RESEARCH REPORT SERIES no. 36-2013

BARKING ABBEY
LONDON BOROUGH OF BARKING AND DAGENHAM
THE RECORDING AND CONSERVATION OF MIDDLE SAXON WATERLOGGED WOODWORK

ARCHAEOLOGICAL CONSERVATION REPORT

Angela Middleton, Karla Graham, Damian Goodburn

INTERVENTION AND ANALYSIS

ENGLISH HERITAGE

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NGR: TQ4391083910

ISSN 2046-9799 (Print)
ISSN 2046-9802 (Online)

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SUMMARY
During the 1985-86 excavation at Barking Abbey Industrial Estate a total of 113 waterlogged timbers were exposed and partially recorded by the Passmore Edwards Museum excavation team. The structural timbers derived from three wells and a multi-phase mill leat channel and were tree-ring dated to the middle-Saxon period.
In 2002 emergency recording of the remaining material was commissioned by English Heritage ahead of the planned demolition of the Passmore Edwards Museum stores. The timbers were subsequently referred to the English Heritage archaeological conservation facilities.
This report aims to provide basic information on the origins of the conserved material; its place as a sub-sample of a larger assemblage; and its character and wider inferences that can be drawn from it. This report also outlines the history of the assemblage recording and sampling methodologies as well as the conservation methodology and results.

ACKNOWLEDGEMENTS
Damian Goodburn would like to clearly acknowledge that the unpublished tree-ring study by I Tyers was drawn on heavily for this study although any errors in this text are the responsibility of the author. During the emergency recording of the remaining lifted sample of timbers the help of J Minkin and E Baker was most useful. Thanks are also due to L Goodman for assistance during the packaging of the material for transport to Fort Cumberland. Thanks are also due to managers B Sloane and N Powell for organising various phases of the work over the years. Finally, thanks are also due to the staff of the English Heritage Conservation laboratory for liaison and the invitation to compile this report and for bearing with delays in its production.

Angela Middleton and Karla Graham would like to thank the following people and institutions for their help and support during this project: Claire Tsang, Roger Wilkes, Eddie Lyons, David Dungworth, Andy Roy, James Pearce, Vince Griffin, Judith Dobie, Gemma Aboe, Libby McCormack, Stefanie Vincent, Mariangela Vitolo (all EH), Glenn McConnachie, Helen Butler, David Pearson (all Mary Rose Trust).

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DATE OF CONSERVATION
2010-2013

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INTRODUCTION

During the 1985-86 excavation at Barking Abbey Industrial Estate a total of 113 waterlogged timbers were exposed and partially recorded by the Passmore Edwards Museum excavation team. The structural timbers derived from three wells and a multi-phase mill leat channel and were tree-ring dated to the middle-Saxon period (Goodburn 2002). In national terms for the middle-Saxon period this is a medium to large sized assemblage

In the late 1980s R Darrah examined 97 of the timbers recording several technological and wood anatomical aspects. This assemblage had been reduced to 39 timbers by 2002 when emergency recording of the remaining material was commissioned by English Heritage ahead of the planned demolition of the Passmore Edwards Museum stores. Since the late 1980s the timbers had been kept in wet storage in tanks. In 2002 the English Heritage archaeological conservation team accepted the assemblage and carried out the conservation of the material from 2010 to 2013.

Previous interim reports do not present, analyse or compare many details of the woodwork as they were produced before the material was fully recorded. This report aims to provide; basic information on the origins of the conserved material; its place as a sub-sample of a larger assemblage; and, its character and wider inferences that can be drawn from it. This report also outlines the history of the assemblage recording and sampling methodologies as well as the conservation methodology and results.

The archaeological woodwork assessment is based on examination and recording work of the sub-sample of timbers. A number of documents were consulted during the production of the report including plans (published and unpublished ones kept with the site archive), a list of timber drawings, notes made by R Darrah, and the unpublished tree-ring study by I Tyers (including useful schematic cross sections of the sampled items; Tyers 1989). Detailed measured timber drawings of the key woodwork from the Barking Abbey assemblage discussed below are held with the site archive. The photographs used here were taken by A Middleton and the explanatory sketches were prepared for this report by J Dobie from drafts supplied by D Goodburn.

EXCAVATION SUMMARY

Barking Abbey is documented as being founded as early as AD 666 as a joint nun and monk house by Erkenwald, whose sister became the first Abbess (MacGowan 1987, 35). The site lies on the edge of the Thames estuary flood plain, just east of the canalised river Roding which leads into the tidal Barking Creek towards the south west. The site lay close to the main route for traders going to and from the newly established international port of Lundenwic in the Strand area of central London (Malcolm *et al* 2003). It became one of the wealthiest abbeys in the land but was eventually demolished during the Dissolution

in the 16th century. In 1985-6 the Passmore Edwards Museum (later Newham Museum Services) excavation team lead by M Stone and K MacGowan carried out excavations prior to redevelopment of the site (MacGowan 1987).

As the site was low lying, just above the Thames Estuary flood plain, historic woodwork might have been expected to have survived. This was the case in cut features including a series of Saxon wells, a large, timber lined channel and one post hole base. The timber lined channel was clearly built and rebuilt in several phases and has been interpreted as a channel for carrying water for milling purposes, so that it is referred to as 'the leat' (Fig 1). The site was located close to a typical point for a mill that may have used river water and possibly tidal creek water. Further study of the topography and levels recorded on the site might clarify this point, bearing in mind middle-Saxon high water levels in this part of the Thames estuary only rarely seem to have reached much over +1.7m OD (Goodburn and Davis 2010). The 'leat' channel ran roughly parallel with the main Roding channel a short distance to the west, a typical position for such a leat.

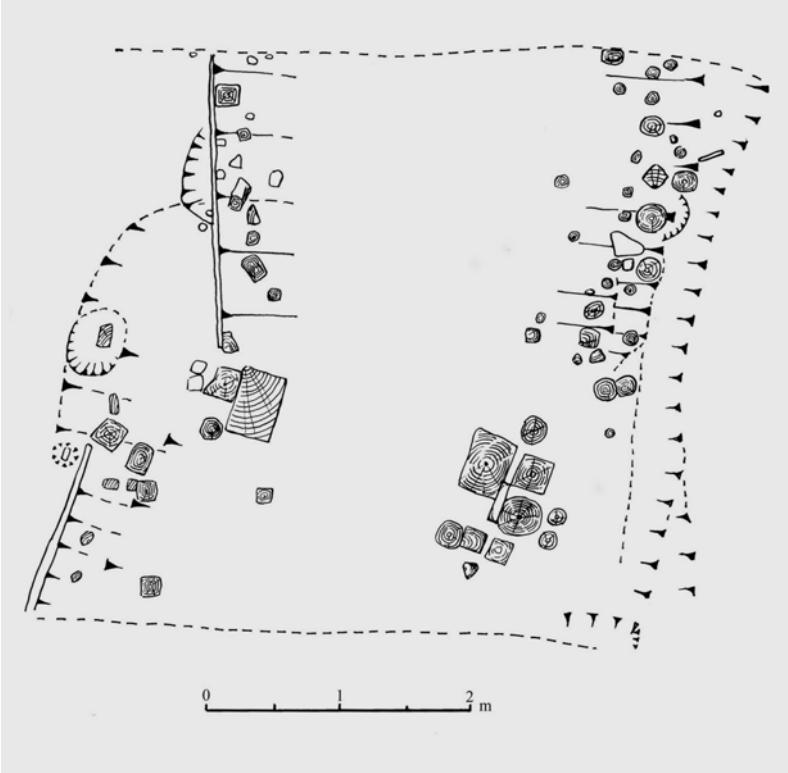


Figure 1: Plan of the leat

It was immediately clear to the excavators that the range of woodwork found included some well preserved material and reused timbers of curious form. A large selection of the timbers were carefully exposed, lifted and taken to the Passmore Edwards Museum stores where they were cleaned, examined, partially recorded and tree-ring sampling took place (before drawing or extensive photography, *see* below). In the late 1980s woodwork specialist R Darrah visited the Museum stores and examined the 97 lifted timbers and pieces of roundwood. Darrah made preliminary notes which are held in the

site archive and highlighted the need for a drawn record of the material (Darrah 1989). In 1996 another small interim report was produced providing a wider overview of the project and archaeological findings such as evidence for glass working (MacGowan 1996).

RANGE AND QUANTITY OF WOODWORK

Timber structures

In the north-west part of the excavation a 3-4m wide channel was found running roughly north-south, parallel with the river Roding, A *c*5m wide section was excavated across this channel and traces of timber linings were found on each side comprising lines of stakes and larger piles, some round and some hewn to roughly rectangular cross sections. Sections of planks were also found set on-edge, wedged behind lines of stakes and piles. In the middle section of the channel it appeared to narrow down and the piles were larger (Fig 1). This arrangement may have been a relict of a bridge or possibly some form of sluice. The excavator suggested that the leat would have been *c*1m deep. The 2002 recording identified all the timbers from this feature as oak. Oak is easily recognised by its macroscopic features such as aggregate rays, blue black heartwood, strongly ring porous structure and clear heartwood sapwood distinction.

The other sources of surviving timbers were three wells, with possibly a fourth one. Fortunately, the sampled timbers are listed clearly by structure of origin in the tree-ring study which has been relied on here (Tyers 1989). In well 2 the lining was rebuilt and made of several phases of corner uprights and planks on edge, with some form of raft at the base. Two phases of timber linings were found in well 3; the first made of a reused plank box and the second made of stakes retaining planking on edge. The planked box frame was jointed at the corners with wedged tusk tenons and each plank had a series of three arched cuts in the lower edges as found (*eg* timbers [3394] and [3396]). A decayed bucket stave was also found in this well (MacGowan 1987). Only a small number of decayed oak beams survived at the corners of the partially exposed well 4.

Tree-ring dated phases

Table 1: Tree-ring dated phases of the leat

1st phase	Timbers with bark edge felling date of 705 AD with others that could fit that felling date.
2nd phase	Timbers with bark edge dates of 745, 748 and 768 AD.
3rd phase	Timbers without bark edges were found to have been felled during the end of the 8th to early 9th centuries AD.

94 of the timbers were assessed for tree-ring study and samples from 43 were considered viable and were measured (Tyers 1989). Enough dating information was obtained that the dates for the timber structures can be summarised.

As the plan (Fig 1) suggests the piles and boards of the leat were found to have been cut and erected over a prolonged period with phases of rebuilding. However, it was possible for Tyers to break this down into three broad phases (Table 1).

No sapwood was found on the samples from well 2 but the timbers were found to have been felled in the early 9th century.

Well 3 was found to have two phases of lining probably fairly widely separated in time although the 1st phase samples came from reused timbers. The first phase comprised a box frame (1st phase) and included timbers felled in 730 AD or soon after. The second phase, comprising the stake and plank lining, was less closely dated, due to lack of sapwood, to the early to mid-9th century.

The timbers of well 4 had too few annual rings for dating.

WOOD RECORDING AND SAMPLING METHODOLOGY

Recording methodology before 2002

During the excavation at Barking Abbey Industrial Estate the woodwork exposed was planned and photographed *in situ* and attributed individual numbers. The bulk of the timbers were then carefully lifted and protected from excessive desiccation and damage. Later some timbers were drawn but not following any pattern that could be understood or compared with other records. After some time R Darrah was able to examine 97 of the timbers found, make brief notes on the assemblage and request scale drawings of key material (Darrah 1989). The material was unfortunately sampled for tree-ring study (by sawing) before the individual timbers were drawn.

Recording methodology 2002

In early 2002 N Truckle, English Heritage (Greater London office) got notice of the planned demolition of the old Passmore Edwards Museum stores. It was realised that waterlogged early woodwork and some later medieval timber building remains were stored there and that they had not been fully recorded. An initial visit to the stores was carried out on 19 March 2002 to rapidly scan and assess the material. A substantial proportion was found to be in solid condition with fairly good tool mark survival despite vandalism on the site and the storage tanks being filled with oil contaminated water. It was

clear that the waterlogged material required a more detailed assessment to inform selection, recording and possibly conservation.

The site archives were checked to assess the records of the woodwork that had already been made. Although notes made by R Darrah on aspects of the woodwork evidence were found, no coherent scale drawings existed, despite his clear requests. The archive also contained a tree-ring study which included schematic cross section drawings of the samples (Tyers 1989). Both these sources were crucial for identifying the middle Saxon timbers in storage as no legible labels survived aside from some site code labels (BAI 85).

Funding for the salvage recording was limited and so had to be tightly targeted. The work was carried out by D Goodburn after discussions with B Sloane (then MOLA) and N Truckle. A total of 74 items of worked timber or roundwood from the BAI 85 site were re-washed and visually examined. Many of these elements were fragments that could be easily refitted to make 39 more complete timbers. Once all the material had been examined the jointed timbers and a selection of the less elaborately worked pointed elements, (totalling 25 items) were drawn to scale. Each drawing was annotated with details such as species group, tool marks and jointing, details broadly equivalent to those noted on Museum of London proforma 'Timber sheets'. When the timbers were drawn they were also photographed (by E Baker, MoLA) so the record was broadly commensurate with what is outlined in the English Heritage *Guidance on Waterlogged Wood* 3rd edition (Brunning and Watson 2010)[1].

Sampling methodology 2002

After discussions with B Sloane, MoL conservators and other staff at English Heritage, the following criteria were used to separate out a sub-sample of the material to be kept for conservation:

- solidity
- preservation of surface details
- the existence of joints
- other traces indicating more complicated uses
- features that could also shed light on the nature of the trees and 'tree-land' accessible to the woodworkers
- other items which were not quite so well preserved but were interesting reused timbers and had clear joints and some potential for future display

[1] It is good practice to complete a wood record sheet for wooden remains from excavations before any other steps are taken, such as sampling for dendrochronology or conservation. These form the first record and should be included in the site archive. An examples of a wood record sheet can be found in Brunning and Watson (2010, p 12-13).

Very decayed and eroded material was not selected for retention and was discarded. A total of 20 timbers were selected (c20% of the total original excavated items), packaged in bubble wrap and passed to the English Heritage laboratory for conservation (Table 2).

All the timbers retained are of one of the native oaks or their hybrids (identified visually and confirmed by the tree-ring study). The timbers were from the following features and are described in more detail below:

- well 3 (1st and 2nd phase)
- well 4
- leat (1st, 2nd and 3rd phase)
- a miscellaneous stake

No timbers from well 2 were retained.

Table 2: Timbers selected for conservation

Small find number	Number of pieces
2855.A	1
2855.B	1
3179	1
3255	1
3344	1
3354	1
3371	1
3393	1
3394	4
3395	3
3396	8
3397	6
3679	1
3681	1
3757	1
3772	1
3773	1
3818	1
BAI85.2	1
leat plank	1

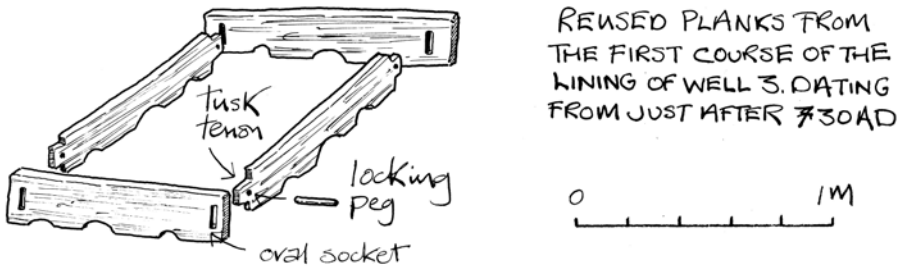


Figure 2: Re-used planks, well 3, 1st phase (drawn by J Dobie from drafts supplied by D Goodburn)

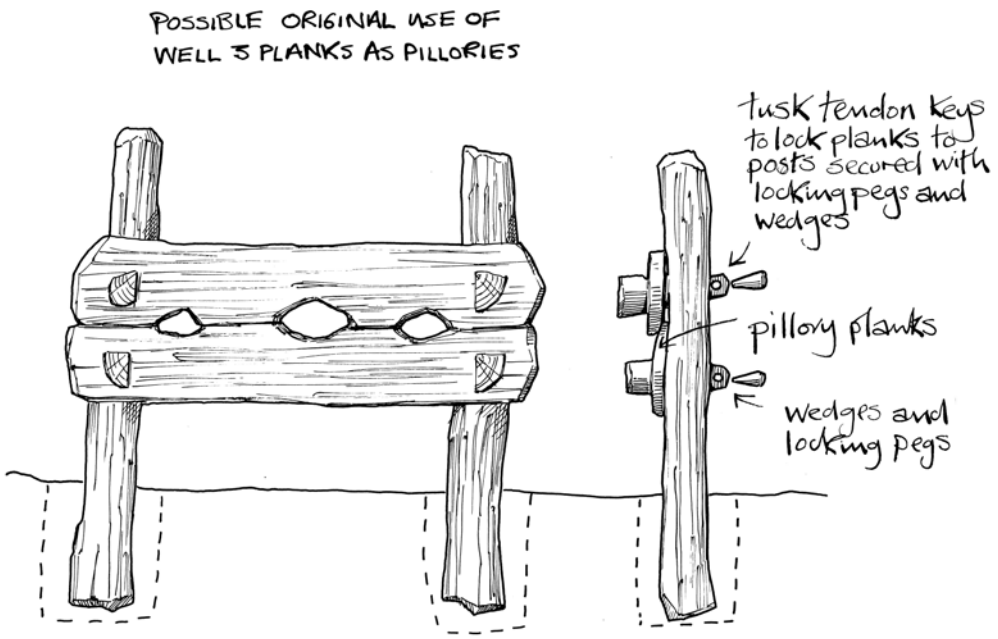


Figure 3: Possible original use as pillory planks of timbers from well 3, 1st phase (drawn by J Dobie from drafts supplied by D Goodburn)

Figure 4: Timber 3394 after conservation

Figure 5: Timber3395 after conservation

Figure 6: Timber 3396 after conservation

Figure 7: Timber 3397 after conservation

Woodwork from well 3, 1st phase

In summary these timbers were jointed to make a box frame lining (Fig 2), recognised as reused from a unique pair of pillories (Fig 3).

The basal course of the 1st phase of this well, dating to shortly after 730 AD, included four very distinctive planks (3394, 3395, 3396, 3397) all of which have been retained and tree-ring sampled. The slicing for tree-ring measuring seems to have removed small amounts of material but exactly how much is uncertain. All the planks had a similar general unique feature of three axe cut arched areas cut out of one edge with the central one being larger (Figs 4-7). These cut outs were up to 250mm wide and up to 130mm deep. This strange and unparalleled feature has been interpreted as evidence of their origin in two pairs of opposed pillory boards. Pillories are identified as different from 'stocks' the latter being fitted with two arches for legs only. The central arch appears to have been used to clamp the neck of the miscreant by sliding opposed boards close together and locking them in place (Fig 3). Toward the ends of two of the planks (3394, 3396) oval mortice-like holes or 'socket joints' were found (Figs 4 and 6) which were cut to accommodate tusk tenons, axe cut, on the ends of the other pair of planks (3395, 3397) (Figs 5 and 7). These slightly tapering tusk tenons had also been bored for tapering locking pegs the holes being *c*26-27mm in diameter. The pegs were not retained. Very interestingly socket jointed planks 3394 and 3396 had the clear shape of part of a relict socket joint on one end. This shows that they had a new socket joint cut further in towards the board centres for reuse to enable the well box frame to be made. The length of the tusk tenoned timbers is just under the gap between the relict socket and that at the other end, just over *c*1.5m. This strongly suggests that originally all the planks were roughly the same length with the tusk tenoned planks (3395 and 3397) cross cut for reuse with axes, through socket joints similar to those in the other pair of planks. In the reconstruction diagram the proportions include the length removed for reuse giving a total original length of approximately 1.8 to 1.85m (Fig 3). This suggestion also has the effect of evening up the proportions in relation to the placing of the arched cut outs. The original socket joints must have been used to secure the pillory planks to a pair of uprights, probably using a tusk tenoned key timber at each end. It is likely that they were also locked with a tapered pin and possibly wedges.

These planks were variously preserved with clear tool marks in places and some surviving rot prone sapwood on plank 3396; indications that the timbers were not used for a prolonged period before they were re-cut for secondary use in the well lining. Close observation of the form of the socket joints and adjacent tool cut marks show that they were cut out by making auger holes at each end of the oval sockets and then using a swung edge tool, such as a narrow 'strap adze' or axe with a blade *c*50mm wide and trimmed with a chisel having a blade *c*25mm wide. Interestingly the auger hole diameter was clearly different in these two planks; *c*34mm in plank 3394 and 38mm in plank 3396.

This indicates the use of two different augers perhaps implying that the pillory planks were made by two different treewrights. The relict socket joint bore clear marks of a rounded axe blade *c*65mm wide, probably a Mortimer Wheeler type 1, narrow bladed felling axe (Wheeler 1927, 22). Similar tool mark evidence around socket joints has been found in late Saxon work from central London (Goodburn 1992, 126).

All of the planks were cleft and then trimmed with axes to moderately regular and smooth planks, but the details of conversion evidence varied as described below. Plank 3394 survived *c*1.67m long by 315mm wide by 60mm thick[2]. It had been hewn from a 1/32nd radially cleft section (Fig 8) from a large, straight grained log a minimum of *c*0.8m diameter at the mid length to the outside of the bark. The parent tree was a minimum of 250 years old and had narrow rings typical of oak growing in wildwood type conditions. One dead knot could be seen suggesting that it had come from a log cut from above the basal area of the parent tree.

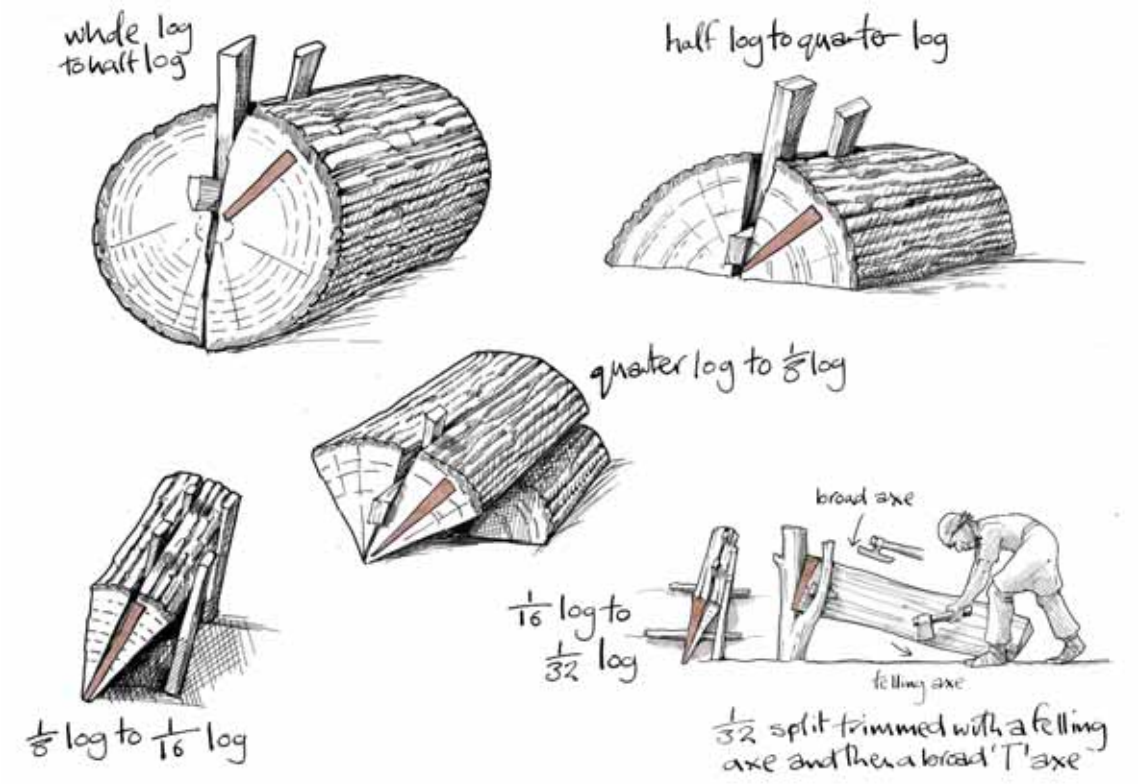


Figure 8: Diagram showing radial cleaving of planks, as used in wells and leat. (drawn by J Dobie from drafts supplied by D Goodburn)

Plank 3395 was also converted as in the above example but was a little eroded so no surface tool marks were seen by 2002. It survived *c*1.44m long by 320mm wide by 45mm thick. It was also cleft from a similar sized parent log cut from a similar sized parent oak.

[2] The dimensions are maximums

The tree-ring study shows that the parent tree was very slow grown and had 275 annual rings to the boundary of the heartwood (Tyers 1989). Adding a minimum of 10 sapwood rings, and a few missing from the feather edge near the heart, indicates that the parent tree was around 300 years old. It was clearly also of wildwood type origin.

Plank 3397 was also similar in its conversion and parent tree characteristics and survived *c*1.51m long by 305mm wide and 40mm thick. Several partial axe 'stop marks' (negatives of the blade edges, also known as 'jam curves') survived on the face that lay outside the well even though it had only been minimally trimmed. These marks were noticeably curved and survived up to 120mm wide. The limited trimming of this plank was shown by the adherence of some loose slivers of timber, such as are often found on the faces of fresh cleft timbers.

Plank 3396 was somewhat different to the other planks in that it was cleft tangentially and hewn to shape or hewn from a cleft half log leaving a little sapwood on the edges. The parent log must have been *c*0.45–0.5m in diameter to the outside of the bark. The parent tree must have been *c*120–140 years old, as shown by the tree-ring study. The outside face of the plank was rather well preserved with very clear axe stop marks surviving towards one end. These marks had been left by two different axes, a narrow bladed felling type axe for the first stages of trimming followed by a broad bladed axe with a nearly straight edge over 150mm wide. The former was probably of the Wheeler type 1 form whilst the broad stop marks were probably left by a 'T' form broad axe. Similar evidence of the use of two distinct axes has been widely recorded on a number of late Saxon and Norman period sites in London and also at the middle Saxon mill at Ebbsfleet where the use of very large T axes with blades up to 300mm wide was recorded (Goodburn 1999; 2000; 2011, 344). This is quite distinct from typical Roman practice where the use of axes with blades over 150mm wide was very rare.

Timber 3393 was found in the second course of edge laid timber lining elements found in situ in well 3. It was hewn to a fairly accurate boxed half rectangular section and survived for a length of 1.45m by 160mm wide and 90mm thick. One end had its original narrow bladed axe cut marks up to 60mm wide whilst the other end had been sawn through for tree-ring sampling in the 1980s (Fig 9). The parent oak was *c*120mm in diameter outside the bark and was cut from a young fairly fast growing tree with many side branches *c*40 to 50 years old. Such timber is typical of that coming from a small standard tree in managed woodland or even overgrown coppiced oak stems. Unlike the wildwood type oaks used for the three radially cleft planks of the 1st course of the well, trees of these two types can still be found in ancient managed 'coppice with standard woodland' in Greater London today (*eg* in Barnet Woods, Bromley). This reused timber had a relict sloping recess or 'scutch' joint cut in one face which would have been used for the upper end of a raking shore timber. It also had a 25mm peg hole through the wider face. Both these features and the proportions of the timber suggest that it was originally a post in a building wall or revetment of some type.

Figure 9: Timber 3393 after conservation

Woodwork from well 3, 2nd phase

Well 3 clearly fell out of use and much later the partly in-filled hollow over the earlier well was dugout and relined with timbers tree-ring dated to the early to mid 9th century (Tyers 1989). There were some problems identifying elements of this feature due to the lack of surviving legible labels and the cutting of samples carried out in the 1980s. However, planks 2855.A and 2855.B derive from somewhere in this phase of the well and were both partly decayed (Figs 10 and 11). Plank 2855.A survived *c*0.45m long by 430mm wide and 70mm thick and was probably hewn from a 1/16th cleft section. It had 256 rings but missed sapwood indicating an origin in a parent oak *c*270 to 300 years old. The parent log must have been *c*1.1m in diameter. These characteristics are typical of oaks grown in tall, dark wildwood-type conditions. Plank 2855.B was generally very similar and had survived 0.44m long by 440mm wide and 70mm thick.

Figure 10: Timber 2855.A after conservation

Figure 11: Timber 2855.B after conservation

Figure 12: Timber 3179 after conservation

Stake 3179 was hewn to an irregular quadrilateral section after being tangentially cleft (ie split along the annual rings) from a radially cleft 1/8th section from a large log. Near the tip a small oval socket joint was found showing that it had been re-cut from a building type timber of some kind (Fig 12). One end was re-hewn to a rough point and had small partial axe marks as the tool could not bite deeply into the hard seasoned timber.

Woodwork from well 4

Small sections of two small, beam-like planks from the lining of well 4 have been conserved, timbers 3679 and 3681. Both had similar general characteristics having been roughly hewn from small, cleft half oak logs leaving much sapwood and bark (Figs 13 and 14). Each timber had the remains of simple, axe cut edge notches or 'laft' joints such as have been found in rectangular structures from later prehistory onward in northern Europe. Both pieces are identified as a simple "laftwork" lining (Fig 15). They had been cross-cut for sampling with a saw in the 1980s, leaving them rather short but they were only partially exposed during the excavation in any case.

Figure 13: Timber 3679 after conservation

Figure 14: Timber 3681 after conservation

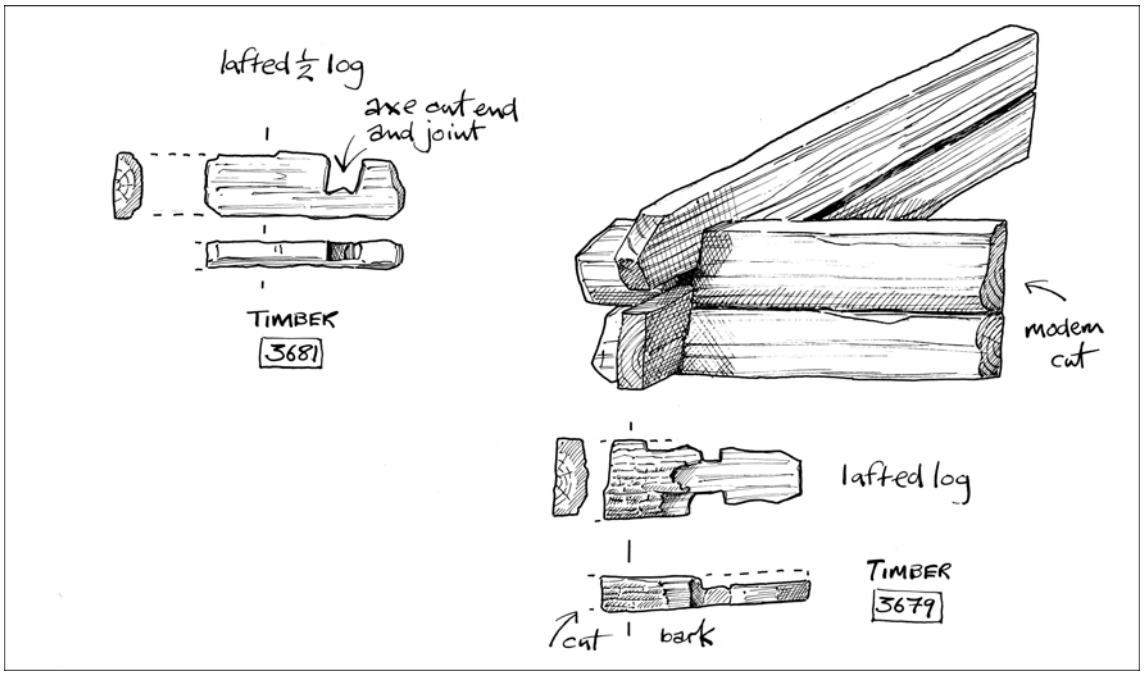


Figure 15: Diagram showing basic form of lafted well lining (drawn by J Dobie from drafts supplied by D Goodburn)

Timber 3679 survived 0.43m long by 140mm wide and *c*50mm thick with waney edges from the surface of the parent log under the bark. The parent log must have been c. 170mm in diameter and cut from a parent tree *c*30 years old, of medium growth rate. It had a deep laft cut in only one edge suggesting that it was probably part of the basal course of the lining. Timber 3681 survived 0.44m wide by 170mm wide and 80mm thick. It had notches on both edges typical of log 'cabin type' construction or 'laft work' and had only been roughly hewn to a sub-rectangular shape leaving some bark. The parent log was slightly larger than that used for timber 3679 but had come from a similar form of modest sized oak. This general approach to making a square structure such as a well lining, revetment, bridge caisson or building wall is also known from later Saxon and Norman period work in London and elsewhere (Goodburn 2001, 77). However, the timber used has normally been found to have been rather larger with a much lower proportion of sapwood. The sapwood rich and small size of the rough hewn half logs used in this well lining indicate a modest outlay in construction materials and labour compared with that employed in the other wells on the site.

Woodwork from the timber lined leat channel, 1st phase (*c*705 AD)

Two planks appear to have survived from the timber lined leat (Fig 1), although there are some difficulties in identifying their original positions due to a lack of clear labelling and cutting down for sampling. The largest section 'leat plank' was re-sawn at both ends and survived 1.45m long by 220mm wide and 55mm thick (Fig 16). The plank had been hewn from a radially cleft 1/32nd section leaving a little sapwood. The annual rings were fairly

narrow and taking account of missing material, the parent log must have been *c*0.75m in diameter and from a parent tree *c*200 years old. A shorter section of radially cleft plank also survived from the leat lining and had the label 'BAI85.2' (Fig 17). This was also sawn across at one end, the other retained marks of its original axe cross cutting. This plank survived 0.66m long by 250mm wide by 60mm thick. Erosion had removed traces of clear tool marks but it was obviously the case that they had been quite carefully hewn to smooth, fairly regular rectangular cross sections.

Figure 16: Leat plank after conservation

Figure 17: Timber BAI85.2 after conservation

Woodwork from the timber lined leat channel, 2nd phase (*c*745-768 AD)

Pile 3773 was one of the largest found in the leat lining structure. With a last heartwood ring dating to 728 AD, it must have been felled in the middle of the 8th century AD. It had been hewn to an atypical, almost square, cross section of 200 by 180mm and survived 0.89m long from tip to the upper end cut in the 1980s (Fig 18). The sides of the pile bore clear, incomplete stop marks 210mm wide indicating smoothing with a broad axe with a slightly curved blade over 230mm wide. These marks must have been left by a 'T' axe. The multi-facetted tip bore the incomplete marks of a narrow bladed axe over 45mm wide, probably of the Mortimer Wheeler type 1 form. The timber must have been cut from a parent log *c*0.38 m in diameter and *c*90 to 120 years old of medium to fast growth.

Figure 18: Timber 3773 after conservation

Pile 3818 only survived as a multi-facetted nearly round tip 0.63m long and 190mm in diameter (Fig 19). It had complete axe marks *c*65mm wide; typical of the use of a general purpose woodsman tool (*ie* Mortimer Wheeler type 1) but there were also traces of incomplete broader axe marks 80mm wide. This patterning of marks shows that there was a phase of secondary trimming just before it was driven. The parent log used for this pile would have been *c*220mm in diameter and was very fast grown. The parent tree was only 25 years old at felling and may well have grown as a singled out stem on a coppiced stool which tends to produce very rapid growth. An alternative origin would be in an open-grown pasture tree in very fertile land.

Figure 19: Timber 3818 after conservation

Woodwork from the timber lined leat channel, 3rd phase (late 8th to early 9th century)

Pile 3371 was of a quite different form to those described above. It survived as a tip only and had been hewn from a radially cleft 1/16th section (Fig 20). It survived 0.45m long by 260mm wide by 75mm thick and bore an incomplete broad axe mark 140mm wide near the tip. With a last heartwood ring of 774 AD it must have been felled *c*785 to *c*825 AD.

Figure 20: Timber 3371 after conservation

Pile timber 3757 was considered possibly of this phase, though its close similarity to pile 3818 suggests that it may have dated to the middle phase of leat lining. It survives as a multi-facetted tip *c*230mm in diameter and 0.93m to the end sawn for sampling. The tip bore the marks of quite rough axe hewing with an axe having a blade at least 60mm wide (Fig 21). The parent log was a little knotty and very fast grown having been cut from a parent tree approximately 30 years old.

Figure 21: Timber 3757 after conservation

Miscellaneous stake 3344

The timber 3344 was clearly from the Barking site but lacking a label and very distinctive character could not be closely provenanced, although it was broadly similar to other stakes from well 3, 2nd phase. The stake had a broken top end and axe cut tip with partial axe marks and survived 0.38m long by 80 x 70mm. It had been tangentially cleft from a radial section from a large oak.

ARCHAEOLOGICAL WOODWORK SPECIALIST'S DISCUSSION

Some wider conclusions for the middle-Saxon period in the region

The material covered here is a limited sample but it still sheds light on aspects of the occupation of the site and also wider issues such as regional woodlands and technology of 'treewrights' of the period. The woodwork also seems to shed light on the infrastructure of social control and Christianity's role in that in middle Saxon Essex.

More evidence of treewright's technology, tools and techniques

It should be clear from the description, illustrations and discussion presented above that the assemblage from Barking Abbey displays many features typical of treewrighting. These include the widespread use of cleft oak timbers and boards and joints such as the pegged tusk tenons in the reused pillory boards of the first phase of well 3, and laft joints in well four. Traces of the use of typical very broad bladed axes, probably of the 'T' axe form alongside narrow bladed felling axes, were also recorded on the surfaces of several timbers such as pillory plank 3396. In general we might suggest that the reused pillory planks are some of the most important material evidence of treewrights work of middle Saxon date excavated in England as a whole. The only rival currently in the south-east region is the assemblage of woodwork from the water mill at Ebbsfleet which have not yet been selected for conservation (Goodburn 2011, 336).

However, we might note that some of the piles used in parts of the timber-lined leat channel were found to have been rather larger and squarer than those used at the Ebbsfleet mill. That site was only a short distance to the south-east on the Kent side of the estuary and was less than 15 years earlier (Goodburn 2011). The use of heavier piles in some phases implies more invested labour and materials and may reflect periods of greater wealth at the Barking site.

Woodmanship summary

In his seminal early work Rackham defined fundamental terms for use in research into peoples interaction with trees for raw materials, food and fuels in the past (Rackham 1976). Practices such as coppicing and pollarding were shown to have great antiquity and together these practices were termed 'woodmanship' and land on which trees grew from hedges to wildwood etc was called 'treeland' ('Forestry' being a rather modern set of practices). He suggested that our period was part of the 'Dark Ages of woodmanship' before details of historic records and maps could be used to reconstruct ancient trees, types of treeland and woodmanship practices. Thus, it behoves any investigator of waterlogged woodwork of this period to distil evidence bearing on the reconstruction of the woodmanship practices and treeland which lay behind it. The character of this

assemblage, when visually assessed from this point of view, falls into two main groups, oak timber with narrow annual rings (under 2mm wide) and oak with medium to wide rings.

The wider rings, often of trees felled when young (mostly less than 100 years old) are typical of material coming from intensively managed moderately open woodland, whilst the narrow ringed material was typically produced in tall, dark woodland undergoing little regular felling *ie* wildwood-type woodland. This division of the material on visual grounds was also clear and further refined during the extensive tree-ring study of a larger sample of the material (Tyers 1989). In that work Tyers was also able to show that timber coming from large, slow grown oaks between 200-300 years old was used alongside faster grown oaks generally less than 100 years old (Fig 22). The large wildwood parent trees used for the radially cleft pillory planks for example were a minimum of 0.8m in diameter and those of the 2nd phase of well 3 were even larger at *c*1.1m in diameter. These contrasted with oaks only *c*0.2m in diameter coming from managed woodland. Tyers was also able to distinguish a subtly defined group with evidence of extremely narrow rings possibly as a result of disease associated with older age (Tyers 1989, 8).

Whilst this pattern of evidence of woodland or treeland types is broadly matched in late Saxon material from the London region; the Barking Abbey assemblage has far more wildwood-derived timber than found at the broadly contemporary site at Ebbsfleet a few miles away on the Kent side of the estuary (Goodburn 1992; 2007; 2011, 339). Presumably the Barking settlement was able to draw on larger blocks of dense woodland inland as well as managed woodland probably closer to the settlement. Alternatively the Abbey may have had preferred rights to a wider area of regional treeland. Clearly to reconstruct a fuller, sharper picture of the treeland forms and woodmanship practice in the vicinity of middle-Saxon Barking, other sources, such as material from regional sites of similar date, charcoal and pollen would also have to be considered but this is outside the scope of this closely targeted study.

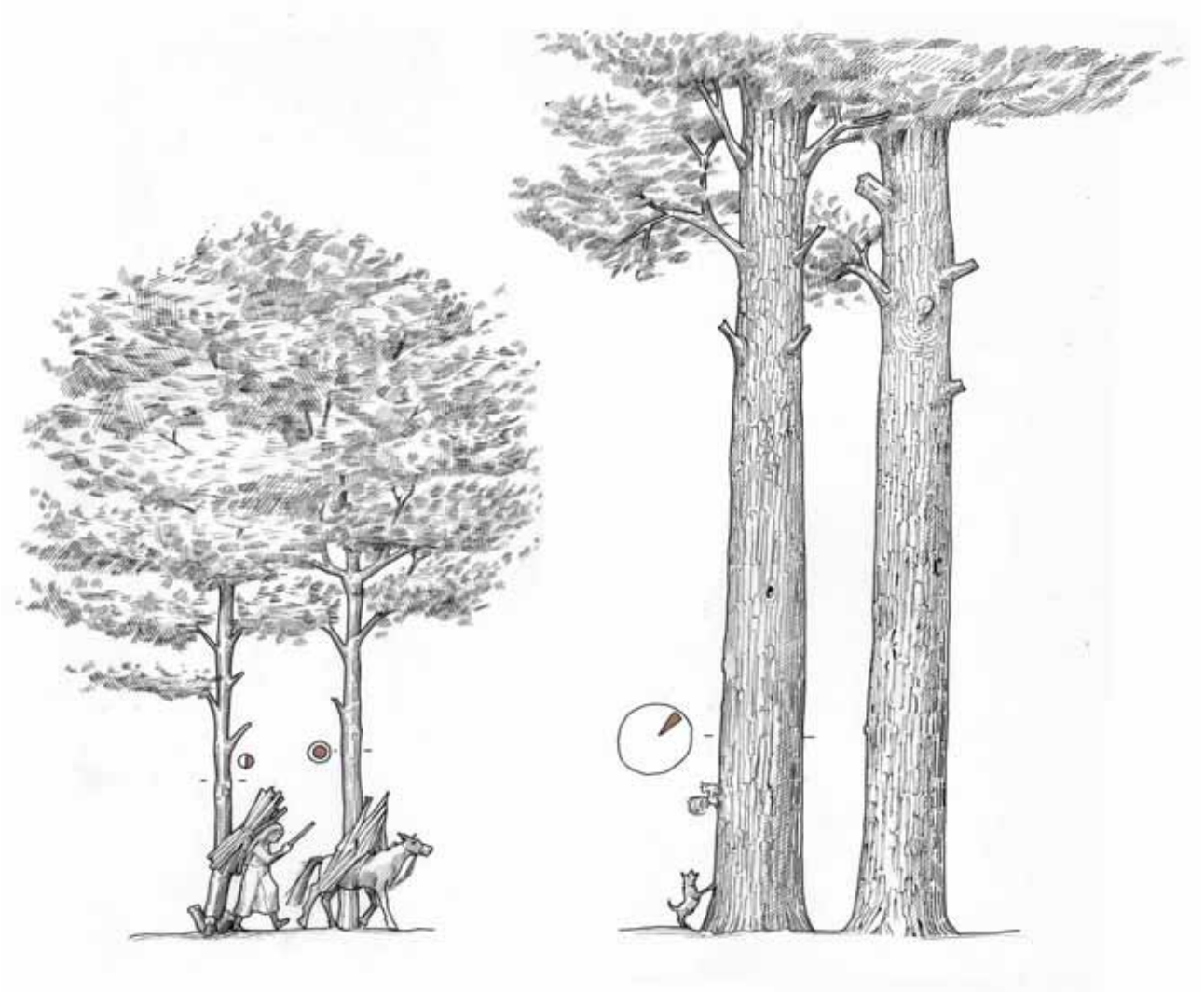


Figure 22: Hypothetical reconstruction of tree-scape (drawn by J Dobie from drafts supplied by D Goodburn)

CONSERVATION

The timbers were visually examined, cleaned and photographed before conservation. The tank, a scaffolding construction, was cleaned internally and set up inside one of the casemates of Fort Cumberland, Portsmouth in 2010.

Condition

The condition of the wood ranged from very soft to well preserved. All timbers showed some superficial infestation with mould. The maximum water content was established using wood samples from 11 out of 20 timbers.

Maximum water content (U_{max}) was calculated as described in Grattan 1987 (*see* formula below). Prior to weighing, samples were submerged in water under vacuum to establish the maximum water content.

$$U_{max} = \frac{\text{(waterlogged weight – oven dry weight)}}{\text{oven dry weight}} \times 100$$

The results are summarised in Table 3 and confirm the wide range of conditions present in the Barking Abbey material. It is noticeable that no sample falls into the class III (<185% water) wood classification system.

Table 3: Maximum water content

Small find number	Wet weight in g	Oven dry weight in g	Maximum water content U_{max} in %	Wood classification
2855.A	0.506	0.16	216	II (185-400% water)
2855.B	1.004	0.124	710	I (>400% water)
3255	1.1	0.141	680	I
3354	1.232	0.249	395	II
3371	0.231	0.018	1183	I
3393	3.6907	0.778	374	II
3394	0.318	Sample could not be retrieved		
3395	0.29	0.068	326	II
3396	0.72	0.1	620	I
3397	1.07	0.174	515	I
3679	2.032	0.243	732	I

Impregnation and freeze drying treatment

A two-stage polyethylene glycol (PEG) treatment was proposed (Table 4) in order to cater for the different degradation stages of the wood. All timbers were placed in the tank

in February 2010 and PEG solution was added. Using the BRIX measurements, the solution had to be adjusted and stirred using a submergible pump to achieve even distribution and the required PEG concentration.

Table 4: Conservation plan

Stage	PEG	Duration
1.a	10% PEG 400	4 months
1.b	20% PEG 400	4 months
1.c	30% PEG 400	4 months
2	30% PEG 4000	5 months

The concentration and the pH of the treatment solution were tested on monthly basis. The PEG concentration was measured according to BRIX[3] (Table 5).

Table 5: PEG concentrations and BRIX equivalents

Solution	Percentage %	BRIX Scale ºBx
Tap Water	100	0
PEG400	10	10
	20	17
	30	28
	40	36
	100	>50 (off the scale)
PEG4000	10	10.5
	20	19
	30	26.5

According to Table 4 the PEG400 solution was increased in increments. After 12 months the tank was emptied and the solution replaced with 30% PEG4000. During the impregnation stage the solution was periodically agitated. Concentration and pH were checked monthly.

The first timbers were removed for freeze drying in June 2011. Freeze drying was undertaken in a Birchover machine (2m length x 0.75m diameter chamber). The smallest timbers were dried first, followed by larger ones, when space became available in the freeze dryer. Freeze drying involved removing excess PEG from the wood surface by dabbing with tissue paper, wrapping timbers in cling film and pre-freezing in a domestic chest freezer at approximately -25 to -30ºC. After 2 weeks timbers were unwrapped and placed in the vacuum chamber of the freeze dryer at -30ºC.

The end point of the freeze drying process was determined by weighing (*see* Appendix). Small timbers were weighed weekly. Large timbers were weighed monthly. Once the

[3] BRIX measures the sugar content of an aqueous solution. The equivalent value for PEG concentrations on the BRIX scale can be established by using standard solutions.

formation of ice in the condenser chamber slowed down weighing of large timbers was increased to fortnightly or weekly.

After freeze drying, excess PEG was removed mechanically with brushes or damp swaps. All timbers had a pleasing surface finish after conservation. Cracking was minimal.

CONCLUSION

The survival of reused pillory planks in well 3 dating to 730 AD or just after, is a very rare survival of the technology which was employed to maintain social order in the vicinity of, or at Barking Abbey itself. It appears that the more recent church was also still sometimes involved in the use of similar public wooden restraints as can be seen in the pair of stocks outside the village church of Ottery St Mary, East Devon for example (seen by Damian Goodburn in 2002). It is tempting to see the double pillory evidenced on this site as traces of how the new church maintained authority on local folk some of whom had only taken on the religion within the memory of oldest residents. These speculations are, however, beyond the expertise of this author. However, we might fairly describe woodwork such as the reused pillory planks found on this site as some of the most evocative middle Saxon woodwork yet found in England.

BIBLIOGRAPHY

Brunning, R and Watson, J 2010 *Waterlogged Wood*: G*uidelines on the recording, sampling, conservation and curation of waterlogged wood.* Swindon: English Heritage.

Darrah, R 1989 *Preliminary notes on the woodwork from Barking site BAI 85*. Unpublished

Goodburn, D 1992 'Woods and woodland: carpenters and carpentry', *in* Milne, G (ed) *Timber Building Techniques in London c. 900- 1400*. London and Middlesex Archaeology Society, Special paper **No.15**, 106-131

Goodburn, D 1999 'The woodwork', *in* Hill, J and Woodger, A (eds) *Excavations at 72-75 Cheapside/ 83-93 Queen Street, City of London.* MoLAS Archaeology Studies Series **2**. London: Museum of London Archaeological Service

Goodburn, D 2000 'Wooden remains as an archaeological resource: some insights from the London wetlands', *in* Rippon, S (ed) *Estuarine Archaeology: the Severn and beyond*. Exeter: The Severn Estuary Levels Research Committee, 187-196

Goodburn, D 2001 'Timber studies' in Watson, B, Brigham, T and Dyson, T (eds) *London Bridge. 2000 years of a river crossing*. MoLAS Monograph **8**. London: Museum of London Archaeological Service

Goodburn, D 2002 *Barking Abbey Industrial Estate (BAI85), London Borough of Barking and Dagenham, Report on emergency timber recording of Saxon timbers.* Unpublished

Goodburn, D 2007 'Treewrighting and woodland management in the 11th and 12th centuries', *in* Bowsher, D, Dyson, T, Holder, N and Howell, I *The London Guildhall: An archaeological history of a neighbourhood, from early medieval to modern times*. MoLAS Monograph **36**. London: Museum of London Archaeological Service, 488-501

Goodburn, D and Davis, D 2010 'Two new tide mill finds of the 690's and 1190's and an up-date on archaeological evidence for changing medieval tidal levels', *in* Galloway, J (ed) *Tides and Floods: New research on London and the tidal Thames from the Middle Ages to the twentieth century.* Centre for Metropolitan History, Working Papers Series **4**, 1-14

Goodburn, D 2011 'Characteristics of the woodwork of the mill', *in* Andrews, P, Biddulph, E, Hardy, A and Brown, R *Settling the Ebbsfleet Valley: High Speed 1 Excavations at Springhead and Northfleet, Kent, the Late Iron Age, Roman, Saxon and Medieval Landscape , Volume 1 The sites*. Oxford: Oxford Wessex Archaeology 336-346

Grattan, D W 1987 'Waterlogged wood' *in* Pearson, C (ed) *Conservation of Marine Archaeological Objects*. Butterworths: London, 22-55

MacGowan, K 1987 'Saxon timber structures from the Barking Abbey excavations 1985-1986'. *Essex Archaeology and History* **22**, 35-38

MacGowan, K 1996 'Barking Abbey'. *Current Archaeology* **149**, 172-178

Malcolm, G Bowsher, D and Cowie, R 2003 *Middle-Saxon London, Excavations at the Royal Opera House 1989-99*. MoLAS Monograph **15**. London: Museum of London Archaeological Service

Rahtz, P and Meeson, R 1992 *An Anglo-Saxon Watermill at Tamworth*. CBA Research Report **83**. London: Council for British Archaeology

Rackham, O 1976 *Trees and Woodland in the British Landscape*. London: Phoenix Press

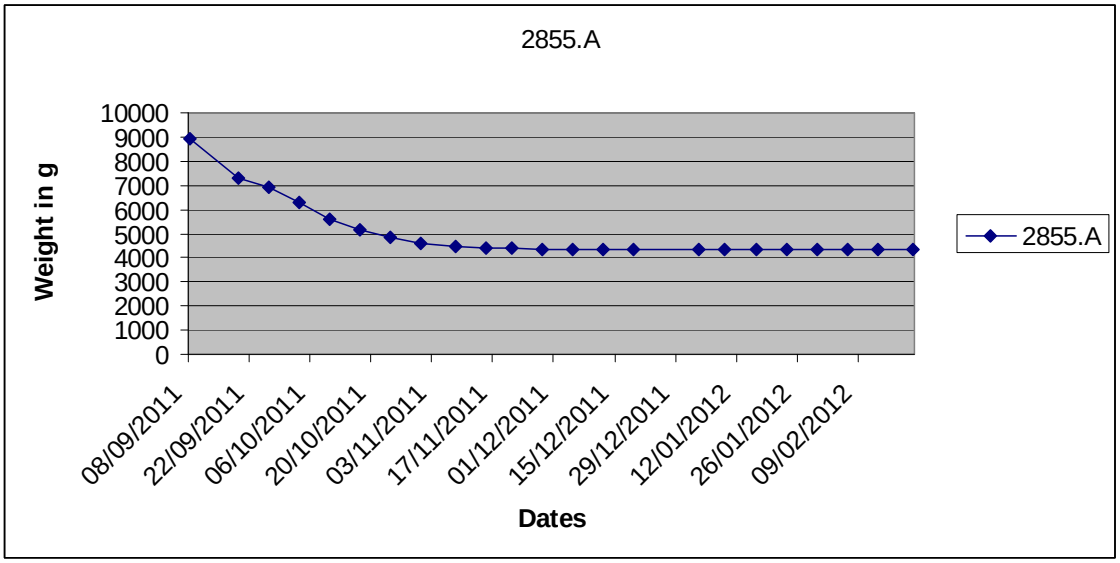
Tyers, I 1989 *Museum of London Environmental Department Dendrochronology Report* **1/88** Unpublished

Wheeler, M 1927 *London Museum Catalogues: No 1: London and the Vikings.* London: Museum of London

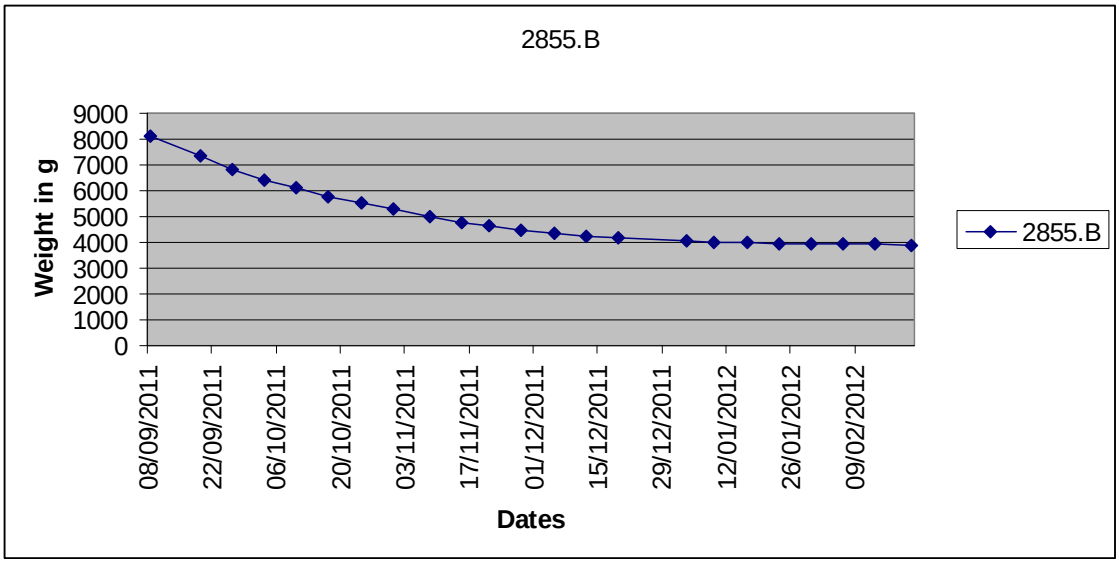
APPENDIX: FREEZE DRYING CURVES

Each graph presents the loss of water during freeze-drying and reaching equilibrium at ambient conditions.

BAI85 2855 A	
	
Before conservation	After conservation
Drying started:	08/09/2011
Drying finished:	21/02/2012
Initial weight:	8949.9g
Final weight:	4327.8g

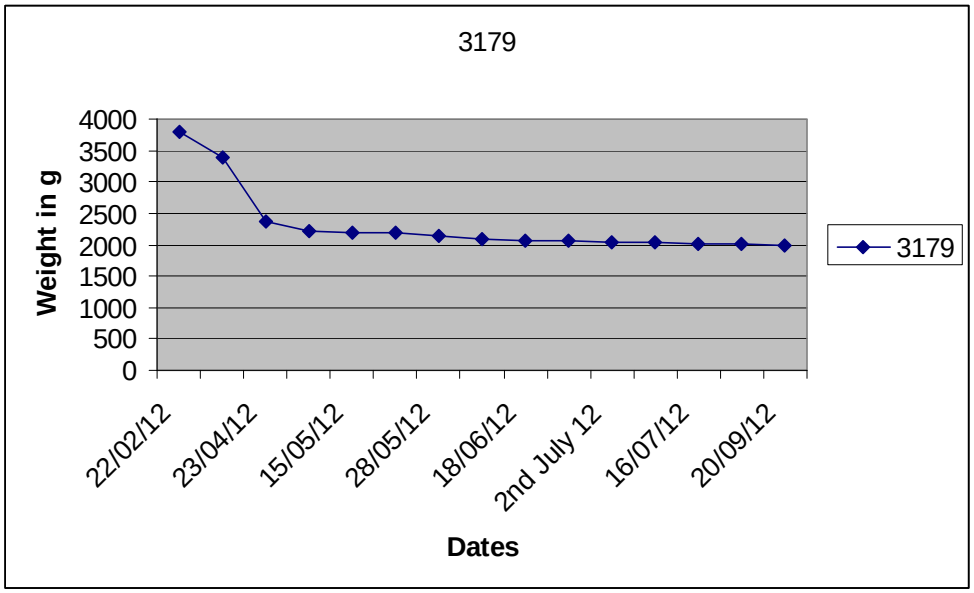


BAI85 2855 B	
	
Before conservation	After conservation
Drying started:	08/09/2011
Drying finished:	21/02/2012
Initial weight:	8119.1g
Final weight:	3911.6g



BAI85 3179

Before conservation	After conservation
Drying started:	22/02/2012
Drying finished:	20/09/2012
Initial weight:	3794.6g
Final weight:	1998.2g



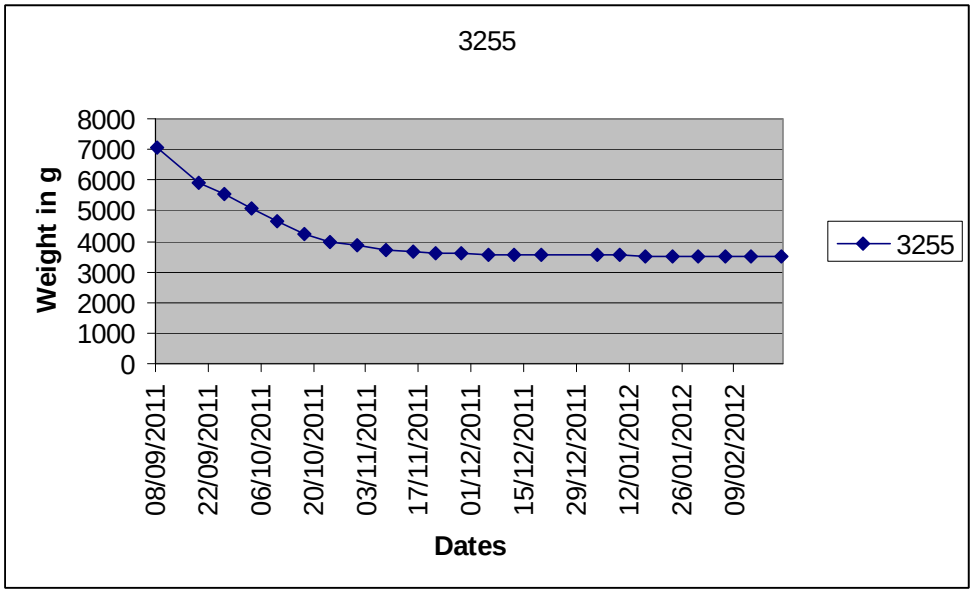
BAI85 3255

Before conservation

Before conservation

After conservation

Drying started:	08/09/2011
Drying finished:	21/02/2012
Initial weight:	7070.8
Final weight:	3515.8



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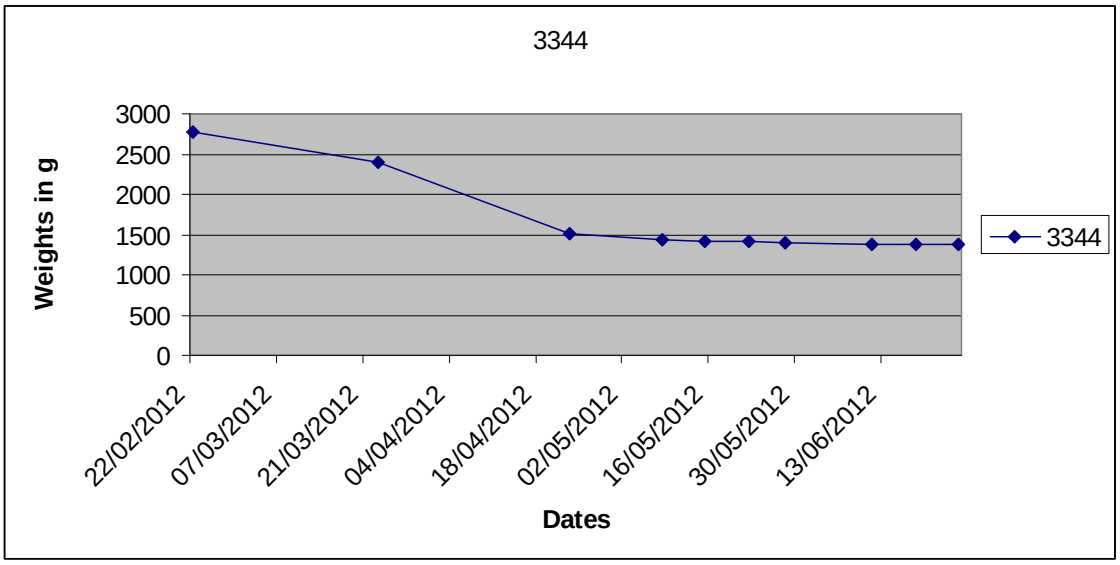
Before conservation	After conservation
Drying started:	22/02/2012
Drying finished:	25/06/2012
Initial weight:	2777.2g
Final weight:	1383.4g



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Before conservation	After conservation
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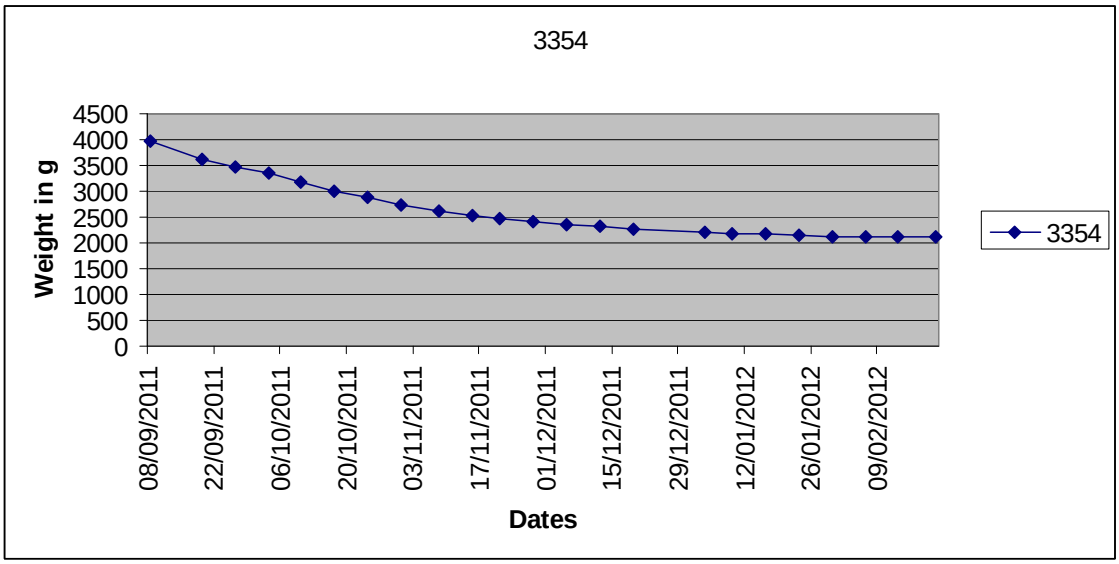
Drying finished:	21/02/2012
Initial weight:	3984g
Final weight:	2104.2g



BAI85 3371	
	
Before conservation	After conservation
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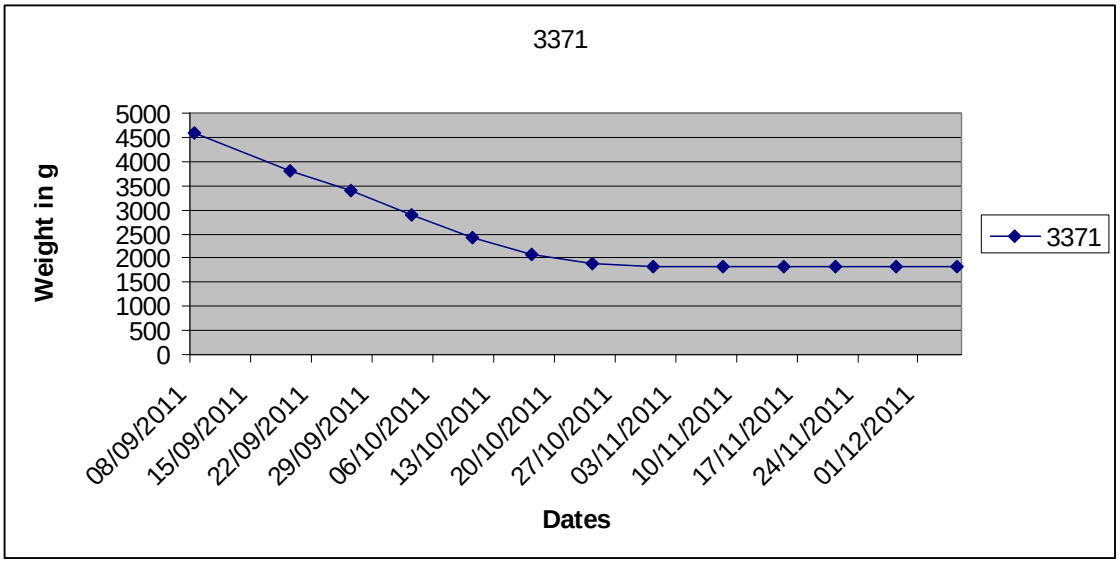
Drying finished:	05/12/2011
Initial weight:	4598g
Final weight:	1813.2g



BAI85 3393	
	
Before conservation	Before conservation
	
After conservation	
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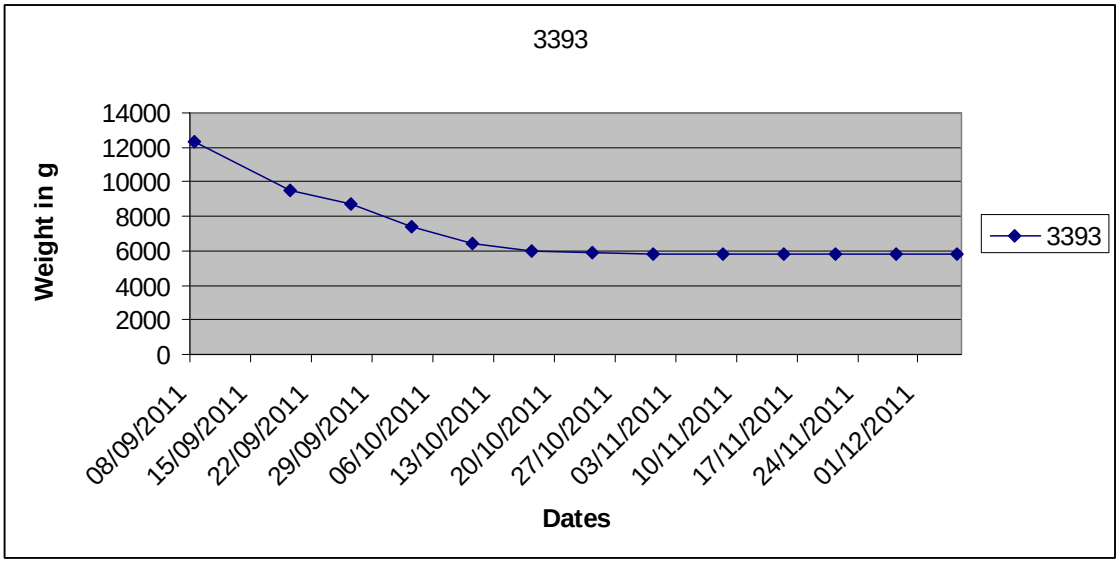
Drying finished:	05/12/2011
Initial weight:	12343g
Final weight:	5809.3g



BAI85 3394

Before conservation

Before conservation

Before conservation

After conservation

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Drying started:	08/09/2011	08/09/2011	08/09/2011	12/07/2011
Drying finished:	09/01/2012	09/01/2012	09/01/2012	15/08/2011
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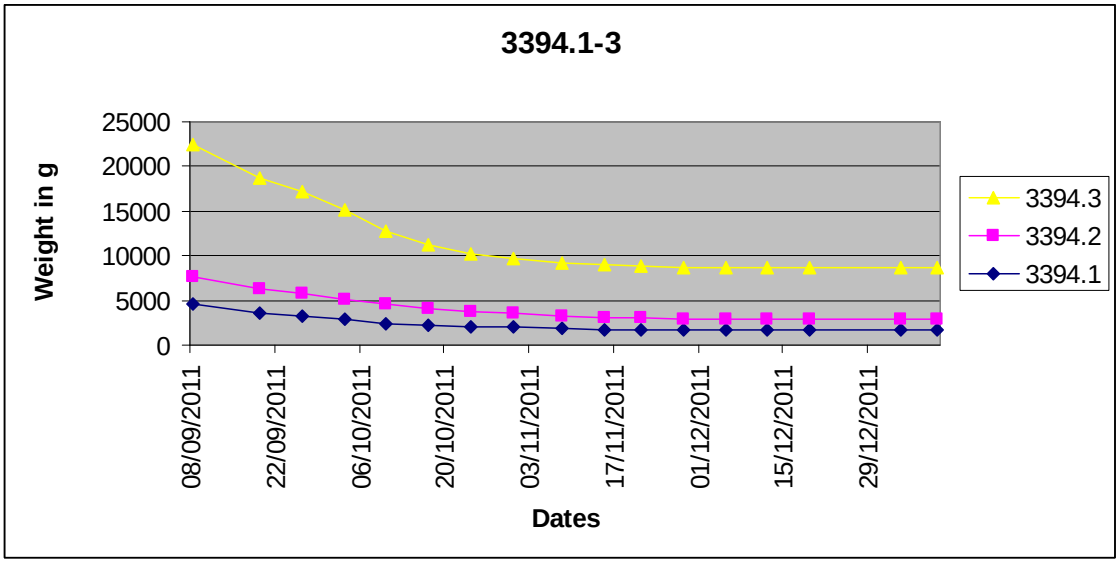
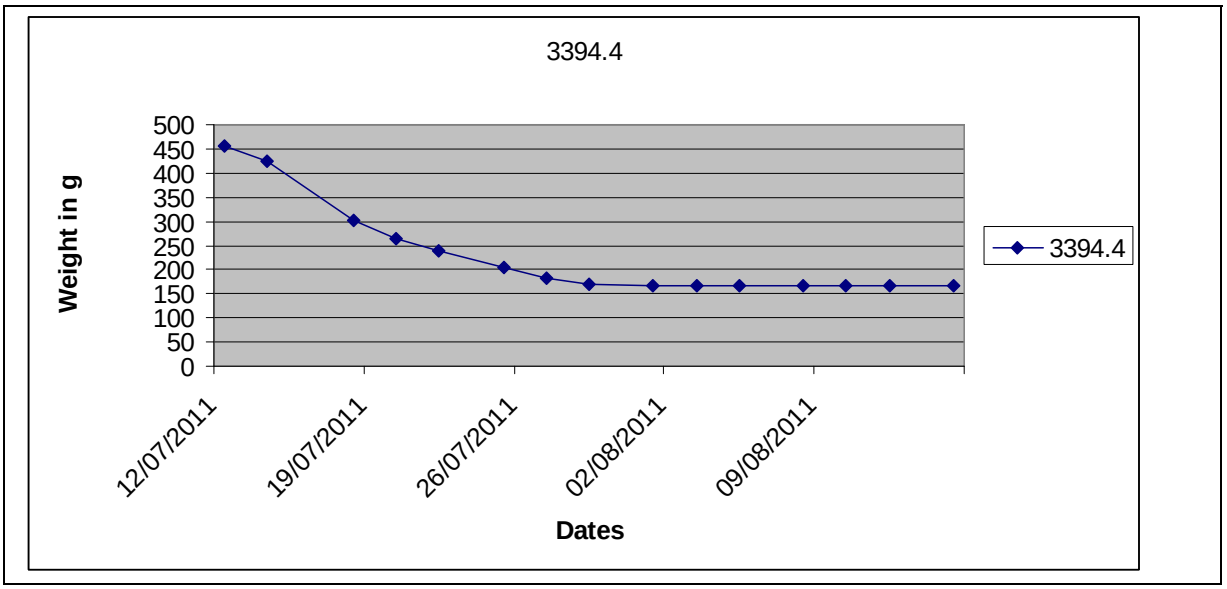
Final weight:	1658.1g	1166.5g	5769.4g	167g

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450
400
350
300
250
200
150
100
50
0
12/07/2011
19/07/2011
26/07/2011
02/08/2011
09/08/2011
Dates
3394.4

BAI85 3395

Before conservation

Before conservation

Before conservation

After conservation

	3395.1	3395.2	3395.3
Drying started:	08/09/2011	08/09/2011	08/09/2011
Drying finished:	21/02/2012	21/02/2012	21/02/2012
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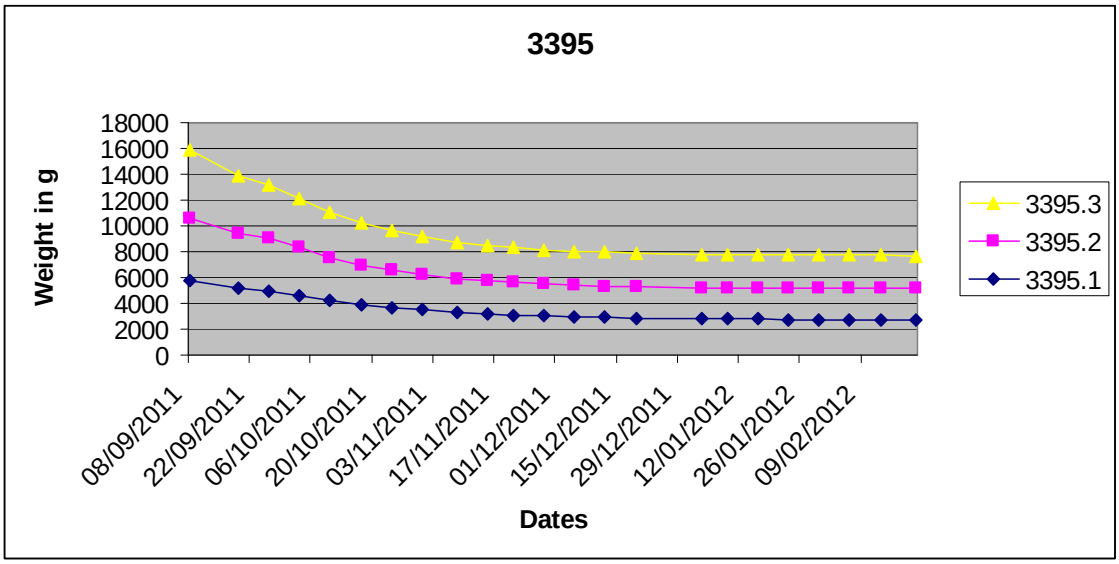
Final weight:	2743g	2380.9g	2577g



BAI85 3396

Before conservation

Before conservation

Before conservation

After conservation

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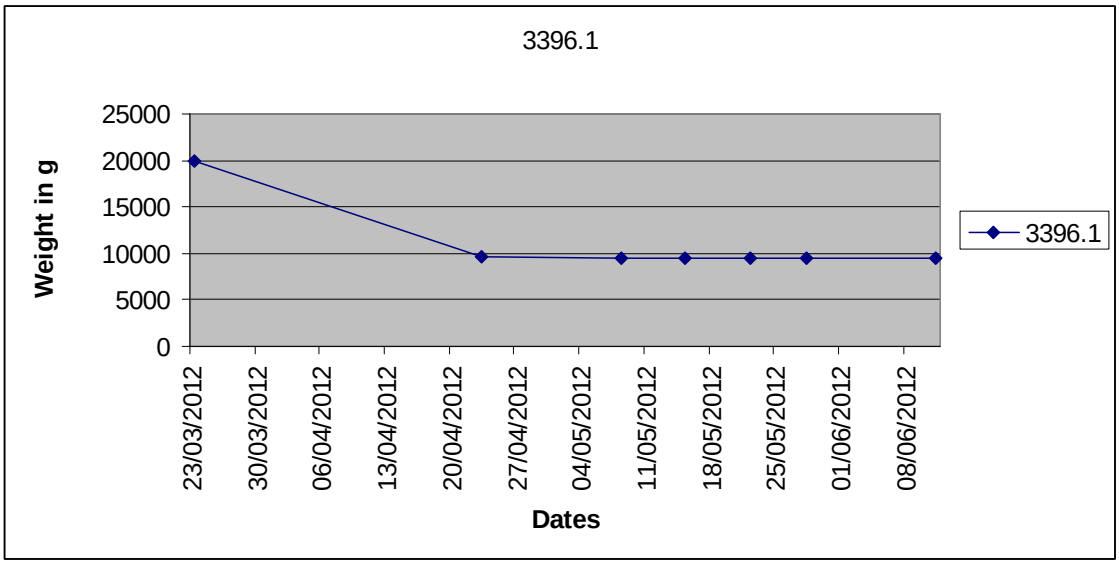
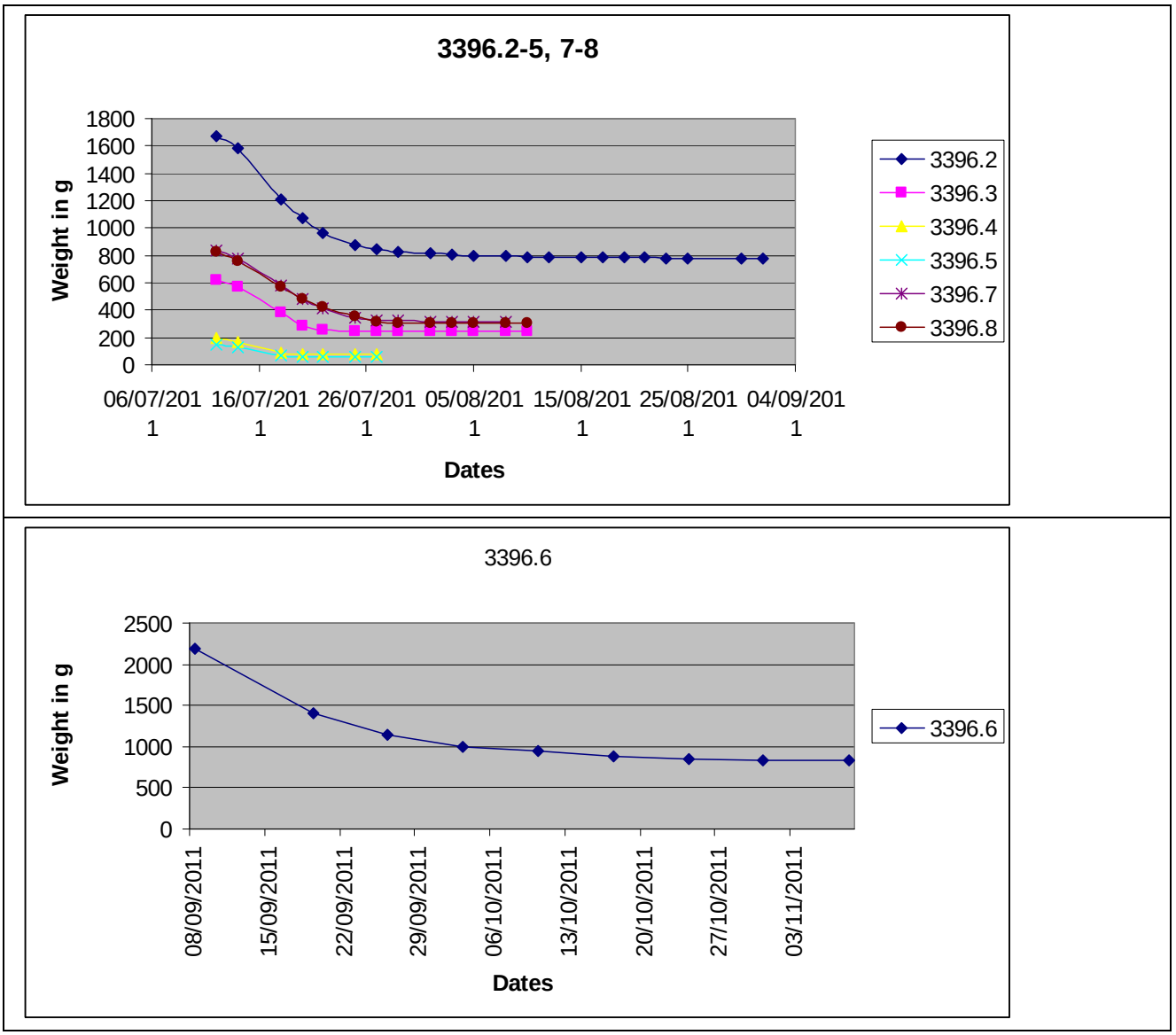
Drying finished:	11/06/2012	01/09/2011	10/08/2011	27/07/2011	27/07/2011	08/11/2011	08/08/2011	10/08/2011
Initial weight:	Weight exceeds scale limit	1670.4g	622.8g	200.8g	149.9g	2191.2g	834g	821.4g
Final weight:	9447.9g	779.1g	241.1g	79.4g	59.2g	839g	319.1g	301.6g




3396.2-5, 7-8
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Weight in g
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2000
1500
1000
500
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08/09/2011
15/09/2011
22/09/2011
29/09/2011
06/10/2011
13/10/2011
20/10/2011
27/10/2011
03/11/2011
Dates
3396.6

BAI85 3397

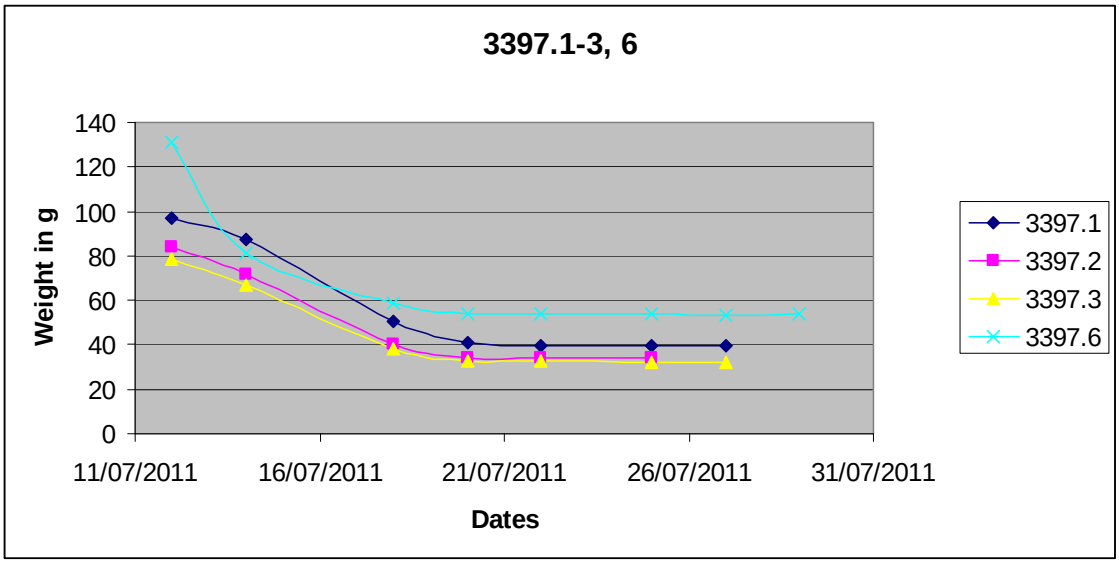
Before conservation

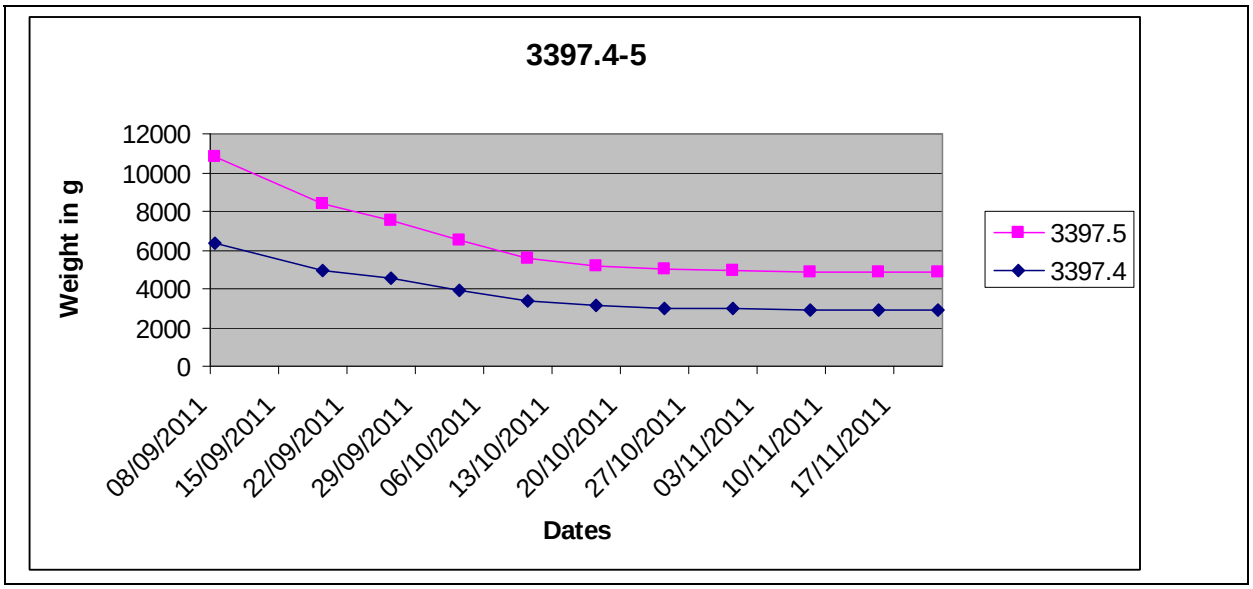
Before conservation

Before conservation

After conservation

	3397.1	3397.2	3397.3	3397.4	3397.5	3397.6
Drying started:	12/07/2011	12/07/2011	12/07/2011	08/09/2011	08/09/2011	12/07/2011
Drying finished:	27/07/2011	25/07/2011	27/07/2011	21/11/2011	21/11/2011	29/07/2011
Initial weight:	96.7g	84g	78.4g	6372.6g	4446g	131.2g
Final weight:	39.7g	34.1g	32.4g	2917.4g	1930g	53.7g

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08/09/2011
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22/09/2011
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20/10/2011
27/10/2011
03/11/2011
10/11/2011
17/11/2011
Dates
3397.5
3397.4

BAI85 3679	
	
Before conservation	After conservation
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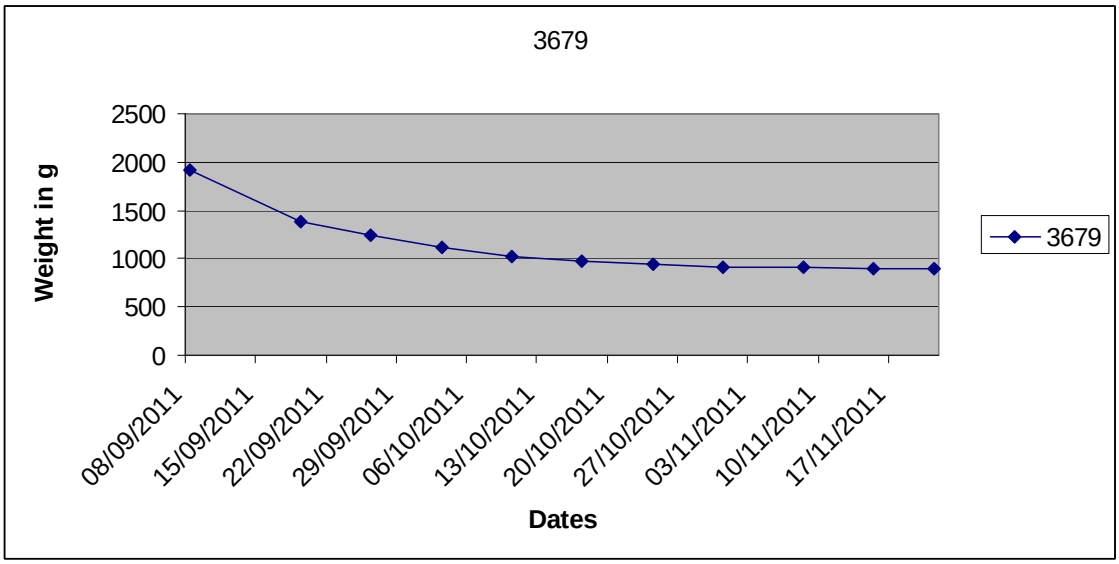
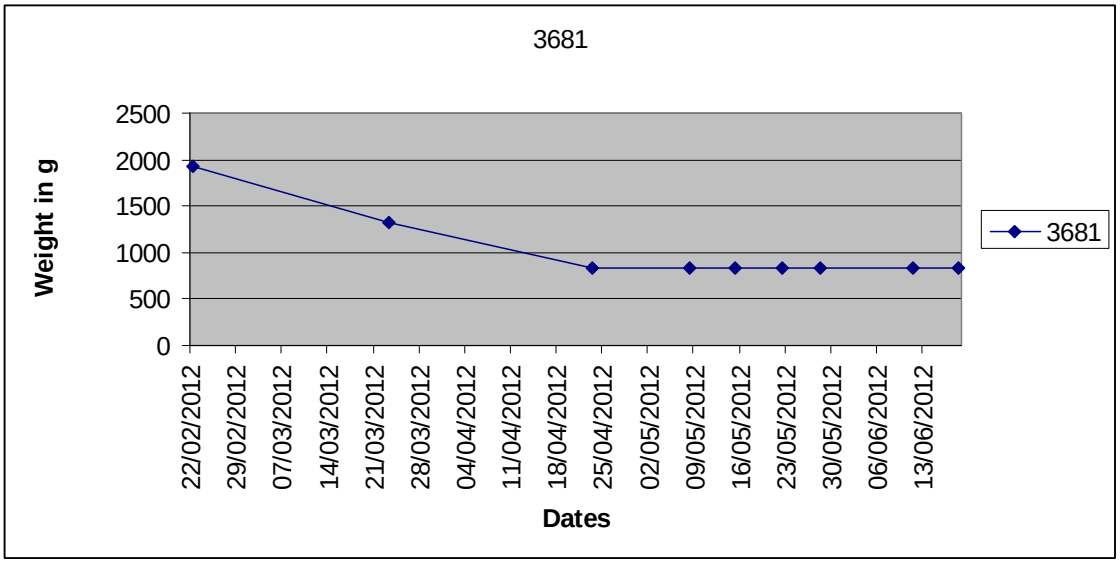
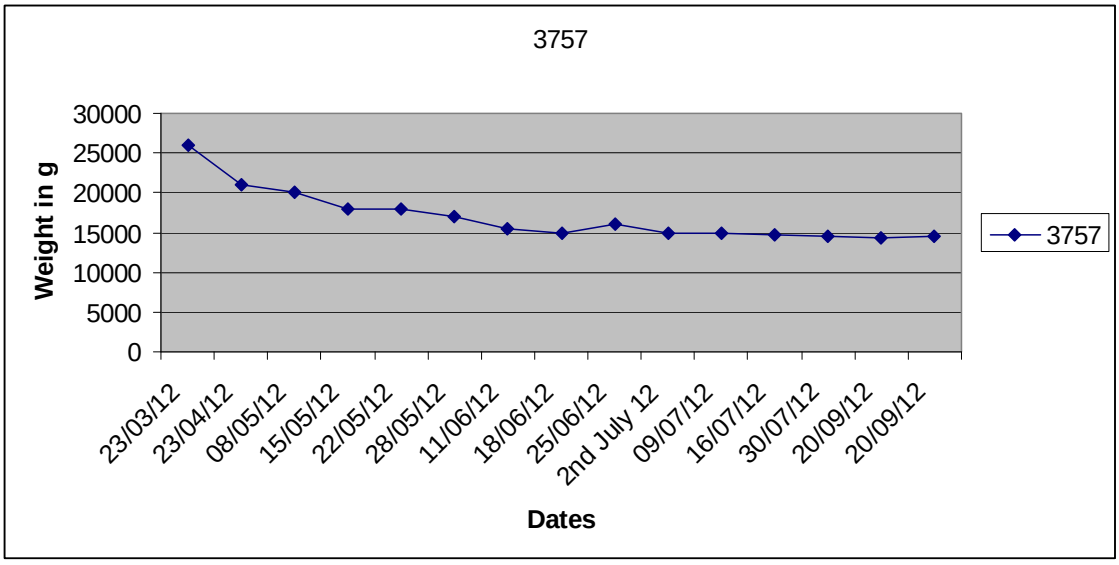
Drying finished:	21/11/2011
Initial weight:	1919.8g
Final weight:	898.1g



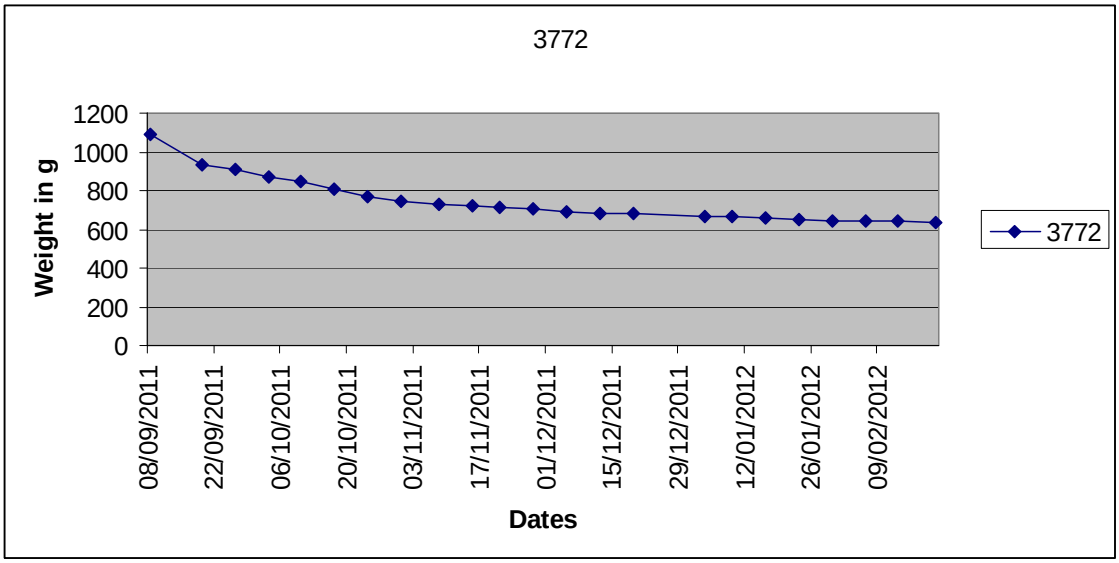
BAI85 3681	
	
Before conservation	After conservation
Drying started:	22/02/2012
Drying finished:	18/06/2012
Initial weight:	1920.7g
Final weight:	834.3g



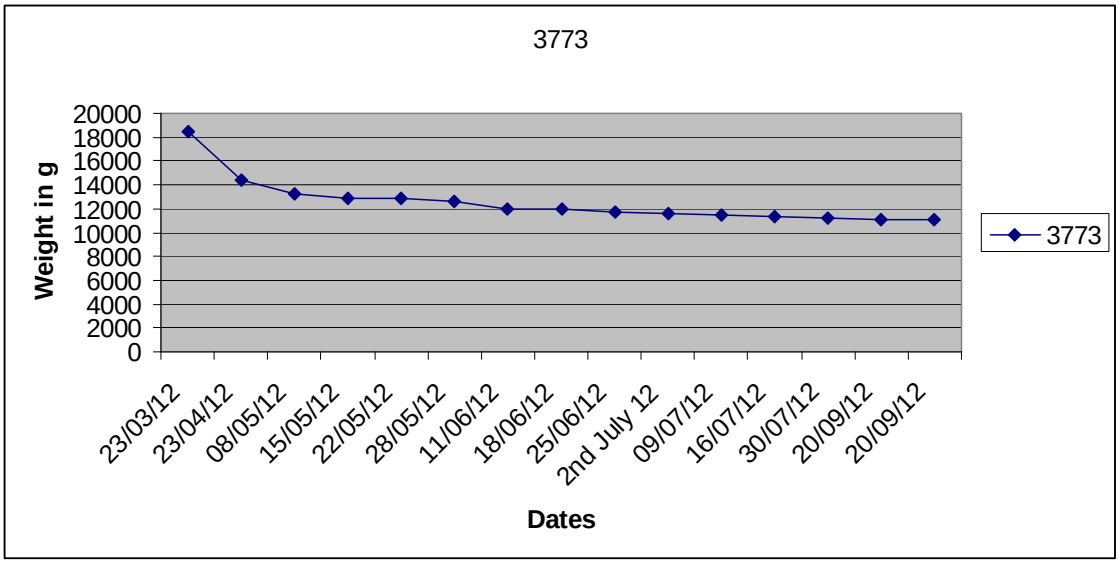
BAI85 3757	
	
Before conservation	Before conservation
	
After conservation	
Drying started:	23/03/2012
Drying finished:	20/09/2012
Initial weight:	26000g
Final weight:	14440g



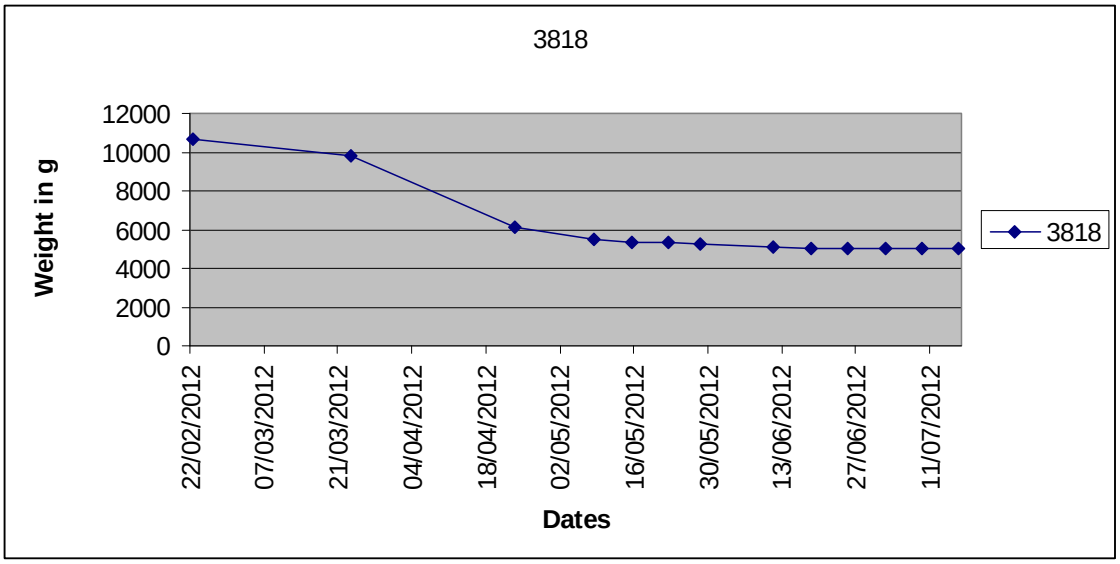
BAI85 3772	
	
Before conservation	After conservation
Drying started:	08/09/2011
Drying finished:	21/02/2012
Initial weight:	1092.7g
Final weight:	638.5g



BAI85 3773	
	
Before conservation	
	
After conservation	
Drying started:	22/02/2012
Drying finished:	20/09/2012
Initial weight:	Initial weight exceeds scale limit
Final weight:	11100g

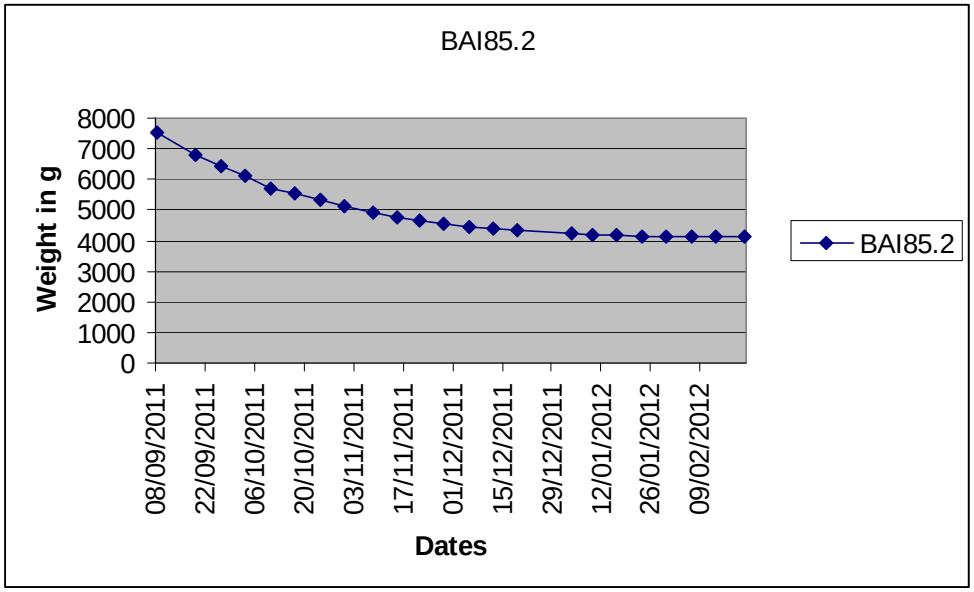


BAI85 3818	
	
Before conservation	After conservation
Drying started:	12/ 07/ 2011
Drying finished:	20/07/2011
Initial weight:	32.7
Final weight:	11.5



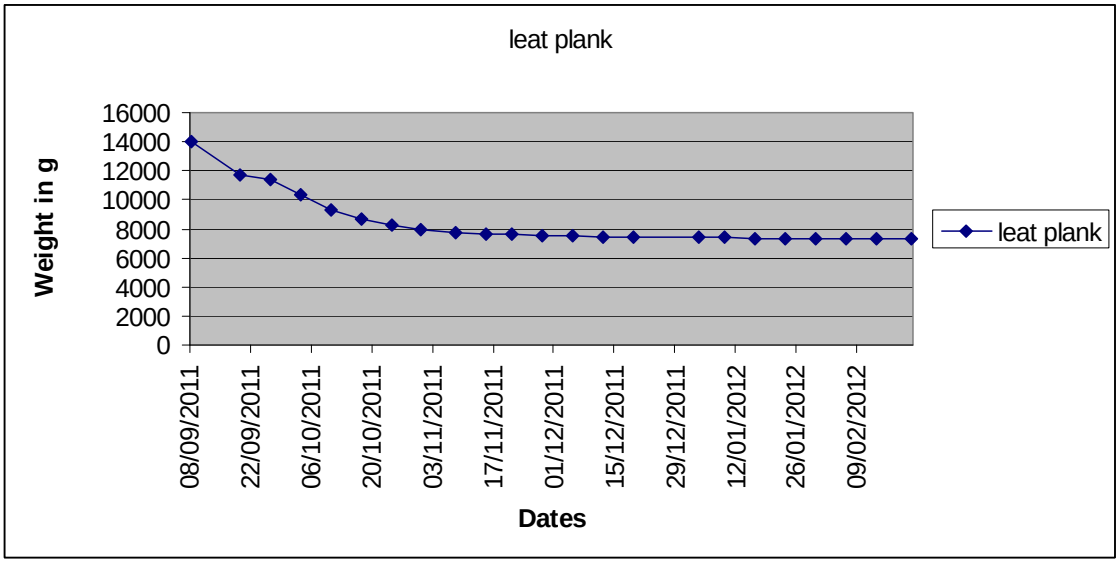
BAI85.2

	
Before conservation	After conservation
Drying started:	08/09/2011
Drying finished:	21/02/2012
Initial weight:	7545.3g
Final weight:	4104.9g



BAI85 Leat Plank		
		
Before conservation	Before conservation	Before conservation
		
After conservation		

Drying started:	08/08/2011
Drying finished:	21/02/2012
Initial weight:	14056.8g
Final weight:	7324.3g



ENGLISH HERITAGE RESEARCH AND THE HISTORIC ENVIRONMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for the protection and sustainable management of the resource, and to promote the widest access, appreciation and enjoyment of our heritage. Much of this work is conceived and implemented in the context of the National Heritage Protection Plan. For more information on the NHPP please go to http://www.english-heritage.org.uk/professional/protection/national-heritage-protection-plan/.

The Heritage Protection Department provides English Heritage with this capacity in the fields of building history, archaeology, archaeological science, imaging and visualisation, landscape history, and remote sensing. It brings together four teams with complementary investigative, analytical and technical skills to provide integrated applied research expertise across the range of the historic environment. These are:

* Intervention and Analysis (including Archaeology Projects, Archives, Environmental Studies, Archaeological Conservation and Technology, and Scientific Dating)
* Assessment (including Archaeological and Architectural Investigation, the Blue Plaques Team and the Survey of London)
* Imaging and Visualisation (including Technical Survey, Graphics and Photography)
* Remote Sensing (including Mapping, Photogrammetry and Geophysics)

The Heritage Protection Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support community engagement and build this in to our projects and programmes wherever possible.

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ENGLISH HERITAGE

ISSN 2046-9799 (Print)
ISSN 2046-9802 (Online)