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Analysis/Dendrochronology
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Report on the quality of the datings of the timbers from Arbon-Bleiche 3

Background:

In August 2013 the aim was to provide a Neolithic oak reference chronology for the southern shore of Lake Constance (all sites in Canton Thurgau) based on the synchronisation of dated tree-ring curves of oaks.

In order to be incorporated in a **reference chronology**, tree-ring sequences must adhere to certain strict quality guidelines: only **A-quality curves** with a length of more than 50 years should be incorporated. ***A-quality dating*** *= independent dendrochronological dating which is further confirmed by definite correlation values with several well-confirmed [regional or supraregional] reference curves. Significant t-test-values [>5] are taken as a given.*[1]

As part of the project the tree-ring sequences for all the Neolithic oak timbers from Canton Thurgau that had already been dated were once again cross-matched with the regional and supraregional oak chronologies available. It emerged that **none** of the oak timbers from Arbon-Bleiche 3 dated in the Zurich Dendrochronology Laboratory in 1995 meet the criteria outlined. At the time the Zurich Laboratory synchronised the 148-year long oak mean curve 1931 which, according to T. Sormaz, consists of 48 single curves.[2] None of the oak curves can be dated as a single sequence and the single curves are not sufficiently similar to allow for their synchronisation in a combined mean curve. The dendrochronological dating of the mean curve 1931 is, therefore, not secure.

Niels Bleicher, head of the Zurich Dendrochronology Laboratory, had almost simultaneously found difficulties with regard to the reliability of the dates obtained from the timbers from Arbon-Bleiche 3 and had also discovered that the oak timbers from Arbon-Bleiche 3 were undatable.

Preliminary work carried out

Some further examinations, although insufficient and not yet completed, have been carried out. My own analyses of the tree-ring sequences of the firs are not yet comprehensive. N. Bleicher in Zurich also carried out further analyses on the tree-ring series and his optical reproductions of the oak and fir curves are available as cdr files.

For the present we can make these general statements:

Fir mean curve 1930 (after Sormaz 2004, Fig. 70, dated to 3370 BC, consisting of 494 single sequences, 128 timbers with less than 30 tree rings)

- The matching of the curves of most of the individual fir sequences seems reasonable. **The relative-chronological sequence of the phases of construction depicted in the pile distribution plans can therefore be confirmed.**
- The dating was established based on a heteroconnection with oak chronologies (in my opinion with inadequate correlation results) and was only confirmed by ^{14}C-wiggle-matching on just two fir samples (also inadequate, see Sormaz 2004, 108–109).
- The end year of the fir mean curve may possibly be confirmed by other regional references from Swiss contexts (according to N. Bleicher).

[1] M.G.L. Baillie/J.R. Pilcher, A simple crossdating program for tree-ring research. Tree-Ring Bulletin 33, 1973, 7–14.

[2] T. Sormaz, Absolute Datierung durch Dendrochronologie und C14-Analysen. In: S. Jacomet/ U. Leuzinger/J. Schibler (Eds.) Die jungsteinzeiliche Seeufersiedlung Arbon-Bleiche 3, Umwelt und Wirtschaft, Archäologie im Thurgau 12, Frauenfeld 2004, 105–111.

- Efforts to date single curves of fir on the basis of the establishes oak chronologies (heteroconnection) have not yielded any results so far.

Oak mean curve 1931 (after Sormaz 2004, Fig.70, dated to 3371 BC, consisting of 48 single sequences)

- The oak mean curve shows no definite correlations between the incorporated single sequences, neither statistically nor visually. The single curves combined in the mean curve do not yield very good results in the correlation with mean curve 1931 (although one would expect high correlation values due to the fact that they are part of the curve).
- Even today (with an improved body of data) the single curves and the mean curve do not convincingly correlate with any of the known oak references. It is not possible to date the single oak sequences.
- The dating is confirmed only by a questionable ^{14}C-wiggle-match of just one oak timber (on this see the remarks by Sormaz 2004, 108–109).

Ash mean curve 1935 (consisting of five single curves, Sormaz 2004, Fig. 70)

- yielded a preliminary date based on its correlation with only one oak reference (inadequate statistical values) and the fir master chronology 1930.

None of the timbers yielded any A-quality dating. (with the possible exception, according to N. Bleicher, of some of the long tree-ring sequences of fir shingles; this requires further reviewing). Short tree-ring sequences (less than 30 tree-rings) are always considered C-quality dates, which cannot be viewed as absolute dates. Due to their limited number of tree-rings, these timbers provide no relevant information with regard to the climate, which is very important in dendrochronological absolute datings.
There appears to be a danger of circular reasoning – timbers are dated by means of ^{14}C analyses, and the dates are subsequently confirmed by ^{14}C analyses.

Evaluation

The construction plan of the settlement which has been published is confirmed in terms of relative chronology by the end years of the fir sequences analysed.

The “absolute” dates established should in future be published only with considerable reservation. (In my judgement, the term “absolute” was and generally still is used to refer to timbers that have yielded definite A-quality datings).

Where they are the only basis for the date, the mean curves of the oaks and firs are not, at present, suitable for the precise dating of timbers from other archaeological sites.

The data should not be passed on to other laboratories unchecked. Before they are further tested and confirmed, the data should not be entered on any external databases.

Under no circumstances should the timber samples from Arbon-Bleiche 3 be used to calibrate measuring equipment for radiocarbon dating at this point in time.

Suggestion:

Due to the importance of the site Arbon-Bleiche 3 for dendrochronological research (Sormaz 2004, 110–111), new ^{14}C analyses should be carried out, if possible on several oak and fir timbers, and the dating difficulties that still exist should be communicated.

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