Wood and Water or Rebuilding Medieval London Bridge

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Summary

During the redevelopment of Fenning’s and Topping’s wharves on the southern approach to modern London Bridge in 1984, a series of area excavations supplemented by salvage recording and watching brief observations were carried by the members of the Department of Greater London Archaeology of the Museum of London (now the Museum of London Archaeology Service or MoLAS). This work revealed the southern abutment of the 12th-century stone-built London Bridge (Fig.1), plus fragments of earlier timber bridges, the associated waterfronts and the buildings of the medieval and post-medieval bridgehead, truncation horizons and fluvial deposits, as well as a Bronze Age ring ditch. A comprehensive timber sampling policy resulted in the collection of a large number of dendrochronological samples.

The aim of this paper is to discuss the post-excavation methodology devised to produce a site-wide sequence from some 15 areas (covering some 2,020 sq m) which were examined in a random order before or during ground works. Until very recently dendrochronology has only been used archaeologically to provide dates from oak timbers. On this project, for the first time, dendrochronology was used as part of an integrated approach to help determine and then refine the site sequence, by using attributes such as “same-tree” links.

Cartographic research has enabled us to reconstruct the entire plan of the medieval bridge - as it appeared in 1799 - using a computer aided design package (AutoCAD). This data is being used with the 1820’s soundings to reconstruct a profile of the river bed and determine the influence of the bridge on the estuarine hydrology.

Recovery of Data and Timber Samples

Archaeological work within the former Fenning’s warehouse basement was a standard open area excavation (Fig.1). This area was extended several times to uncover more of selected features. In particular four narrow trenches were opened up along the northern side of the basement to examine the sloping foreshore. Work on Topping’s Wharf consisted of a series of watching brief observations made during ground reduction, most of this area having been excavated in 1970-72 (Sheldon, 1974). Archaeological work on the area adjoining the foreshore was undertaken in a series of five to seven metre square close-wall shored boxes or “bays”. To prevent the collapse of the river wall only alternate “bays” were dug out initially. In between each “clearance” or reduction in ground level of several metres, one or two days were available for recording structures and deposits. Thus it was possible to detect and record all major structures, but not in the detail that controlled excavation would have provided.

Problems in recording the archaeology were compounded by its very nature - a complex foreshore sequence with a combination of the normal vertical build-up of deposits, the lateral development (due to reclamation) and the truncation horizons caused by flooding, plus the daily problems of the incoming high tide flooding the areas of excavation. Large timbers were planned in situ, labelled, then lifted out by machine for further study and sampling. For the first time on a London waterfront site an extensive timber sampling policy was carried out of all species, not just the oak timbers. A total of 786 timber samples were recovered from Fenning’s and a further four samples from Topping’s Wharf, compared with only 94 oak samples recovered from the waterfront excavations at Trig Lane (Milne and Milne, 1982). In the Trig Lane publication it was noted by the dendrochronologist that “with hindsight, many more of the 450 timbers revealed at this extensive site should have been sampled in order to provide the necessary replication of the smaller timbers and to gain most information from them … (Brett, 1982: 75).

All observations were located to the contractor’s site grid, the precise position of every timber and section being plotted by theodolite survey. Without this crucial work, everything would have been in vain as it would not have been possible to put together composite plans or see details such as how the timber bridge structures were built one upon another.

During the reduction of each “bay” a stratigraphic sequence was assembled for all structures and deposits. However, as alternate “bays” were dug out, all the early portions of site sequence were too far apart for any correlation to be made until all the intervening areas had been examined. This method of working was rather like being given most of the pieces...
Figure 1: Plan of the site at Fenning's and Topping's Wharf and Medieval London Bridge. The plan of the bridge is taken from the 1799 survey, notice the gap where one of the central starlings was removed in 1759. During the late 18th century all the buildings were removed from the bridge and the roadway widened.
of several large jig-saws, but in a random order, so trying to determine the importance of each piece, or even the exact number and subject of the various jig-saws was impossible until we had all the pieces at the end of the site.

Post-excavation: Pre-assessment

In 1993 Fenning's Wharf became one of the English Heritage funded Greater London post-excavation and publication projects. All work on the project has been structured according to the framework laid down in MAP2 (Andrews, 1991) and the unpublished MoLAS MAP2 working party report. This management framework results in the work being organized into a series of linked stages (Fig.2).

At the pre-assessment stage of the project, a context index was compiled (including all samples). Originally all the contexts were classified into basic descriptive fields such as FILL, LAYER or TIMBER etc. But this proved to be very unsatisfactory for the timbers, as it provided no detail, so, with the help of MoLAS's ancient timber specialist (Damian Goodburn), a detailed classification of all timbers was produced. From the stratigraphic records, checks matrices were produced for all the separate areas. At the same time all the dendrochronological samples were examined to determine their species and suitability for further work (samples with more than 50 rings) and the noting of characteristics such as the presence of bark edge or heart/sap-wood boundary. This data was added to the context index.

Post-excavation: Assessment

The aim of the site archive work at assessment level was to produce a grouped, site-wide sequence. This was done by combining the individual stratigraphic matrices for the numerous areas of investigation, into three sequences; one for the foreshore, a second for the landward part of the site and a third for Topping's Wharf. Besides stratigraphic position, a number of other criteria for linking deposits were used to construct the site sequence. These were: similarity in colour, soil texture and frequency of inclusions. Due to the slope of the foreshore, OD levels were only of limited use for stratigraphic correlation. The criteria for linking masonry or timber structures were mainly spatial, but descriptions of stone and mortar types dimensions and OD levels were also important. The site wide sequence was presented in two "interpretative group summaries", one for Fenning’s Wharf and the other for Topping's Wharf. These summaries consisted of lists of contexts, brief descriptions and interpretative comments for every group and sub-group. With these two documents and the 1:100 plans produced to illustrate key features, it was possible for the first time to have some real understanding of the site sequence and to start spotting the errors in earlier interpretations. Most important was the realization that we were dealing not only with the late 12th century stone bridge, but that there were fragments of a number of earlier timber bridge abutments and caissons below the 12th century stone abutment. Also it became apparent that the stone abutment had undergone several additions.

At this stage of the project dating evidence was provided by spot-dating of all pottery and a few dendrochronological dates. It should be explained that limited work had been done on the dendrochronological samples earlier before the present project began. Sufficient information was therefore available to assign broad dates to most but not all groups.

In 1984 some key oak timbers from Fenning’s Wharf mostly abutment sill beams - were dated by Ian Tyers. In 1990, as part of an English Heritage funded London dendrochronological project, Ian dated the beech timbers from the 12th-century abutment by cross-referencing them to dated oak timbers from the same structure. A random sub-sample of the elm timbers was also examined but not dated. From 1988-92 a number of boat timbers from the site were dated by Ian as part of the Ancient Boats project (Marsden, 1994).

The interpretative group summaries (including all available dating evidence) and revised context indices (with group and sub-group data added) were produced for distribution to all the specialists before they produced their assessment reports. It was therefore possible for the specialists to view their material not simply on a context level but to compile or compare assemblages, using the sub-group or group structure, which is a great help when considering the potential of material for analysis. This decision was intended to facilitate integration of very diverse data, which it did to a degree. However, as all the specialists were producing reports independently at about the same time there was little opportunity to cross-reference the work. This work will have to be done at the analysis stage of the project, using the individual reports and the revised group summaries (to be produced at the start of the analysis).

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Stage 5: Publication

Tasks - preparation of graphics and editing of publication text

(Report to English Heritage)

Stage 4: Analysis

Tasks - get C14 dates on prehistoric material. Analysis of dendrochronological results. List of research aims to form agenda for discussion by contributors/specialists, who will prepare reports for publication, while the principal authors will be preparing the main publication text and an integrated synthesis.

(Report to English Heritage)

Stage 3B: Assessment

Tasks - Production of specialist reports on flints, pottery (spot dates), coins, environmental samples, dendrochronology (timbers dated), documentary research, etc. Cross-site correlation of matrices to facilitate production of group and sub-group sequences, incorporating spot dates and dendrochronology, etc. From this data an interpretative group summary is produced. Using this summary, all the specialists can relate their material to the site sequence and correlate their work with the other contributors. This data forms the basis of an assessment report and updated project design, which includes an interim site synthesis.

(Report to English Heritage)

Stage 3A: Structuring the site archive or pre-assessment

Tasks - Processing and cataloguing of finds, dendrochronological and environmental samples, etc. Compiling context index, checking site records, producing site location and area of excavation plans. Producing a checked stratigraphic matrix for each trench/area.

Stage 2: Excavation/fieldwork

Stage 1: Project planning/evaluation

Figure 2: The structure of the London Bridge Project post-excavation programme
The Results of the Dendrochronological Assessment

The largest and most important specialist report was on the dendrochronological samples (Tyer, 1993). This vast database is important for a number of reasons. Firstly, it has provided a chronology for the development of the waterfronts around the bridgehead - vital in view of their piecemeal archaeological investigation (described earlier). This has resulted in the identification of a fragment of the late Anglo-Saxon bridge abutment dating from c. 987-1032, which is the earliest remains of a medieval bridge found on site. Dendrochronology has now dated a series of Saxon-Norman landward abutments and box caissons all pre-dating the Norman stone bridge. The construction of the stone bridge by Peter of Colechurch is dated to c.1176-1209 by documentary evidence and the construction of the southern abutment is now dated to 1187-88 by dendrochronology.

Secondly, the boat timbers from the site had already been dated for part of another project (discussed earlier). But no work had been done on their associated timbers to determine their structural context (reused in revetments) and the date of their reuse, which would provide some idea of their use-life. For instance, a series of clinker boat planks dated to after 1081, were found reused as staves in a baseplate revetment with a date range of 1093-1145, suggesting that the boat may only have been in use for 10 to 20 years before it was broken up and reused.

Thirdly, the dendrochronological dates and same tree links have been used to test the identification of a number of structures assembled from the site records. For instance, same tree links demonstrated that certain timbers interpreted as reused material, serving as foundations for the mid 12th-century bridge caisson, were not only reused but probably came from the same structure and in some cases the same-tree links suggest which structure they were derived from. Interestingly some same-tree links show that a number of planks used as the caisson foundations were not reused. This type of information has prompted some important revisions to the group sequence. Also the dendrochronological dates and same-tree links between a number of timbers have been used to identify timbers from the same structure, which were found in secondary contexts due to reuse or flood damage.

Lastly, this was the first London site on which beech and elm timbers were sampled. The beech timbers have already proved datable (discussed earlier). It is hoped that by linking the elm timbers with oak and beech material, it may be possible to date them. This has not proved possible yet, because the elm is all “fast grown” - few samples have more than 50 rings and the growth pattern does not appear to be very consistent. However, it is worth remembering that in Scandinavia pine and spruce samples are now datable, so in time it may be possible to date English elm.

Thus the dendrochronology has been used as a dynamic part of the site assessment, to help revise and refine both the group and the dating structure. It has not simply been used as another dating technique, which has been its traditional archaeological role during the last 30 years.

Cartographic Research: Rebuilding London Bridge

Thinking about how the excavated portion of the 12th century stone bridge relates to the rest of the structure is obviously vital when considering issues like methods of construction, design, road links and comparison with other bridges. However, the rest of the medieval bridge was demolished in 1826-32, except for fragments of the northern-most piers, which were rediscovered and destroyed during the development in 1921 and 1937 (Pearson, 1922 : 400).

Instead of using contemporary survey data, we have used large scale maps and surveys of the bridge produced shortly before its demolition to reconstruct its entire plan on CAD and the extent of the various properties on the southern ”bridge-foot” and relate this data to the excavated structures on Fenning’s Wharf. Incidentally, this work has proved that the position of the medieval bridge shown on the Ordnance Survey maps is incorrect. Using detailed surveys of individual buildings on the bridge, like the chapel, it should be possible to produce a CAD plan of most - if not all - the pre-18th century buildings on the bridge.

It is also proposed to use the 1820’s soundings data taken before the demolition of the old bridge to reconstruct a three dimensional profile of the riverbed. This profile will be constructed using the latest CAD technology (it is now possible to transfer incomplete 3D grids via "Surfer" to AutoCAD and produce surface profiles compatible with AutoCAD map tiles and models). The aim of this work is to show the influence of the piers and starlings on the tidal regime. It appears that the bridge was acting as a partial dam.

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