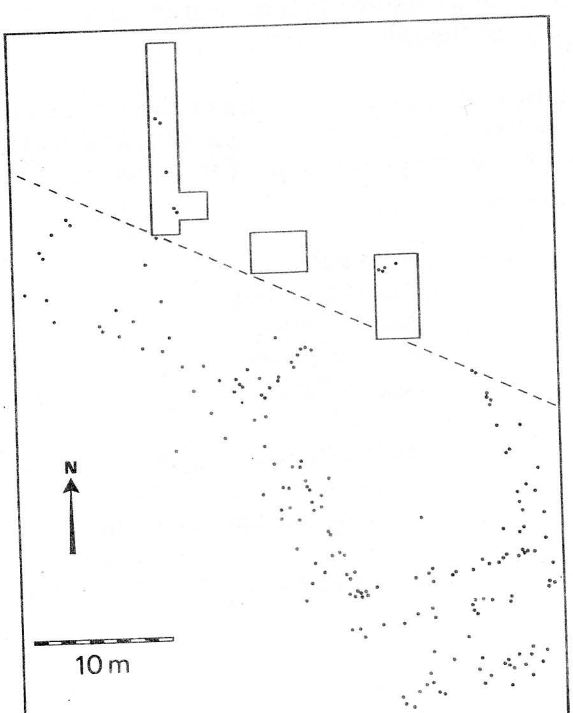


Fig. 1. All the piles of oak.

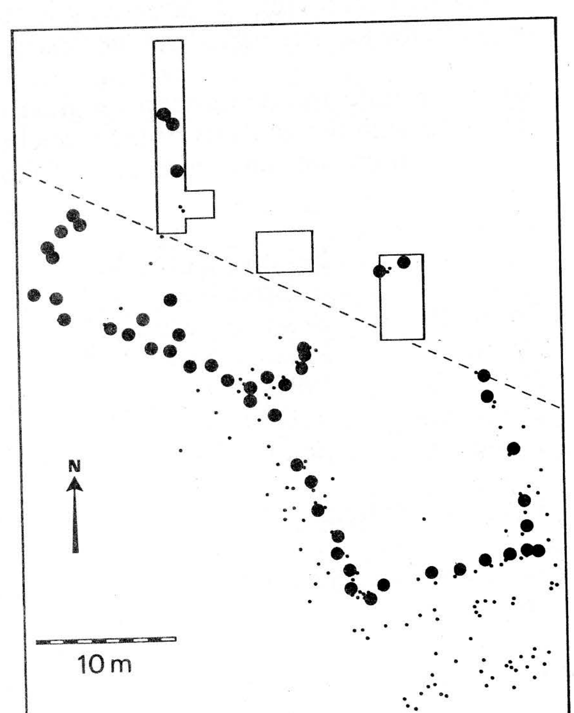


Fig. 2. Autumn-Winter Year 0-1.

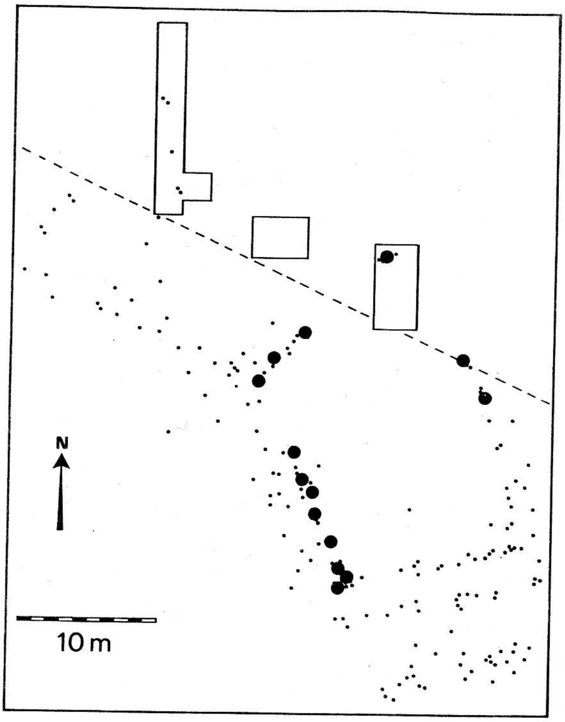


Fig. 3. Autumn-Winter Year 2-3.

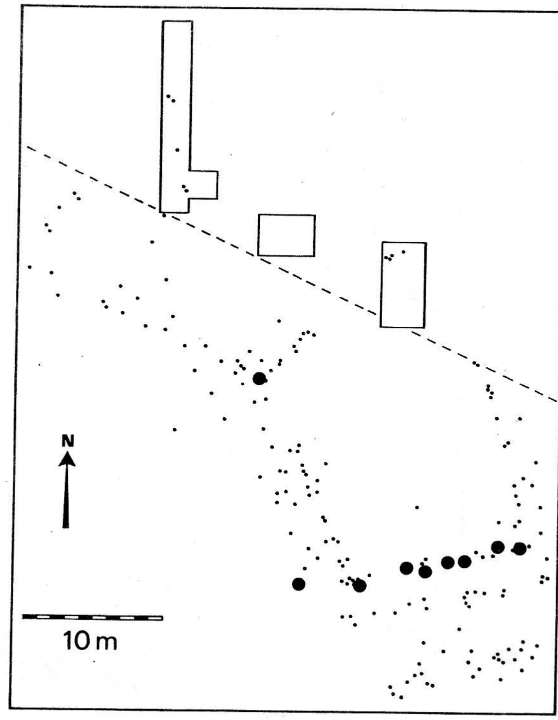


Fig. 4. Winter-Spring Year 10-11.

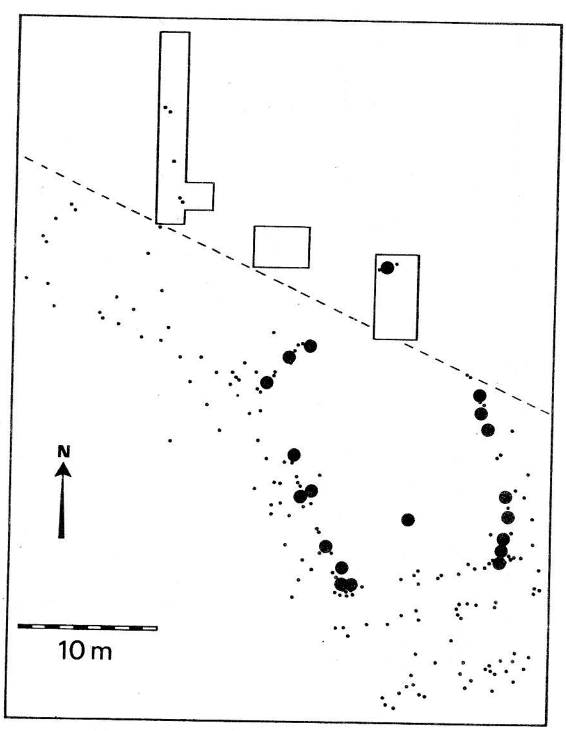


Fig. 5. Winter Year 11-12.

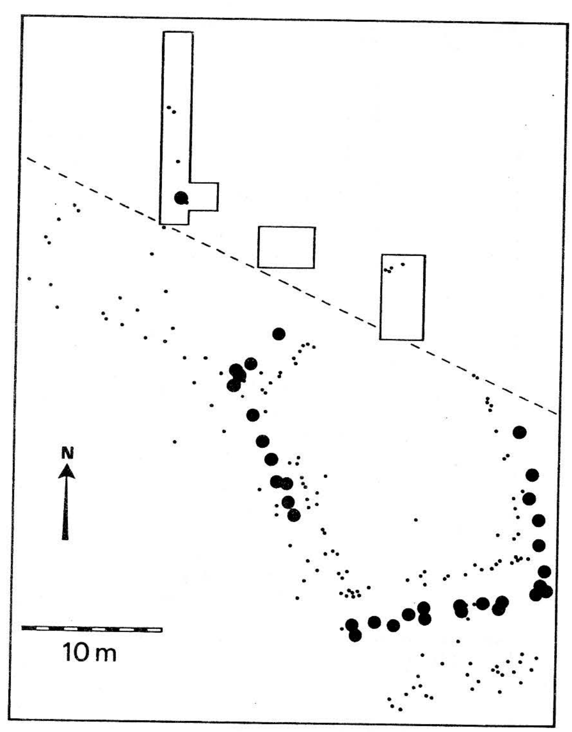


Fig. 6. Spring-Summer Year 15.

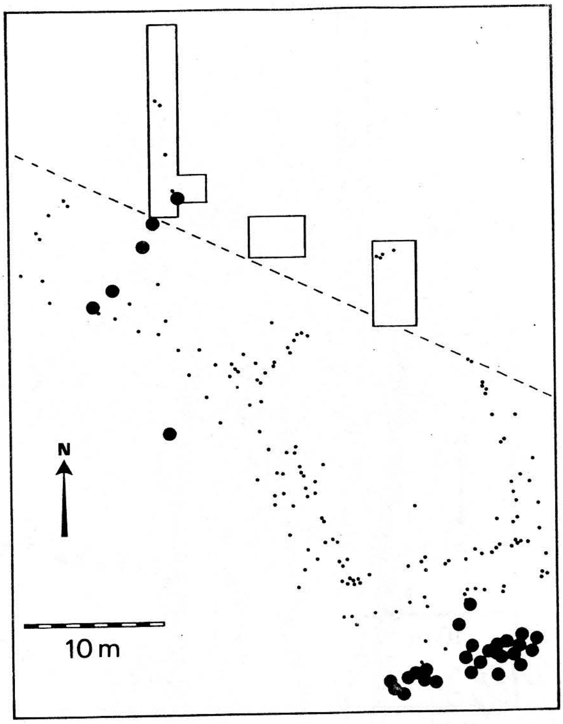


Fig. 7. Winter Year 16-17.

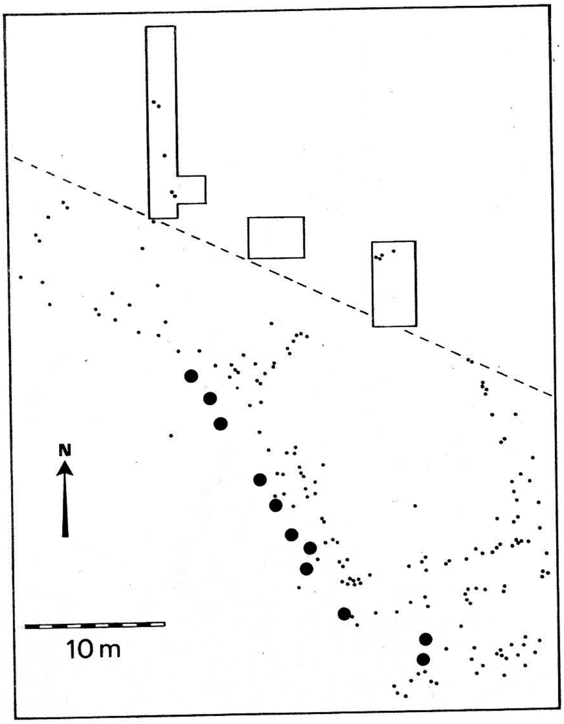


Fig. 8. Spring-Summer Year 17.

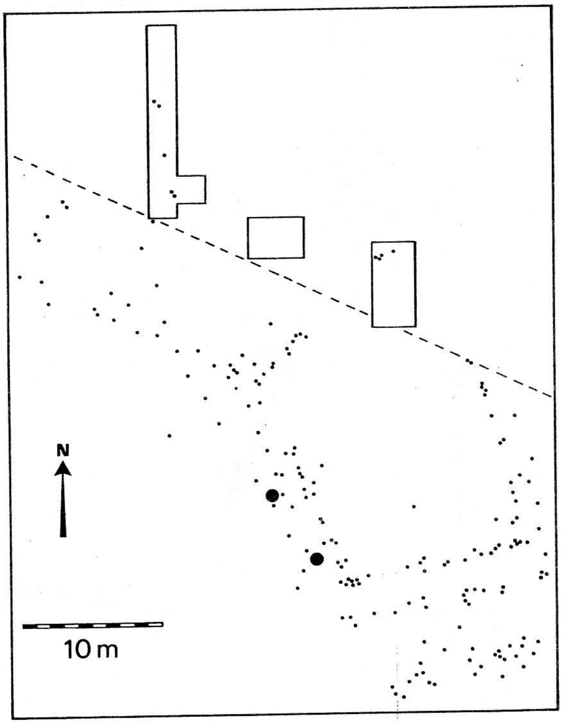


Fig. 9. Spring Year 18.

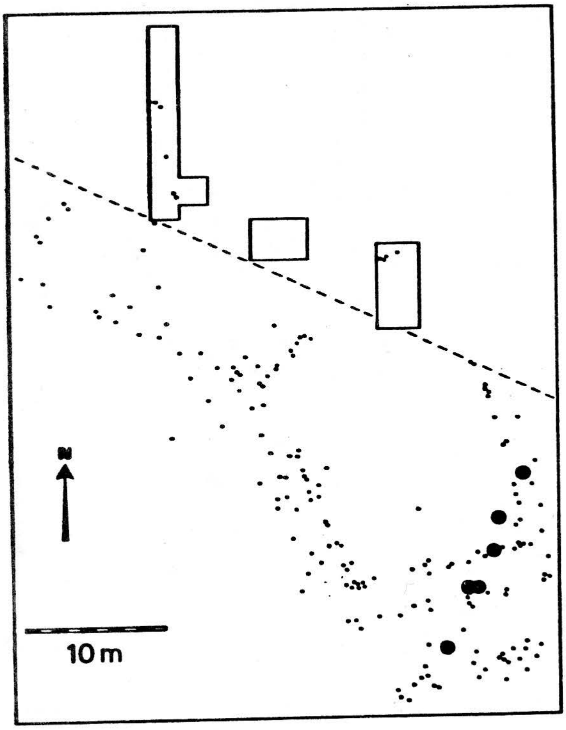


Fig. 10. Year 40-42.

Fig. 11. No of stumps per sq m. S = 1 stump

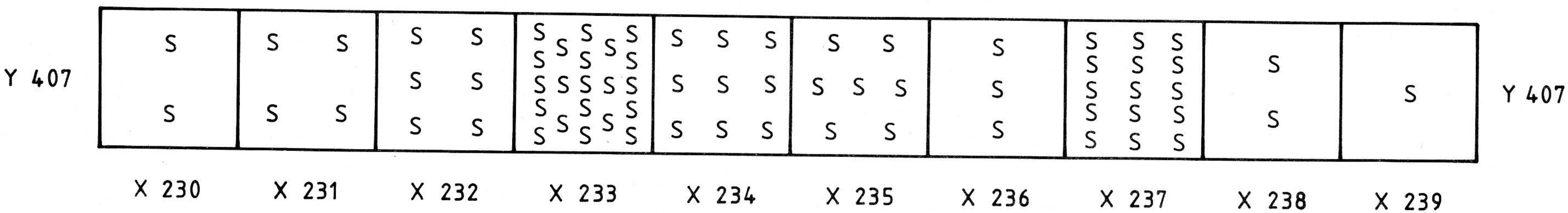


Fig. 12.

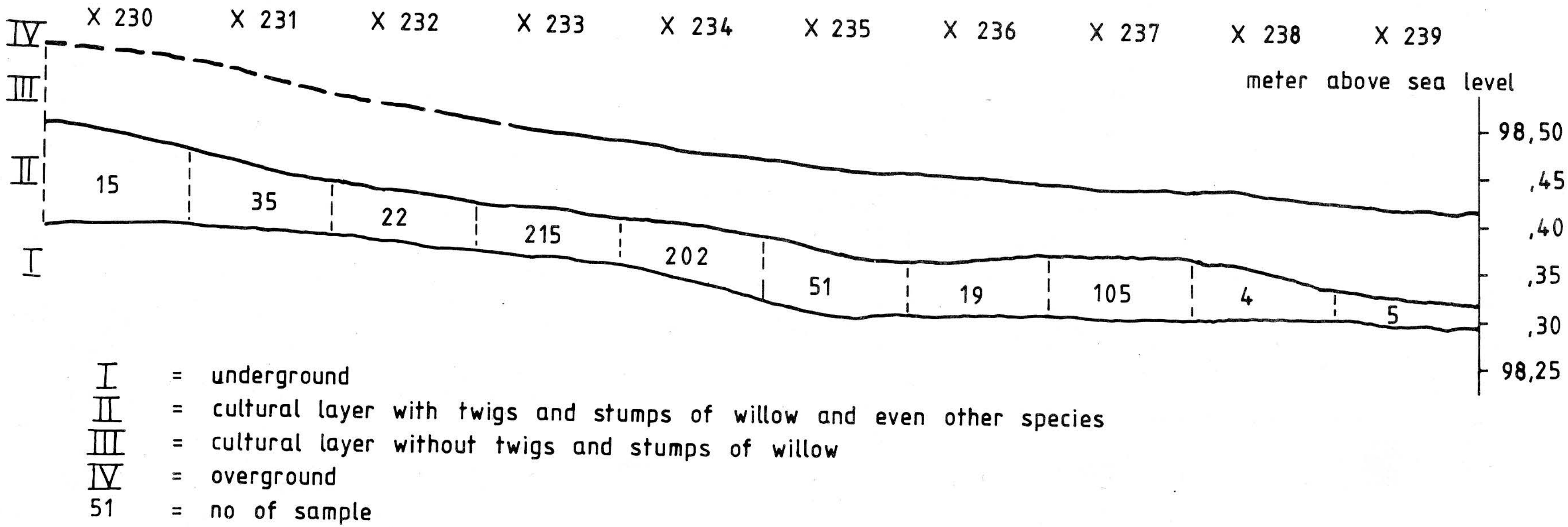
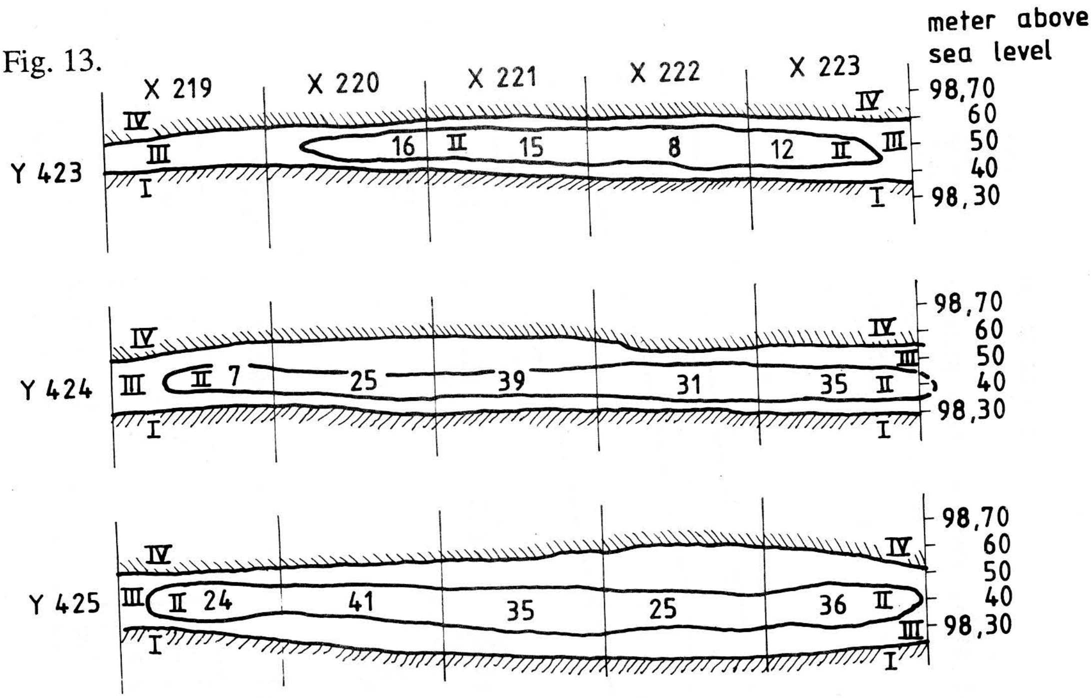
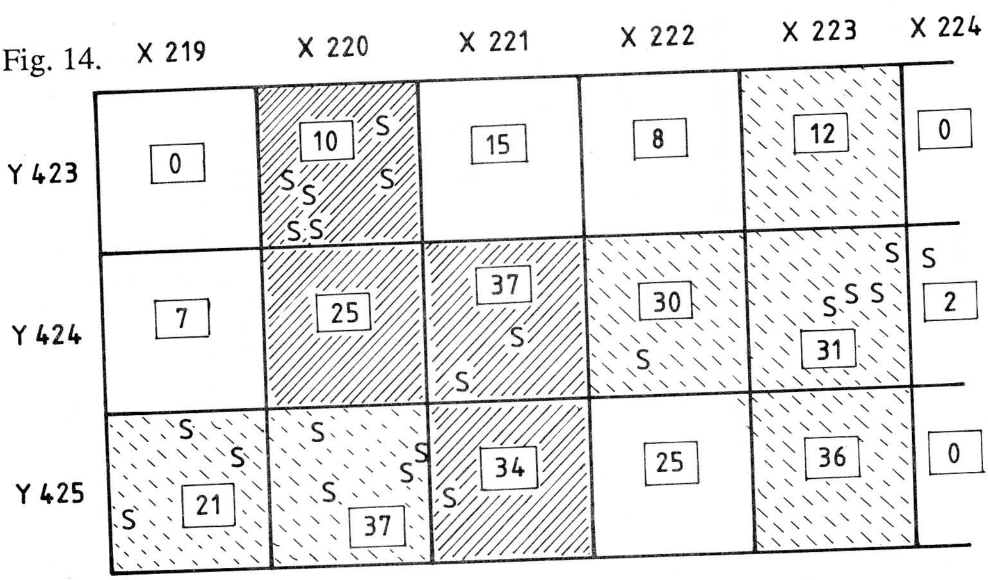


Fig. 13.



I = underground with twigs and stumps of willow and even other species
II = cultural layer with twigs and stumps of willow
III = cultural layer without twigs and stumps of willow
IV = overground

Fig. 14.



= ≥ 50 % 3–4 years old twigs
= 25–50 % 3–4 years old twigs
21 = total no of twigs of Salix per sq meter
S = stumps

Fig 15. No of Tree Rings in the samples TPÖ Salix, branches and stumps

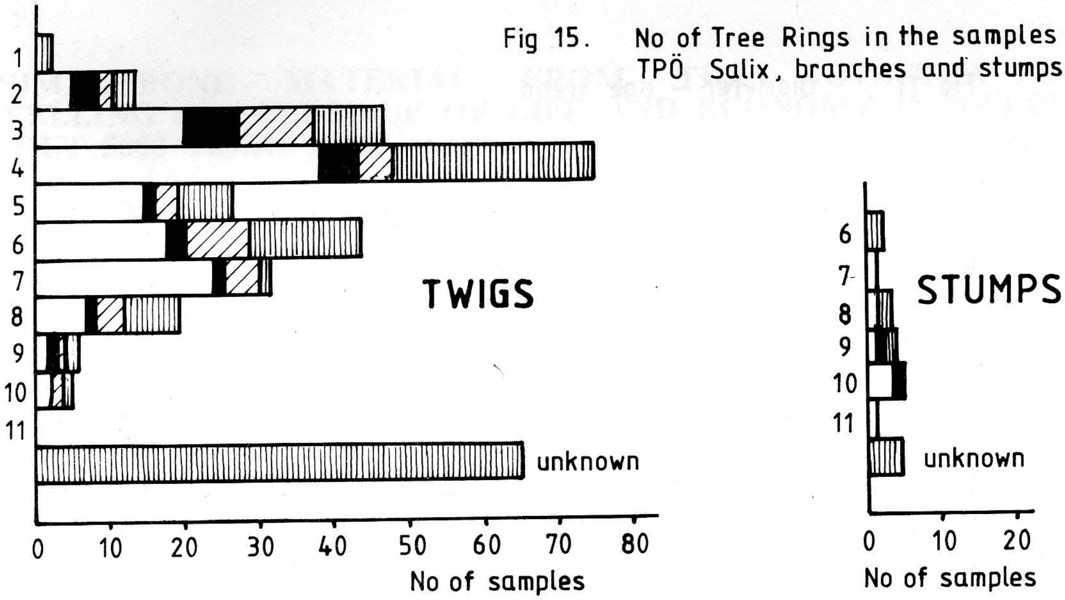
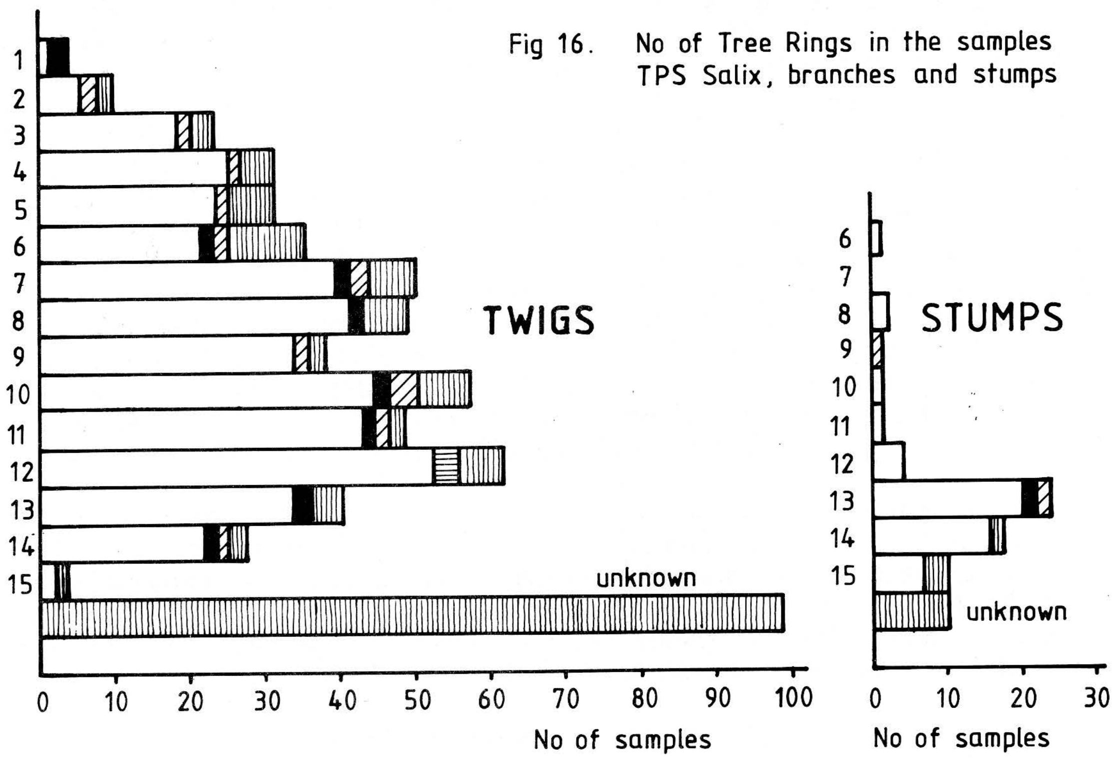


Fig 16. No of Tree Rings in the samples TPS Salix, branches and stumps



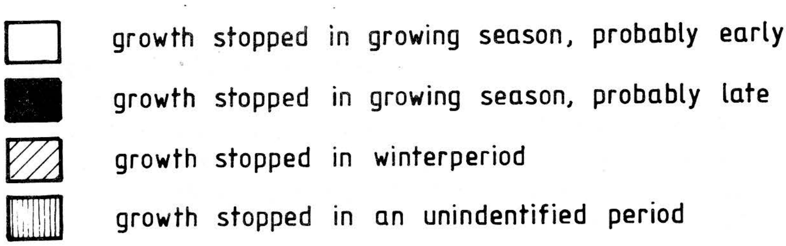


Fig 17 Diameter — age trend