

# **Great efforts on small woods**

## **Analysis of short ring-series from the Neolithic lake-shore settlement of Hornstaad-Hörnle I A**

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### **Introduction**

On the shore of Lake Constance in southern Germany a Neolithic lake-shore-settlement has been investigated in length from 1973 to 1978 and again from 1983 to 1993 by the Archaeological Department for Monument-Preservation of Baden-Württemberg. The research has yielded a vast amount of information on both the ecology and economy of the Neolithic settlers and on the extremely complicated stratigraphy of the site. However, in spite of sedimentological and limnological analyses the genesis of the layers is still not well understood. Dendrochronological dating of the excellently preserved houseposts (carried out by A. Billamboz) did not improve our understanding, since the posts penetrated all layers of the stratigraphy. The aim of this study was to improve our understanding of the duration of the settlement and of the genesis of the stratigraphy. It was based on dendrochronological dating of the clearly stratified small pieces of wood and on analyses of as many other features as possible of these pieces.

### **Material and methods**

The aim was to date all the single layers of the site. For this, we used the master-chronology of the house posts (several species) established by A. Billamboz (preliminary report in Billamboz 1990. A comprehensive publication is in progress.) Based on the calendric dates of the houseposts as well as on the stratigraphical data it was clear that the pieces of wood should date within about fifty years of each other, between 3930 and 3880 BC.

About 4000 small pieces of wood (Fig. 1) were analyzed in terms of their species and many other features such as grade of degradation, shape or presence of fungi. Some 250 of them – mainly beeches (*Fagus sylv.*) – were measured and synchronised optically making use of a thorough dendrotypological analysis (Fig. 2). This means that not only the ring-widths were taken into account but also the trend, species and features characterizing the sample as a whole as for example the shape (for a discussion of the term dendrotypology see Billamboz 2000). In a few instances it was possible to put pieces of wood back together just as an archaeologist does with potsherds. In order to integrate more and shorter series, I built many groups of similar curves with a high visual agreement thus creating longer mean curves for the comparison with the reference.

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Figure 1 - Examples of small wood-samples sometimes capable of dendrochronological dating.

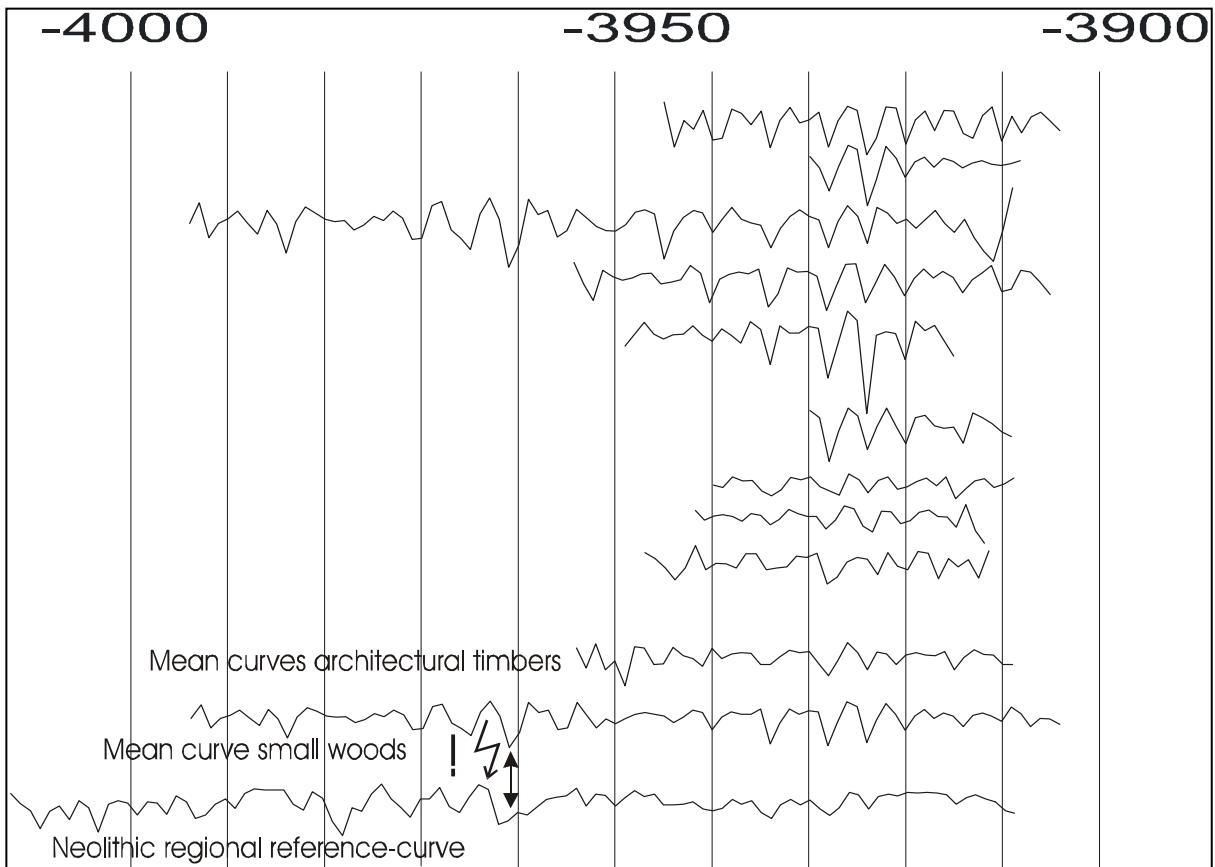


Figure 2 - Short ring-series of dendro-groups (above) and reference-curves (both detrended). The arrow marks a missing ring in the series of the small woods due to the small number of longer curves.

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## **Results**

45 series could be crossdated after sufficient tree curves had been included in these groups. Their mean chronologies had become long enough to allow for visual synchronization with the chronologies of the architectural wood. The presence of a characteristic sequence of ring-width variations in the master chronology (a ring-width 'signature') during the interval mentioned above improved the chance of successfully dating the short series. Experience has shown that among short series those of branches are the least reliable mainly due to pre-lethal phases (Schweingruber 2001) and mechanically induced flawed curves. On the other hand even tiny chips split from stem-wood can exhibit enough rings to yield a reliable synchronisation. Several pieces of just about an inch in radius showed about a hundred rings. One of the most important results was that two of the older layers very different in thickness represented equally long spans of time. These two layers were separated by the remains of a catastrophic fire that had burnt the village down. This fire was dated by A. Billamboz (A. Billamboz forthcoming).

Surprisingly the chips of the youngest two layers were often older than the fire and showed no duration exceeding the dates of their predecessors. The youngest dated wood was found in the thick layer after the blaze and thus in the middle of the stratigraphy.

The analysis of the distribution of wood-chips within the single layers showed that there was a time of concentration after the blaze while the time before this incident was rather characterized by diffusion. In the younger layers the concentrations fade again and the distribution becomes more diffuse.

Another interesting aspect was the anatomy: No preserved wood was cut in summer and there were hardly any fungi in the wood – save some in the outmost rings.

## **Discussion**

The results were surprising at first since they obviously did not fit in with the stratigraphy. Of course we had expected the youngest dates to be in the youngest layers – but it did not turn out that way. Thus the dating of the single elements in the stratigraphy succeeded only partially.

The equally long duration of two layers very different in thickness point to ephemerally changed sedimentation processes after the fire. These are also reflected by the changing distribution of the woods in the layers. This is a step to understanding the distribution of archaeological finds and shows clearly that the lake constantly influenced the sedimentation.

It furthermore enables us to estimate the duration of the following layers. Since their structure is very similar to those that could be dated it appears reasonable to reckon with a similar span of time each. Thus the current estimation of the village's duration is considerably longer than it has been up to now.

The interpretation of the fungi in the outmost rings is not easy. Fungi grow very quickly and their position in the wood means that the fungal growth was stopped very soon after the insedimentation. A possible explanation may be that the fungal growth was suppressed by low temperatures during winter and by the high seasonal water level of the lake during the warmer seasons. In the summer the winter-cut small woods were probably already so wet that they were not swept away with the rising tide as was all wood cut in summer.

If this hypothesis is true this means of course that we can hardly interpret the spectra of the species ecologically since we lack of all summer-cut wood (which is why these spectra will not be discussed in further detail here). Since the lake's water level is about two meters higher in summer than in winter this implies also that the shore was flooded every summer. This fits perfectly in with the archaeo-ethnobotanical results and would mean that the houses were built on stilts. It also explains why all preserved wood was cut in winter for the summer-cut wood had no time to soak and was washed away. It does not appear likely to assume that the settlement was only seasonally inhabited just because we haven't found wood cut in summer. This also fits the archaeobotanical results.

## **Conclusion**

Small woods are a useful source of information and should be more frequently analysed. In this study it was possible to add some information on the beginning and duration of the settlement which probably began a bit earlier and lasted considerably longer than expected. Concerning the stratigraphy we showed that the lake played a major role in the genesis of the layers and we can estimate the effects of this quite exactly. It flooded the settlement every summer and thus washed some components of the cultural layers such as freshly cut wood away while others as for example soaked wood of the last autumn remained. This is particularly important when trying to interpret the remains and the spectra of many thousands of analysed small pieces of wood, twigs and all the architectural timbers from an ecological point of view. In this case it showed us the severe problems connected with this task. The dates also showed that the processes of sedimentation can change ephemerally and lead to false interpretations if not corrected by Dendrochronology. In this case layers of different thickness do not necessarily mean a different intensity of occupation.

Furthermore it was possible to demonstrate that – given a reliable masterchronology and a brief period for the possible results – short series of as few as twenty rings can be dated with a reasonable margin of certainty

Since the wood-anatomy and the fungi were the basis for the current interpretations this is therefore a reminder to pay attention to wood-anatomic features in order to use dendrochronology to its full extent.

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