AN APPROACH TO THE SAMPLING AND STORAGE OF WATERLOGGED TIMBERS FROM EXCAVATIONS

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Wood preserved in waterlogged archaeological deposits is frequently encountered in archaeological excavations. Wood may be found as objects; as more or less complete structures of manageable size, such as boats or pit linings; or as large structural timbers, often incomplete, which do not in themselves comprise an object or a structure. These structural timbers are usually an embarrassment to the excavator, who may be short of storage space and have a limited budget for conservation. Nevertheless, they afford an opportunity to obtain much information, both about historical technology and for dating purposes, and cannot simply be discarded without consideration being given to this.

When waterlogged wood is found there is a limited choice of courses that may be followed. Briefly, these are to conserve the object fully, to store the object complete but unconserved, to take and store a sample only, or to discard the piece entirely. It is important to recognise that this choice can only be made by the director of excavations, preferably in consultation with the curator of the museum or other institution which will ultimately be responsible for the finds from the site. A proper decision can only be made if the archaeologist is in possession of a full assessment of the alternatives open to him or her, and a conservator will usually be in the best position to provide this assessment. Furthermore, the conservator may often be asked to advise on what information can be obtained from ancient timbers, and while it is clearly not his or her job to carry out this type of investigation, a knowledge of the information potentially available, and the type of sample required, may reasonably be expected.

Large quantities of waterlogged structural timber, together with many wooden objects, were found in Winchester during the excavations which took place between 1961 and 1971. A policy for dealing with this material was gradually worked out, and subsequent work on the publication of the sites has enabled the success of the policy to be evaluated. The criteria and methods used, together with an outline of the information obtained, are described here.

THE PROBLEM

Waterlogged timbers were first encountered in quantity in 1964, when a Saxon timber-lined well was excavated. It was not until 1969, however, when 14th century waterlogged layers were reached on the large, and historically densely occupied, Brook Street site, that decisions had to be taken as to what should be done with the large number of timbers that were expected to appear during the final two seasons of excavation on the same site.

It was realised that this timber would be a great potential source of information. Such information would fall under the following headings:

i methods of construction, and types of carpentry joints used.
ii the species of wood used.
iii dating evidence: dendrochronology
carbon 14

In deciding on a policy for this timber, the following factors were taken into account:

i finance and availability of storage space and labour.
ii the necessity of being able to identify individual pieces, and of all pieces being easily accessible.
iii adequate preseravation of the wood for our purposes.

i Finance and resources

Although the study of the timber was important, this was only one aspect of the investigation and recordings of the sites, so expenditure had to be kept to a minimum. Labour during the excavation season was relatively plentiful and cheap, while labour out of season or during the post-excavation publication period would be expensive and scarce. This had to be taken into account when a system was designed. Storage space was also limited.

ii Identification and accessibility

Pieces of unknown provenance would be valueless, so it was essential that identification marks should be permanent. It was obviously most important, in view of the limited time available for working on the publication of the sites, that any given piece should be easy to find and retrieve when required.

iii Preservation

Any method or preservation involving the introduction of carbon compounds other than the original wood (such as polyethylene glycol or acetone/resin) would render the wood valueless for carbon 14 dating measurements. Dimensional changes that would result from any sort of drying without a consolidant would jeopardise dendrochronological measurements, in which the width of each annual ring is compared to that of its neighbours. From attempts to keep pieces of timber sufficiently damp by simply wrapping them in polythene sheeting it was known that this was not successful. Experimental results indicate that even sealing in polythene does not prevent shrinkage[1]. To ensure adequate preservation and dimensional stability of waterlogged timber without complete conservation it is necessary to keep it actually immersed in water.

THE POLICY

In the light of these considerations, and of the information that would be required from the wood, a policy was decided on. All objects as opposed to structures, of whatever size, would be conserved fully, since they would not be used for dating procedures. Complete structures, such as the Saxon pit lining recovered in 1964, should be considered for storage intact, with a view to preserving them in the future. Structural timbers with features of exceptional interest should either be stored whole, or the interesting part should be kept. For the majority of timbers, however, it would be sufficient to make a careful drawing of the piece on the site, paying particular attention to constructional details. The remainder of the piece could be discarded.

METHOD OF STORAGE

Many methods for conserving waterlogged wood have been published elsewhere, and will not be discussed here.

Only the method used to store timbers and samples is given in this paper.

As the Saxon pit lining had remained in satisfactory condition for a number of years through storage under water in a large outdoor tank, it was decided to adopt this method for the rest of the wood. A number of tanks were used, small enough to facilitate retrieval of particular pieces as required. Details of the storage system, sizes of samples, and materials found satisfactory are given in the Appendix.

INFORMATION RETRIEVED—AN EVALUATION OF THE POLICY

i Methods of construction and carpentry techniques

In this area, the results of the policy have not yet been evaluated, since the timber, and the records of it, have still to be worked on for publication. It is probable that more resources should have been devoted to recording the timber on site. Although structures and timbers were carefully drawn *in situ* it was difficult to keep pace with drawings of individual timbers. However, as is always the case on excavations, diverting more resources to one aspect of recording would have resulted in less being given to other aspects — in this case the planning of the site would have suffered, since it was the planners who were responsible for drawing the timbers.

ii Identification of species

All non-oak timbers were sampled for wood identification in 1973, after two years of storage. 'Oak' and 'non-oak' were identified with the naked eye, using the following criteria: to be oak, the wood had to have (a) the very large vessels, easily visible without magnification, **and also** (b) the highly characteristic broad rays of oak. No mistakes appear to have been made in identifying pieces positively as oak during this initial screening; but approximately 15-20% of the 'non-oak' samples did turn out to be young oak. This error was entirely acceptable since 'non-oak' was all sampled for further identification, and the pieces would not have been suitable for dendrochronological measurement. The wood was all well enough preserved for identification to be possible using normal microscopic techniques[2]. The initial screening out of oak was extremely useful, as much of the wood was identified as oak in this way. Wood identification using a microscope is both skilled and time-consuming, and should be kept to a minimum.

iii Dating evidence

a) Dendrochronology

During the screening of the samples in 1973 pieces of timber were selected for dendrochronological measurement[3]. Suitable pieces were mature oak, with at least 50 annual growth rings. In all, over 200 samples of timber have been measured and used in the construction of a dendrochronological curve for archaeological periods in the Winchester area. Many additional samples of later timber have been used to complete the curve to the present day. This should enable us to date accurately structures ranging from Roman times to the fourteenth century.

The best dendrochronological samples were from quarter-cut planks, which often had two or three hundred annual rings. Large posts were less useful; these tended to have relatively few rings which were widely spaced. Clearly the wood had been specially selected by the original carpenters. The principal cause of a sample realising less than its full potential was where the sample of a thin plank had been too small, and had not had sufficient protection in the storage tank. It had then tended to break across the annual rings. Too many breaks rendered the sample virtually useless for dendrochronology. Other than this, though, no problems were encountered with the dendrochronological samples, and even some semi-dry pieces which were inadvertently left out of water, wrapped only in polythene, proved to be satisfactory. However, these were large solid timbers, and thin planks could not have survived storage in this way.

b) Carbon 14

The most reliable carbon 14 dates would be obtained if samples were submitted to the processing laboratory immediately after they were recovered, before they could be contaminated with modern organisms. This is not always possible — it takes time to raise finance for more than a few samples to be processed, and it is preferable to wait until all potential samples are present, and preliminary evaluation of the site has been completed, before selecting samples for measurement. When samples have to be kept then the method of storage should provide the most favourable environmental conditions possible. The disadvantages of introducing fungicides, many of which are carbon compounds, must be balanced against the growth of modern fungi, etc., that will take place without them. It is not feasible to allow samples to dry out — the processing laboratory will generally want to know the number of annual rings present, and shrunken wood is also likely to trap contaminants which cannot be washed out during subsequent pre-treatment. The carbon 14 samples at Winchester were taken from wood that had been kept in storage tanks for over two years. The baths contained fungicide, but quite a range of algae and microscopic animals (and even fungi in the centre of thick pieces of wood where fungicide had not penetrated) were observed during wood identification. In spite of this, the wood samples have given very consistent carbon 14 dates. This may be due to the very thorough pre-treatment carried out by the processing laboratory[4], but clearly our storage system is satisfactory for this purpose.

CONCLUSION

In conclusion, the decision to store samples, and not entire timbers, has been seen to be justified. All the information so far been required has been obtained, and the timber takes a fraction of the space which would have been necessary had it been preserved complete. Storage of every piece entire would have presented formidable problems of retrieval. The storage system is inexpensive and extremely simple to operate. The importance of making sufficient detailed and permanent drawings and

notes of timbers which are to be discarded should be emphasised. Improvements would be recommended if this method of storage was adopted, and these are described in the Appendix below.

It should also be emphasised that the system described here should not be considered as more than a relatively short-term measure. It is very difficult to maintain waterlogged wood in good condition once it has been excavated, and storage can never be used as a substitute for conservation if permanent preservation of the wood is intended. Long term storage, however carefully conditions are controlled, has not been successful to date. In the best conditions offered at Winchester there is wood which is still in a very good state after twelve years storage, but there is undoubtedly a limit to the time during which the majority of the samples will remain useful.

APPENDIX – DETAILS OF STORAGE SYSTEM

The system

Each sample is placed in a polythene bag, with one or more polythene identification labels. One label should be attached to the sample with a pin or staple. The bag is suspended from a bar resting across the bath or tank; about 10 samples hang from each bar. The bag should be completely immersed in water. A second identification label is attached to the cord from which the bag is suspended, at the end which is tied to the bar. This label makes it possible to identify the sample without taking the bag from the water.

A list is kept of all the samples in each bath, since it proved impractical to store samples in numerical order. In all, about 1,800 samples and about 30 large complete timbers are stored.

The only serious deficiency in this system of storage is that it does not afford sufficient protection to samples of thin planks, which are among the most valuable pieces for dating purposes. It would be desirable to store these in a special tank reserved for this type of sample; plank pieces would probably survive best if kept flat. Thin planks must always be handled with care.

Size of samples

This naturally depends on the investigations which are planned. As a rough guide, three times the amount of wood that will be required for a complete set of investigations should be kept, to allow for repeat samples to be taken and leave a reserve. At Winchester, for wood identification a very small sample, a 1- 2 cm. cube, was sufficient. For dendrochronology, a section of wood covering the whole available annual ring sequence was needed, but as long as the sub-sample was robust enough not to break, the length down the grain of the wood could be kept to a minimum – usually about 5 cm. The amount of sample required for carbon 14 measurement depends greatly on the requirements of the laboratory which is to undertake the measurement, which should be consulted at an early stage for advice and instructions. A minimum of 200 gms. of wet wood will probably be required. As a general rule, size of sample should be related more to the weight of the wood than to any particular dimension, as long as the whole sequence of rings is preserved. For planks, a sample measuring about 50 cm. along the grain will probably be sufficient, but for thick posts a shorter piece can be kept.

Containers

The relatively few whole timber which have been kept are stored in large galvanized iron tanks. The samples are kept in domestic baths, obtained from a local scrap merchant. The waste holes have been sealed with ordinary rubber bath plugs. Each bath contains about 40 - 50 samples.

Materials

Thin polythene bags (thick ones deteriorate badly) with the corners cut off to allow water to enter. Bags last best if completely immersed.

Polythene labels, at least two for each sample.

Brass or galvanized iron drawing pins.

Terylene blind cord; again a thin gauge is best. Obtainable from hardware and camping shops. Ordinary plastic string does not last.

Bars made of ¾" dowelling.

Dymo tape labels and stainless steel staples (obtainable from J. H. Rosenheim & Co., Glenford Works, Quarry Road, Rutherglen, Glasgow). The Dymo labels are stapled to the label which is exposed to light, as they are more permanent than marker pen.

Waterproof marker pen (Pentel thick fibre pen was the most durable brand found, but even this fades if exposed to sunlight).

Dowicide 1 fungicide (this is very alkaline, and does not kill algae; there may be a more suitable alternative).

Ordinary rubber bath plugs were the best way of sealing holes.

Dow Chemicals 'bathtub caulk' silicone rubber sealant was used in places. This brand of sealant performed best.

Factors which affected preservation

Light level – should be low but not completely dark.

Availability of oxygen – should be kept to a minimum; deep narrow tanks are best for preservation.

Temperature – ideally, should not be too high and should not be low enough to result in wood freezing, which would result in damage to the structure.

Cleanness of samples, and hence water – adhering mud provides nutrients for micro-organisms and should be carefully washed off.

Amount of handling – should be kept to a minimum, since mechanical damage results.

pH – waterlogged conditions in the soil are usually acid; unfortunately Dowicide 1 fungicide is very alkaline. Wood would probably be preserved best if pH was kept low.

Tanks stored in a cool shed would probably be ideal, at Winchester there is no such space available, so the timber is stored out of doors. One bath was kept for a time in complete darkness, which promoted the formation of a sinister black slime. Some light seems to be necessary to

avoid this. The slime has not re-appeared since the bath was brought out of doors. In baths which are in the sun there are problems with the growth of algae and the fading of labels. It has not been possible to devise lids for the baths: this could be an alternative to a shed.

The best preserved wood is that which is stored in a deep tank against a wall which gives total shade. This contains the Saxon well lining excavated in 1964, which is still in excellent conditon. The timber was very well washed before storage, and the water remains very clean, with no growth of micro-organisms.

Footnotes

1. B. Munthäler, ***Conservation of waterlogged wood and wet leather,*** ICOM travaux et publications XI, Editions Eyrolles, Paris 1975. p. 16.
2. Identification was carried out by the author, with assistance and instruction from Dr. David Cutler. The results of this and the dating studies described below will be published in Winchester Studies Vol. 10, ***Environment and Chronology in Early Winchester,*** Ed. Jane Renfrew.
3. Dendrochronological measurements, and the statistical analysis of them, are being undertaken by Prof. A. C. Barefoot, with assistance from the Department of Forestry, Oxford.
4. Carbon 14 measurements are by the C^{14} – Tritium Measurement Laboratory, AERE, Harwell.