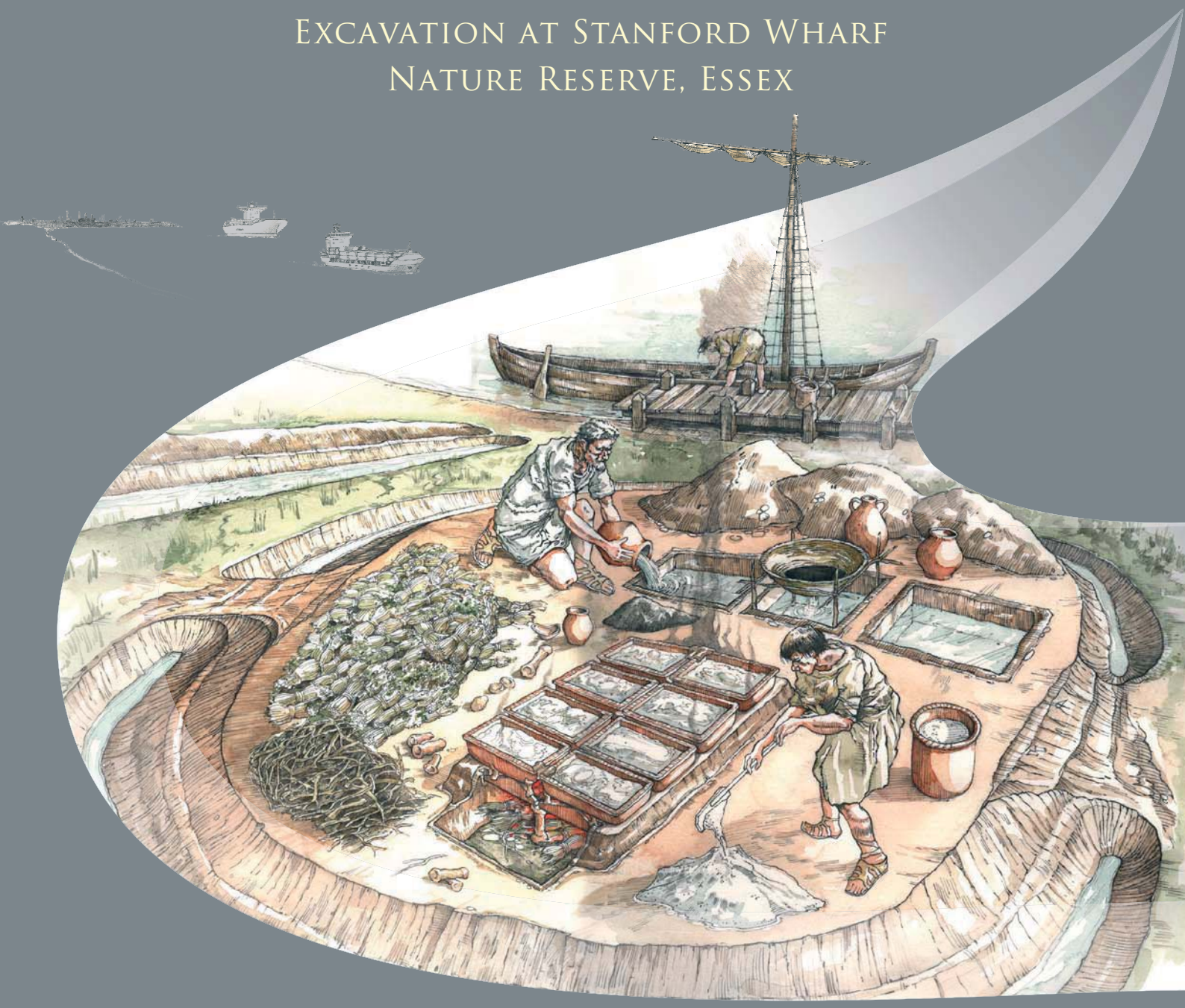
London Gateway

Iron Age and Roman Salt Making in the Thames Estuary

Excavation at Stanford Wharf Nature Reserve, Essex



Specialist Report 14

Woodwork

by Damian Goodburn,
with a contribution by Dana Challinor

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Site location and factors affecting the survival of early waterlogged woodwork

Stanford Wharf Nature Reserve was low-lying former farmland won from the Thames estuary salt marsh in the post-medieval period and bounded to the east and west by tidal creeks. The intended use of the site as a wildlife refuge ahead of large-scale development close by required the stripping of an arbitrary 0.5m of topsoil and in some places more. As much of the land surface lay at around 2m AOD, or just over (K Anker, pers. comm.), judging from other sites along the estuary the waterlogged remains of medieval and earlier timbers were likely to be uncovered. Woodwork of various kinds was indeed revealed, with much of it surviving up to *c* 1.5m AOD, no doubt partly an effect of the location but also the local details of drainage history since *c* 1600. In the following summary report the woodwork discussed is considered against the backdrop of a huge archive of early woodwork records from the London and wider Thames estuary region and a few key sites beyond.

It is fair to record that in the London and Thames estuary region we have been very fortunate to have excavated and analysed a very wide range of Roman and later woodwork. The quantity of worked timber and roundwood is unparalleled elsewhere in Britain for the historic period, totalling many thousands of items and hundreds of projects too numerous to list here. But to enable the reader to access the published reports concerning both Roman and medieval woodwork and get a sense of the range of material, a few key references are listed:

- Port/waterfront infrastructure (Milne 1985; Brigham 1990; Milne 1992; Andrews *et al.* 2011)
- Buildings (Goodburn 1991a; Brigham et al. 1995; Goodburn 2007; Goodburn 2011c)
- Boat and ship remains (Goodburn 1991b; Marsden 1996; and Clarke 2004).

Other parts of England have also yielded some large and reasonably well studied

collections of Roman period woodwork, particularly Carlisle (Zant 2009). A relevant point here is that recent detailed studies of Roman-period waterlogged woodwork from rural and sub-urban contexts have shown that some assemblages have native 'British' or 'Barbarian' (Iron Age) features not typical of woodwork in thoroughly Romanised core areas such as central Londinium. These features include the wide spread use of wattle work and earth-fast constructions and irregular cleft timber, with a lack of the use of typically Roman saws, nails, straight, and square-hewn timber (Darrah 2009; Goodburn 2011a).

As will be seen, the vast bulk of the Roman-period woodwork found at Stanford Wharf has few of the characteristics of formal Roman workmanship. This contrasts strongly with the character of most of the woodwork recorded from the nearby site of Roman Northfleet, where typically Roman square-hewn or sawn timber dominated (Goodburn 2011b).

Specialist site visits and the development of a project specific approach to excavating, recording and sampling the woodwork encountered

On the initial exposure of the upper parts of groups of timbers or worked roundwood, this writer was requested to visit the site and provide advice on the initial interpretation, likely broad dating, recording and sampling of the material. This visit was made in July 2009, and several groups of structural woodwork then partially exposed were examined *in situ*, and provisional suggestions made as to their possible function and broad dating. Some of the key features of the site, such as the existence of salt-making structures, water channels and the survival of building elements to ancient ground levels (or just above) were then becoming apparent. Tentative discussion was then made as to possible date ranges for some structures based specifically, on the OD level of survival and general character of the material seen. The suggested date ranges were predominantly early Roman or middle Saxon based largely on analogy with findings higher up the estuary in London, Thamesmead and Northfleet in terms of relative OD levels, rather than specific woodworking details.(Milne 1985; Brigham 2001, 27; Stansbie 2011, 185). The Roman dating was beginning to be supported by finds spot dating. During this visit, some extra driven posts or piles of the probable 'boathouse' in Area A were also identified.

A second visit was made in September 2009, when the majority of the timbers had been lifted to help carry out the basic recording and sampling of *c* 50% of the larger repetitive items. After this phase of on-site timber recording, about half the larger timbers and nearly all the small items were double wrapped, labelled and retained for more detailed recording later in 2010. By then, some of the piled and wattle structures had been given broad C14 datings to either the Roman or later post-medieval periods, although some tool mark, relict joints and species used were beginning to indicate that some of the material might actually be of medieval date .

Site specific problems concerned with dealing with the waterlogged ancient woodwork found

Unfortunately the 0.5m topsoil stripping was not always parallel to the horizon at which woodwork became apparent, nor the ancient stratigraphy, therefore the site archaeological team had to deal with the unusual circumstances of partially masked structures and stratigraphy.

Despite this limitation and restrictions on fully exposing some woodwork, most structures noted below were fully exposed. However, in a small number of cases worked wood, such as wood group 5972, was partially exposed and left *in situ*. Natural decay, repeated ancient estuarine erosion and probable recycling of wood for fuel have also caused some damage to timber and roundwood structures. Such processes are likely to have been behind removing the inevitable debris layer and launching skids timbers that must have been associated with the end of the boathouse facing the tidal channel.

The methodology of waterlogged woodwork recording and processing employed, prioritising a full representative sample of the material

Apart from the two site visits by this author, OA site excavation staff completed pro-forma 'timber sheets' with measured sketches on the reverse. This basic level of record was assessed as adequate for *c* 50% of the more repetitive and less well preserved items, such as the bulk of round log piles, when set along side more detailed recording of a full representative sub-sample. The more detailed recording, including

scale timber drawing, was carried out over several days by this writer assisted by OA staff off-site. It would be fair to note that the methodology employed is in keeping with the standards set out in the English Heritage guidelines on waterlogged wood and the relevant sections of the Museum of London archaeological site manual, commonly used alongside the EH guidelines for dealing with historic woodwork (Brunning 1996; Spence 1990). Here we must also note that some items of woodwork were planned, levelled and partially described, but had to be left *in situ* because they lay beyond the zone of disturbance to create the nature reserve.

The quantity of woodwork revealed

The overall size of the assemblage partially or fully excavated at this site is *c* 108 listed items, where some numbers identify whole light wattle structures or small groups of woodworking debris, rather than single items. In regional and national terms this could be described as a medium to large-sized assemblage, although one dominated by substantial repetition of fairly simply worked items, such as piles and stake tips. About 25 of these numbered worked items could not be fully excavated, or they broke up on lifting, and 15 of the larger repetitive pile timbers were recorded and sampled on site. The rest of the assemblage was double wrapped and moved to cool dark storage at OA facilities. Sometime later, this material was washed, recorded and sampled by this writer and assisted by OA finds staff.

A summary of the range and character of woodwork revealed

A probable earlier Roman timber boathouse structure (9500)

The building plan form

Early in the excavation in Area A the truncated remains of a structure built on a NW-SE alignment was uncovered. It survived as a very elongated 'U' shaped arrangement of 12 oak log piles (Fig. 14.1) with what may have been an open or lightly built end to the south facing a silted estuarine channel. It seems likely that the E-W channel at the south end eroded away any smaller timbers that were associated with the apparently open end. Unfortunately, a later phase of erosion and or decay and robbing of the structure removed any clear 'floor-type' layers, which could have provided much

corroborative evidence of how the structure was used. The driven oak posts survived up to 1.17m long by 180mm in diameter, though others were smaller. The wall timbers would originally have been at least 2.2m long (probably more) and probably required some form of light piling rig to drive in.

The main posts were set on the long walls around 2.1m apart and could have supported a light weather-board or overlapping vertical pale cladding (Fig. 14.2). Thin stable and weather resistant cleft oak weather board and fence pales are common finds on London and Carlisle Roman sites where they were clearly used for sheathing buildings and making wind-proof fences (Ridgeway 2009; Zant 2009, 240; Goodburn 2011c). Such boards were simply nailed to upright framed or earth-fast posts or driven piles trimmed to varying degrees. The fact that the uprights were set squarely opposite each other probably implies that some form of tie beam was set between them. None of the plan features of the building, such as the post spacing, nor the remaining woodworking details are specifically Roman, but appear to reflect local 'rustic workmanship'.

The surviving plan form of the building was *c* 13m NW-SE by *c* 6m across internally, but it may have been longer and eroded by the channel to the south. The very unusual building form and its location on the edge of a tidal channel are the most diagnostic evidence for its original function as a probable boathouse. It appears to be very difficult to imagine any other likely function for a structure of such an odd form with one tapering end in such a location. At the tapered north end, two smaller uprights were driven about 0.95m apart either side of the structure's central access. These are likely to have formed a doorway. Any ropes used to haul a vessel into the boat house would have to have been led through this opening to a hauling party or some form of windlass.

Parallels and the practical reason why boathouses were built for planked wooden craft

Until the discovery of modern paints and sealants, the planks of wooden planked vessels were prone to damage by being dried out, shrunk and split by fast changes in humidity caused by strong winds and the sun. They were also prone to damage by fresh water induced rot and absorbing excessive amounts of water if kept permanently afloat. Boathouses are indeed still a features of the River Thames today, where they are used to protect lightly-built, often antique wooden pleasure craft. Historic

boathouses with and without roofs are also common features of the coastal areas of northern Scotland and the Isles as well as western Scandinavia. In the Atlantic island locations the wind was the main limiting factor with the very lightly-built boats used there. But further east and south the wind and sun and also damaged by fresh water falling as rain or snow are also factors (Christensen 1979, 20). Substantial boat or ship houses are a feature of the coastal and riverine scene from the Bronze Age in some parts of Europe, particularly in the classical Mediterranean world (Blackman 2000). In a Roman context further north, small fortlets for patrol boats were also built along the Rhine (R Bokius, pers. comm.).

The sort of craft that may have been stored in the boat house when not actually in use

Although the variously preserved and excavated remains of three Roman-period planked vessels have been found towards the head of the estuary in London, none can be used to provide a possible model for the vessel likely to have been sheltered in the boathouse at this site (Marsden 1994). Two, the Blackfriars 1 and County Hall ships were too large, and the much shallower and narrower Guy's Hospital vessel was only very partially recorded. Therefore, although it dates to the later Roman period (early 4th century) and was found some distance away in the Severn estuary, the Barlands Farm Boat could provide a plausible model for a boat to be housed in the probable boathouse (Nayling and McGrail 2004). This vessel was found largely complete, missing only the very bow end. It had a fairly flat-bottomed hull pointed at both ends and the remains of a mast step. Following a detailed analysis it was suggested that it was a small estuary barge, originally about 11.4m long by 3.16m wide and around 0.9m deep (Fig. 14.3). Clearly these proportion are ideal as a fit for the dimensions of the probable boathouse. The boat was calculated to have carried 2.5 to 6.5 tonnes, given the weather conditions, and to have been propelled by the tides, poles, oars and fair winds. Such a size and form of vessel could have multiple functions from bringing in fuel and victuals and taking salt out to small coastal trader or even as an estuary fishing boat.

The uprights of the probable boathouse

The five pairs of driven posts of the long walls and the two north wall stakes were all made of small whole oak logs with the branches and some bark removed. Pencil form points were axe hewn, leaving nearly complete narrow axe stop marks up to *c* 70mm

wide on pile 1477 (Fig. 14.4). The shape of the tips varied considerably, and we might suggest the work was done by several different hands. The posts were all truncated, with the longest survived up to 1.17m and between 180-150mm in diameter. The uprights in the north wall forming the jambs of the doorway were much smaller, down to only 70mm diameter. The timber used was of fast to medium growth and probably came from some form of fairly open managed woodland.

Dating

This structure has been dated to the early Roman period principally by C14 samples taken from the outer sapwood of two of the piles, 1119 and 1424. Two determinations were obtained: cal. AD 50-240 (94.6%)/cal. AD 20-40 (1.4%), 1885 ± 40 BP (SUERC-24584/GU-19377) and 30 cal. BC- cal. AD 130 (94.5%), 1945 ± 30 BP (SUERC 24881/GU-19628).

A loose group of piles or driven posts (6292) to the north of the probable boathouse 9500

The layout of the uprights and possible functions

About 12m to the north-west of the north end of the probable boathouse structure, a small amorphous group of six truncated oak stakes, stake holes and small piles was found. There were no clear, easily understood alignments, although pile timbers 5713 and 5778 and stake hole 5600 formed a rough NW-SE line aligned with the probable doorway of the boathouse (Fig. 14.5). Today, English beach fishermen lay out a line of block and tackle for hauling up craft a long way up the shore, as the nature of such multiple lines require the space. Evidence for Roman block and tackle was found on the Blackfriars 1 wreck (Marsden 1994, 37). The landward end of such a tackle or windlass would need strong anchor points, and it is possible that any of the timbers belonging to group 6292 provided such points.

The piles and stakes

All the lifted examples were of oak round log piles similar to those of the probable boathouse with axe-cut tips of a varied form from blunt and four sided to elongated and pencil form (Fig.14.5, piles 5969 and 5778). None of the piles looked very freshly made, having what looked like old drying splits or ‘shakes’ even near the tips, which

would have remained pristine if used freshly cut. The diameters of the uprights varied from *c* 100mm to *c* 170mm, with the longest surviving up to *c* 1.5m long with rot truncated tops. Pile 5969 was the heaviest example, with a diameter of 170mm and an unusual 'flat' hewn on the lower part of one face; it also had traces of charring on the opposite face, showing that it was clearly reused (Fig. 14.5). The original function is uncertain, and although it had *c* 50 annual rings, no sapwood survived and so it was not selected for tree-ring study. Pile 5778 can be taken as a slightly fresher pile with a little sapwood surviving, but it to had too few annual rings to be viable for tree-ring dating. It was *c*160mm in diameter and survived 1.49m.long.

A timber-lined drain exposed in intervention 5971, Ditch 8551

The disturbed remains of a timber sided drain was found resembling those widely used in Roman Carlisle where logs or cleft timbers formed the roughly revetted sides of a drain. Such drains had no bottom planking, but were originally covered with lid planking that seemed to double as a board-walk surface (Zant 2009, 142). Board walks would clearly have been of use at this site. The drain seems to have fallen out of use, and then silted up and filled partly with woodworking debris. One of the oak kerb timbers 5971 is described in more detail below.

An early Roman wattle, channel-blocking revetment in Area D, structure 2027

In Area D well to the east, the remains of the top of some very robust vertically-set wattlework was uncovered. It was found that the *c* 3m section of wattlework had been set across a channel (Fig. 14.6). It was suggested on-site, on the basis of familiarity with similar later structures in Southwark, that the wattle revetment might have been one of a pair revetting the soil of an earthen causeway. With further cleaning traces of a similar parallel feature were found *c* 4m away.

Unusually the uprights were made of comparatively heavy oak poles hewn flat on two faces, together mixed with some smaller round oak stakes (Fig. 14.6). Some of the heavy stakes, for example 2139, were over 130mm across (some of the very heaviest wattle stakes ever seen by this writer). After careful cleaning off-site, it was clear that at least two of the stakes had been skilfully hewn from the top of relatively small young oak poles with *c* 30–35 annual rings. The woodsmen were making full use of all possible lengths of wood, even if they were rather crooked. The tips were neatly axe cut to a variety of shapes. Stake 2139 had surviving axe stop marks up to

70mm wide.

The rods were also quite robust, up to 50mm in diameter, and woven in a plain in-and-out weave. The ends were neatly cut to a chisel or wedge form with a number of blows from a small axe with a rounded blade (Fig. 14.6). This structure to has no specifically Roman features, but would not be out of place in a Rustic Roman context.

Very few finds were found associated with this structure, but a C14 date was obtained from young roundwood of cal. AD 60-250 (95.4%; 1860 ± 40 BP: SUERC-24586/GU-19379). There are no technological reasons for doubting this broad dating, as very few features of wattlework are stylistically datable.

Decayed post bases from later Roman enclosure 9506

To the north in Area A, the clear plan of a rectangular enclosure was found demarcated by posthole lines and posts set *c* 2m apart. In some of these holes, the very decayed and friable remains of small post bases were found, with three being solid enough to record (5547, 5858 and 5669; Fig.14.7). Although initially recorded as round, they were actually hewn to rectangular cross sections from whole or halved logs. Post 5669 was a neatly hewn, boxed heart post with a sawn base; that is, it is typical of Roman workmanship. It survived *c* 0.17m tall and *c* 120mm x 110mm, and was cut from slow grown oak., though was too desiccated for tree-ring sampling. Post 5547 was slightly smaller, made from a half log with an axe cut base, and survived 0.22m tall 80mm wide x 50mm thick. The third example, 5858, was more distorted, but appeared to have and axe felling cut at the base. It survived 0.27m tall, 100m wide, and 80mm thick. The acute curve of the grain at the felled end is probably a coppiced heel. The use of large old oak coppice poles for small structural timber is well known in Roman timber framed-building timbers from London (Brigham *et al.* 1995).

It is likely that these posts supported fence rails to which light cleft oak paling was nailed, a system of fencing well known from a range of Roman London sites (Goodburn 2011c). Fallen pales in London have been found with a length of *c* 1.85m, about 6 *pes monetalis*. Pales overlapped at their vertical edges would provide a wind-proof screen that would keep out rough weather and casual thieves. As salt was a valuable commodity and the site vulnerable in its coastal setting a solid fence would have been particularly important.

Timbers from a late Roman roundhouse 9501

Plan form and woodworking considerations

Near the middle of Area A, clear remains of a large roundhouse with an internal diameter of *c* 13m were found. The general form of roundhouses is well known in British archaeology. The construction of the walls clearly varied greatly from mass walling in stone and earth in the extreme west and north of Britain, to walls of light wattle and daub work in the south-east. In this case at Stanford Wharf, clearly dating from well into the Roman period, the walls seem to have been lined with small oak timbers and wattle work. Fifteen of these were found very decayed and desiccated, but it could be seen in the best preserved examples that they were *c* 100-70mm wide cleft half poles set close together as pairs in a trench. The gap between each pair was over 2m and probably originally included light wattlework which was truncated. Outside this wooden lining was a gap to the next circular drainage trench of between 0.9 to 1.5m. This gap probably accommodated a clay mass wall approaching 1m wide at the base, but which need not have been over 1.5m high. The would have been covered by over sailing thatch and would have been battered.

Strangely, there was no clear trace of internal roof support timbers for this building (Reynolds, 1979, 29). A roof made of poles must have been set onto the wall heads or within them in the manner of the crude crucks used in many vernacular buildings of western Britain in more recent times (Walker and McGregor *et al.* 1996). The roof would also have required a strong woven or nailed on ring beam and some collar beams to reduce roof thrust.

The best preserved posts

Post 5036 was decayed, but it could be seen that it was hewn from a halved log of oak to shrunken dimensions of *c* 80mm wide and 35mm thick with a truncated height of 0.2m (Fig. 14.8). It had an axe cut base, as did post 5038, which was a more irregular upright hewn from a cleft half log pole.

Building timber off-cuts from circular building 5760

On the west side of Area A, a circular building of uncertain function was found. Inside was an arrangement of four main post-bases with one additional base to the south-east. These bases formed a square *c* 4.5m across. One of the postholes

contained rammed chalk and oak building timber off cuts used as make-up or hard 'post pad' material. The debris is typical of that produced by carpentry operations in which medium sized oak logs were hewn into squared beams. Once the assemblage was carefully cleaned and examined, it could be seen that the most intact large wood chips derived from notch and chop hewing to produce beams around 200mm square from logs around 0.35m diameter. The notches or weakening cuts were cut about 300mm apart to make it easy to split off the bulk of the waste, which is normally recycled as fuel. The axe marks were very well preserved, particularly on knotty beam end off-cut 5868, where a stop mark 80mm was preserved (Fig. 14.9). An axe with a blade of that width is not unusual in a Roman context when many types of axes were made and used, as detailed recording in London has shown (Brigham et al. 995; Bateman and Cowan 2008).

The post-base layout suggests to this author that a small *c* 4.5m square timber framed tower must have stood there. Perhaps we could tentatively consider it as a possible signal or beacon tower in a time when this coastal setting may have been vulnerable to attack by sea raiders. It would also have acted as a 'sea mark' for sailors trying to locate the mouth of Mucking Creek. Similar practical requirements resulted in the building of tower houses and beacon towers during the Tudor period, when piracy was also a problem in the region.

A selection of important smaller items of Roman-period woodwork

Timber 6505, pit 1249

During the second phase of cleaning and recording, a strange jointed pole of young oak was found. It was *c* 85mm diameter and 1.12m long with neatly chamfered ends, which suggests that it was designed to be carried (Fig. 14.10). One face was hewn flat and been pierced by three rectangular through mortices *c* 40-55mm long, which had clearly held cross pieces of some kind. The marks of chisels 18mm wide and spoon augers were found in the mortices. The timber had not been used long as bast, was still adhering in places. There are several possible functions, including a carrying frame or litter used over soft ground, some type of stand where the mortices would have held legs, or part of a partially-made ladder.

Timber 5864: a board base for a basket

A broken fragment of radially cleft oak board was found with a length of *c* 0.20m long with a width of 100mm and thickness of 15mm. Around the edge, traces of 19 through holes were found, which were tapered down to *c* 3mm diameter and were *c* 10mm apart (Fig. 14.11). It would seem clear that this was the base of small very finely woven basket. A similar but larger oak basket base was found in Roman Carlisle (Howard-Davis 2009, 810). In recent times cane baskets were often made with board bases.

Identification of the basket fibres by Dana Challinor

The fibres in the holes were examined. A conclusive identification was not possible, but the following observations can be made. There are no vascular bundles, and therefore the fibres are not monocotyledonous. Pores are present, but there is no ring porous structure, ruling out oak, ash or elm. There is not enough of the pore structure to be certain, but it resembles a diffuse porous species with small radial files, for example *Betulaceae* or *Salicaceae*. Overall, Salix/Populus seems likely, but this identification cannot be confirmed.

Timber 5975, a reused plank of possible lashed plank boat origin

Boats made from planks are rare finds in British prehistory and the Roman period. One of the distinctive features of the prehistoric pre-Roman 'native' vessels was the use of thick cleft and sculpted planks that were lashed or sewn together with woody plant fibres. Unfortunately the recorded examples are of the Bronze Age or early Iron Age. Direct late Iron Age evidence is currently unknown. However, if we use the closest prehistoric find as a model, the Dover Boat, we find the use of thick sculpted oak planks with oval holes near the edges for lashings of several strands, used to join the planks together (Fig. 14.12; Clarke 2004). These holes were cut out with gouges and chisels from both sides, leaving a slightly hour glass shaped opening through the plank edge. Plank 5975 was found in a sondage through an early Roman drain (ditch 5971). One end was recut with a saw in Roman times, the other cut for lifting in 2009, and one edge was split off while the other was smoothly rounded. It survived 0.5m long by 130mm wide, perhaps more originally, and was 65mm thick. One clear oval lashing hole *c* 12mm wide and 40mm long was found, and traces of another 150mm away. A totally certain identification of the origin of this plank fragment is not clear,

but the possibility that it might have been part of the top plank of a lashed plank boat is perhaps possible. Other explanations might be that it was part of the repaired side of a large dugout boat that had split. Finally, we have to note that large dugout vessels resembling dugout boats were used in some salt making processes and even called 'salt ships'; this might be another possible origin.

Timber 2076, a sawn plank off cut

Both sawing along the grain and sawing out planking and occasionally thicker timber, have been found to be key features of Roman woodworking technology introduced very early in the occupation, with the use of sawn plank being very common in London and nearer Roman sites such as at Northfleet (Brigham *et al.* 1995, 42; Goodburn 2011b, 356). It is a clear marker of the rather rustic nature of Stanford Wharf site that so little sawn material was found there. However, this off-cut shows clear marks of being manually sawn out and also cross cut with a saw (Fig. 14.13).

Post-Roman woodwork

Initially, nearly all of the woodwork found was thought to be Roman due to the existence of Roman pottery in deposits through which timbers had been driven. But technological details, the use of elm (unknown in Roman London), and later C14 dates show that some of the material is medieval or post medieval.

A pair of carefully made isolated, middle Saxon piles found in Area D

It might have been thought that, as the nearby site of Mucking is famous for early Saxon settlement, Saxon-period structures would have been found at Stanford Wharf. In fact, little evidence of Saxon structural activities was found apart from a pair of carefully made, apparently isolated, oak piles found in Area D (2058 and 2059) (Fig. 14.14). On the tips they had well preserved axe marks, which were too wide and straight to be typical of the Roman period. On pile 2059, the nearly straight stop marks were recorded up to 150mm wide, and on pile 2058 up to 170mm wide without being complete, suggesting the use of some form of wide broad axe with a blade at least 200mm wide. Roman axe marks of this size had only been recorded twice on large oak beams in London, but are commonly found on late-Saxon timbers (Goodburn 1992). Detailed work on the Northfleet Saxon mill timbers revealed very broad axe marks tree-ring dated as early as AD 692, but no trace of the use of broad

axes was seen on the Roman woodwork (Goodburn 2011b, 337). The piles also seemed a little fresher and less degraded than the piles discussed above. On these grounds, it was suggested that the piles might well be of Saxon date. This dating was confirmed by a C14 obtained from pile 2059 of AD 660-780 (94.5%; 1287 ± 25 BP: OxA-24582). The function of the isolated pair of piles is very hard to ascertain, although part of a small jetty or fishing platform might be plausible.

Unfortunately the upper, minimally worked, parts of both piles were sawn off on-site to facilitate lifting and transport of the timbers, but in the drawings the original outline is made complete with pale lines. Pile 2059 survived 1.78m long with a diameter including bark, of 120mm. The point was four facetted, as was that of its sister pile 2058, which was 130mm in diameter, and had survived 1.4m in length.

Later medieval pile and stake structures in Area B

Just south of the centre of Area B, a group of ten small driven piles and stakes of mixed species were exposed. On excavation, it was found that most fell into two roughly straight parallel lines, aligned approximately north-south. These alignments were found to have run across an irregular, silt-filled channel, apparently of late Roman date. As the stakes varied greatly in size, it is unlikely that they once supported any type of bridge. The two alignments would appear to be the truncated remains of revetments to either side of a short earthen causeway with the sheathing having been rotted away.

Some of the piles were hewn from small elm logs, including some that had already been used previously, as demonstrated by relict peg holes and a rectangular mortice in piles 4389 and 4388 respectively (Fig. 14.15).

Although finds in the channel fills and date range of features near by suggested a Roman date, initially woodwork details suggested to this author that a much later date in the high medieval period might have been more likely. The use of elm is unknown in Roman and Saxon London, but common in later medieval times. The solidity of the timber and the presence of a neat, long rectangular mortice of later medieval form also suggested a high medieval date. A C14 date of cal. AD 1305-1365 (56.2%)/cal. AD 1385-1420 (39.2%) (569 ± 24 BP: OxA-24851) obtained from elm pile 4608 confirmed the suggestion.

Interestingly the main plan of Area B does show a silted medieval channel reaching into the salt marsh at that point, so perhaps the short revetted causeways

were used to gain access to the slightly higher ground to the north or perhaps even a low hump or island that lay over the buried Roman saltmaking area. This writer's experience living and working in such tidal marshes indicates that even low rises with slightly dryer ground than the rest of the marsh would have been useful as 'stepping stones' for walking to the medieval channel were boats may have been moored. They would also be useful in connection with wild fowling which is also likely to have been important.

It is quite clear that the range of stake and piles sizes and species varied for these causeway revetments, and this may well represent different phases of construction. However, it is clear that the larger piles were used in the softest mid channel locations where the silt must have been deepest and a hollow probably still existed. The irregular scatter of some of the stakes probably also indicates repairs. Here we can consider three examples of the uprights as a sub sample, all of which indicate the *ad hoc* use of material easily and cheaply to hand. Pile 4608, the elm survived 0.84m long by 105mm diameter and had a very crudely and hurriedly cut tip. The complete axe stop marks showed that a narrow bladed small axe had been used with a blade only 63mm wide with a fairly straight edge. The pile was cut from a stem of moderate growth, having *c* 30 annual rings. Pile 4388 was also made from a whole young elm stem; it survived 1.04m long by 115mm diameter. In this case the tip had been carefully made more elongated and had the stop marks of a broader axe blade over 65mm wide. More unusually for a piece of large roundwood, it also had a neat, long, rectangular through mortice. The original function of the timber is not very clear, but it may have been used in some form of fencing. The parent stem was a little faster grown, with *c* 20 annual rings. Finally, pile 4710, which was of a pale wood, possibly willow, survived 0.97m long with a diameter of 105mm. It had a four facetted tip bearing clear axe stop marks *c* 62mm wide, and had clear signature marks from a nicked blade edge not found on the other stakes examined.

A post-medieval/modern farm structure in Area A

The gridwork-like spread of oak piles and posts in the south-eastern part of Area A has been C14 dated to the late post-medieval to recent period and is shown on a 19th century map. The spread of dates is possibly explainable by the use of an assortment of old oak timbers from old buildings and ships demolished or broken up in what were timber-hungry surrounds of the site in the 19th century. The plan form looks like some

form of stock yard where animals are sorted, marked and de-horned, rather than an enclosing sheepfold shelter. The latter would have had uprights set around a perimeter of the fold area, rather than a gridwork. The C14 date obained from timber 1326 was cal AD1640-1710 (21.4%)/cal. AD 1720-1820 (48%)/cal. AD 1830-1890 (8.2%)/ cal. AD 1910-1960 (17.8%), 185 ± 40 BP (SUERC-24585/GU-19378)

An assessment of the wider importance of the woodwork assemblage

It is clear that the archaeological investigations at Stanford Wharf Nature Reserve, although limited by the nature of the brief, have provided an important series of views of a stretch of intensively used industrial coastline of the Roman period. This has included the important regional industry of salt making and its necessary supporting infrastructure, which was constructed of timber and roundwood. This includes the remains of what is nationally a unique find of a simple timber boathouse capable of housing a small estuary barge. Some of the surviving elements of a roundhouse and portable woodwork have also been items rarely found preserved on Roman rural sites. Less substantial timber and roundwood structures have also be recorded, showing periodic, less intensive use of the salt marsh zone in Saxon and medieval times.

The project has also provided some important evidence for reconstructing past environments and the woodwork has contributed to that data set. The analysis of the woodwork has also shed some light on changing relative sea levels the most crucial parameter for land use in the zone.

Timber dating and relative sea level change

In addition to the established sediment and microfaunal approaches to the study of changing tidal levels in the historic Thames estuary, archaeologists working on the waterfronts of the upper estuary in London realised in the 1970s that closely dated timber structures could be stratigraphically associated with normally-dry occupation features such as hearths, building floors and roads to provide relative sea level points of comparative precision (Milne and Milne 1982; Brigham 1990). More recently, it has also been possible to refine the dating and precision of the data as well, as fill in some of the gaps, tempered by experience of tidal zone living and working, to produce an up dated version of sea-level change graphs produced earlier (Brigham

2001). Most of the data collected concerns the upper estuary, and so absolute OD levels and related date brackets could be expected to differ from those at Stanford Wharf in the lower estuary, where they would be affected by the slope effect and the 'fetch' (that is, the distance over which waves can build). Wave height is not a significant factor in the upper estuary or the inland ends of tidal creeks.

Although still a study in progress with some gaps in data, particularly from the end of the Roman period to middle Saxon times, some very clear trends can be clearly noted which are relevant the Stanford Wharf project. During the later 1st century AD, adjacent riverside occupation levels lay between *c* 1.5m and 2m AOD; during the 2nd century the higher spring tide levels fell rather fast, reaching around 0m AOD by around AD 300. Apparently during the 4th century, the levels started to rise quite rapidly, and by the late 7th century AD (692), when the Northfleet tide mill dam and sluices, were built the level reached up to *c* 1.7m AOD. Thus, a fundamental question relating to migration-period settlement of eastern England is how rapid was that rise in the southern North Sea region, forcing abandonment of coastal farmland on the east side of the sea? See Main Report, chapter 5 (*A mooring/boathouse structure and an associated timber group*) and chapter 8 (*Coastal wetlands: applying a model of utilisation*) for further discussion of sea level.

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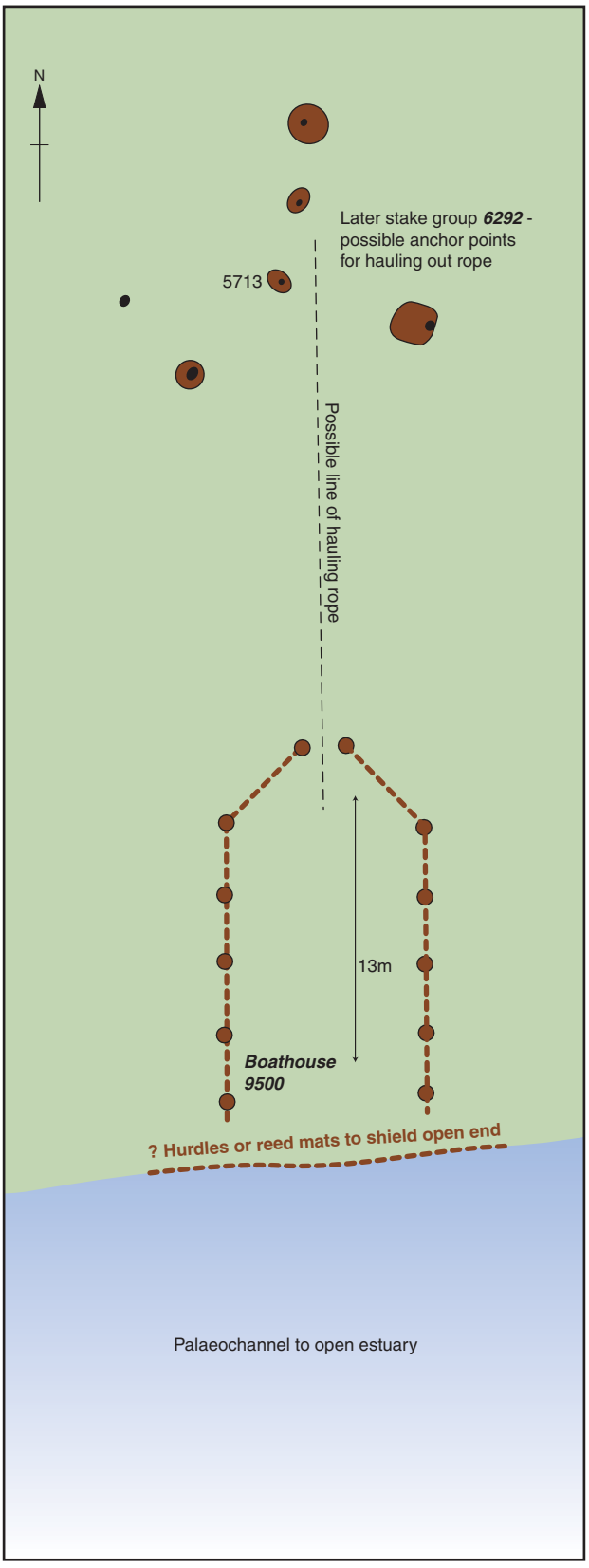
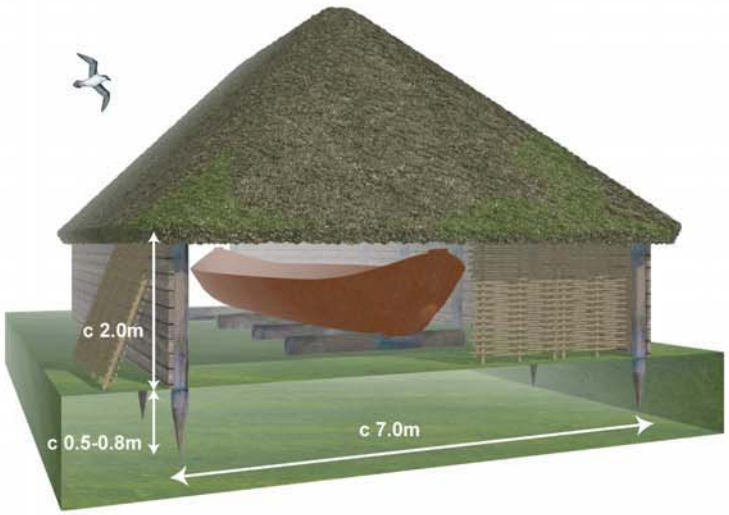


Figure 14.1: Relationship between boathouse 9500 and timber group 9292



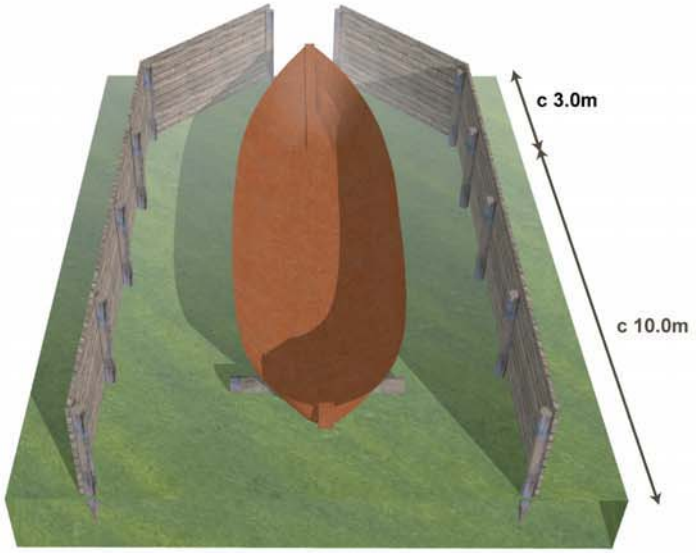


Figure 14.2: Reconstruction of boathouse 9500

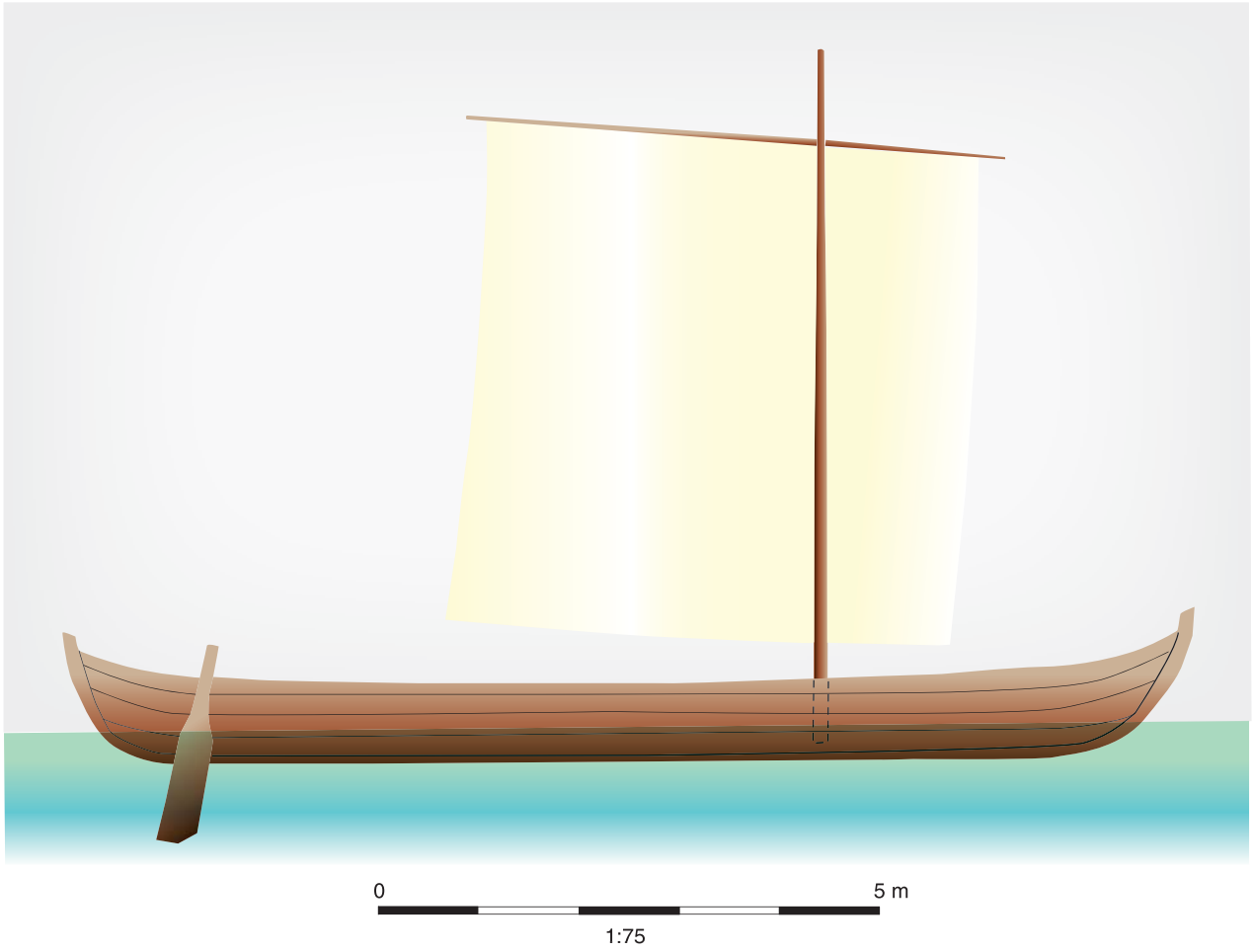


Figure 14.3: The Barland's Farm Romano-Celtic boat, the type of craft likely to have been stored in boathouse 9500 (after Nayling and McGrail 2004, Fig. 8.20; original drawing by Owain Roberts)

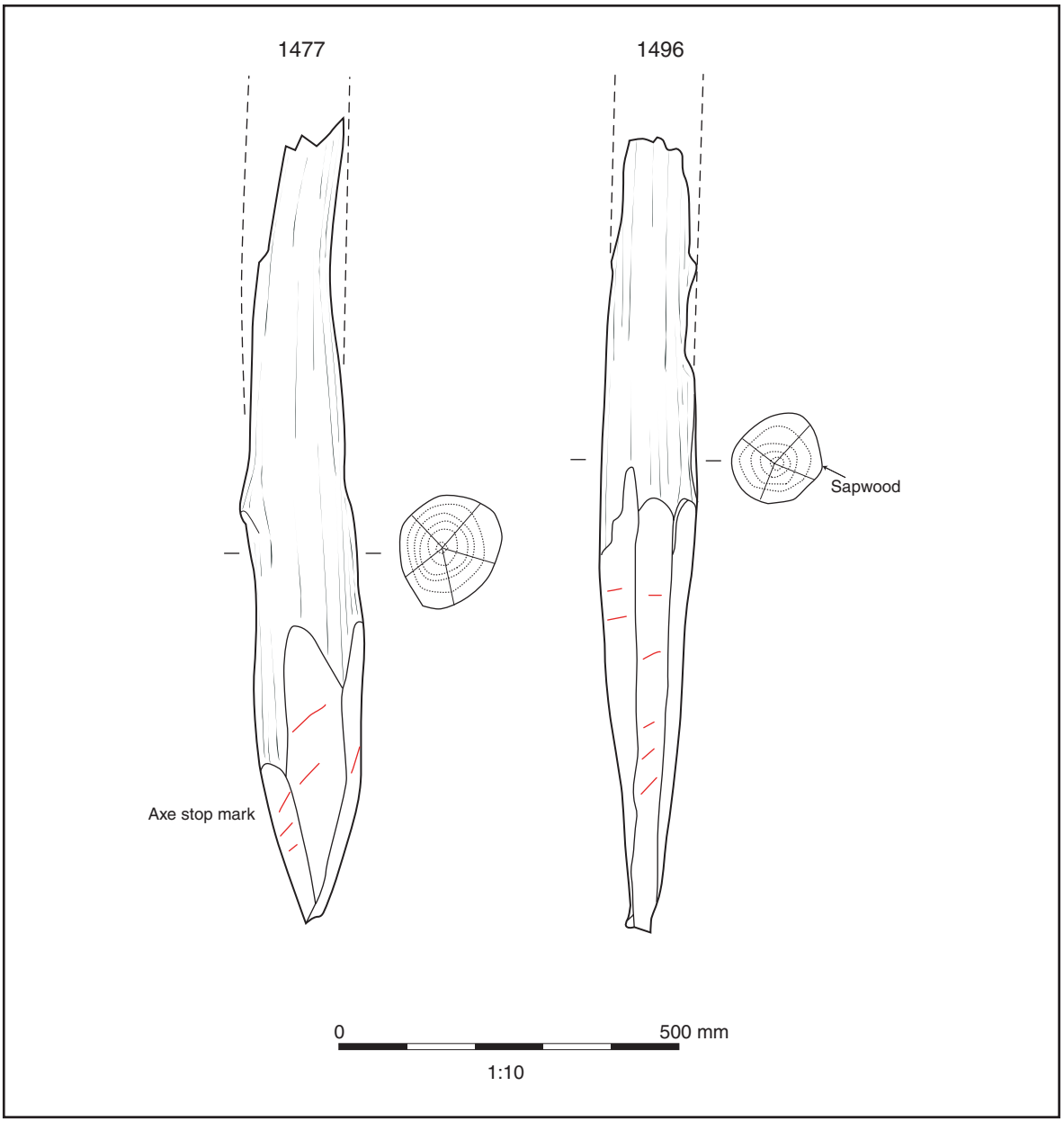


Figure 14.4: Oak piles 1477 and 1496 from boathouse 9500

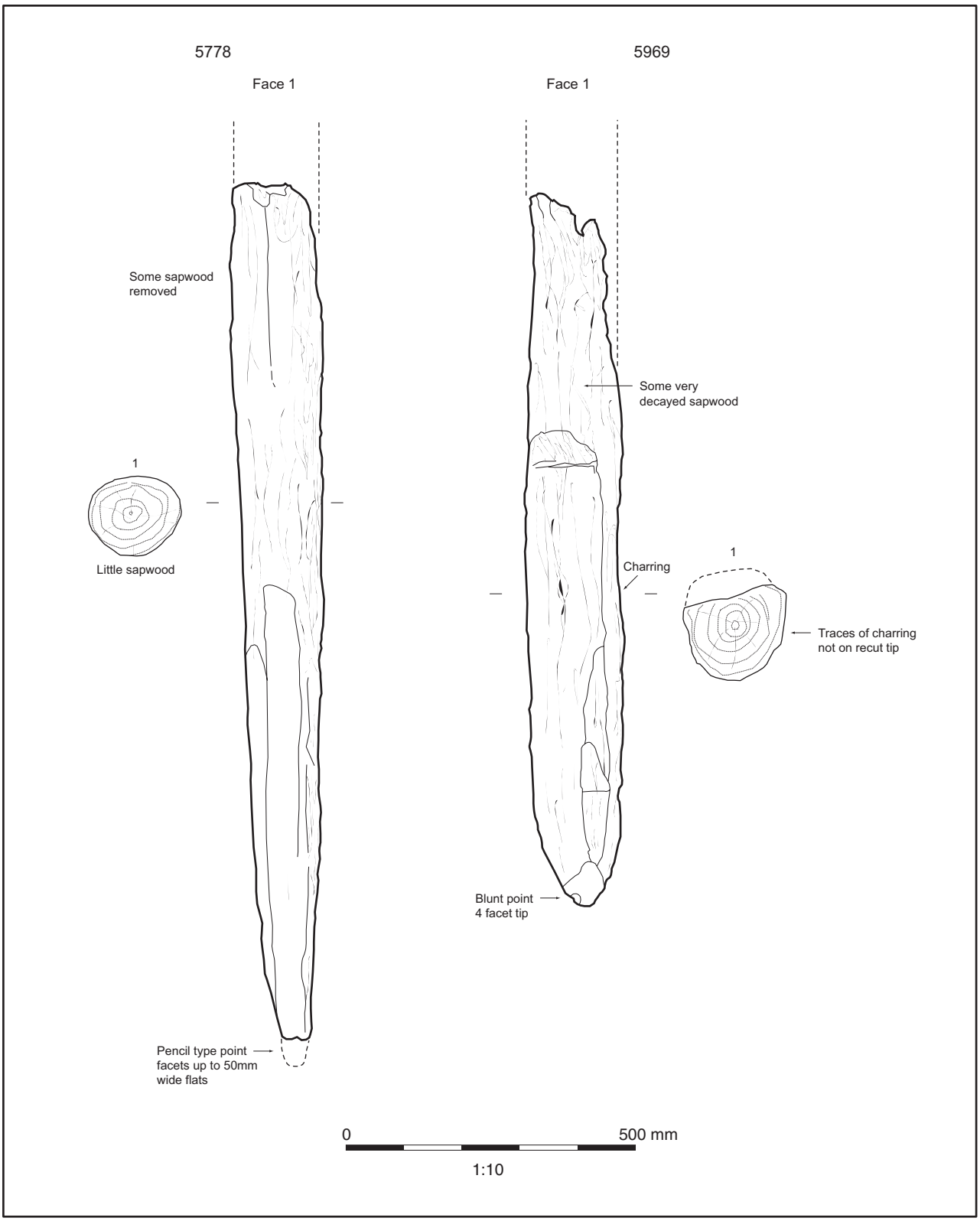


Figure 14.5: Piles 5969 and 5778 from timber group 6292

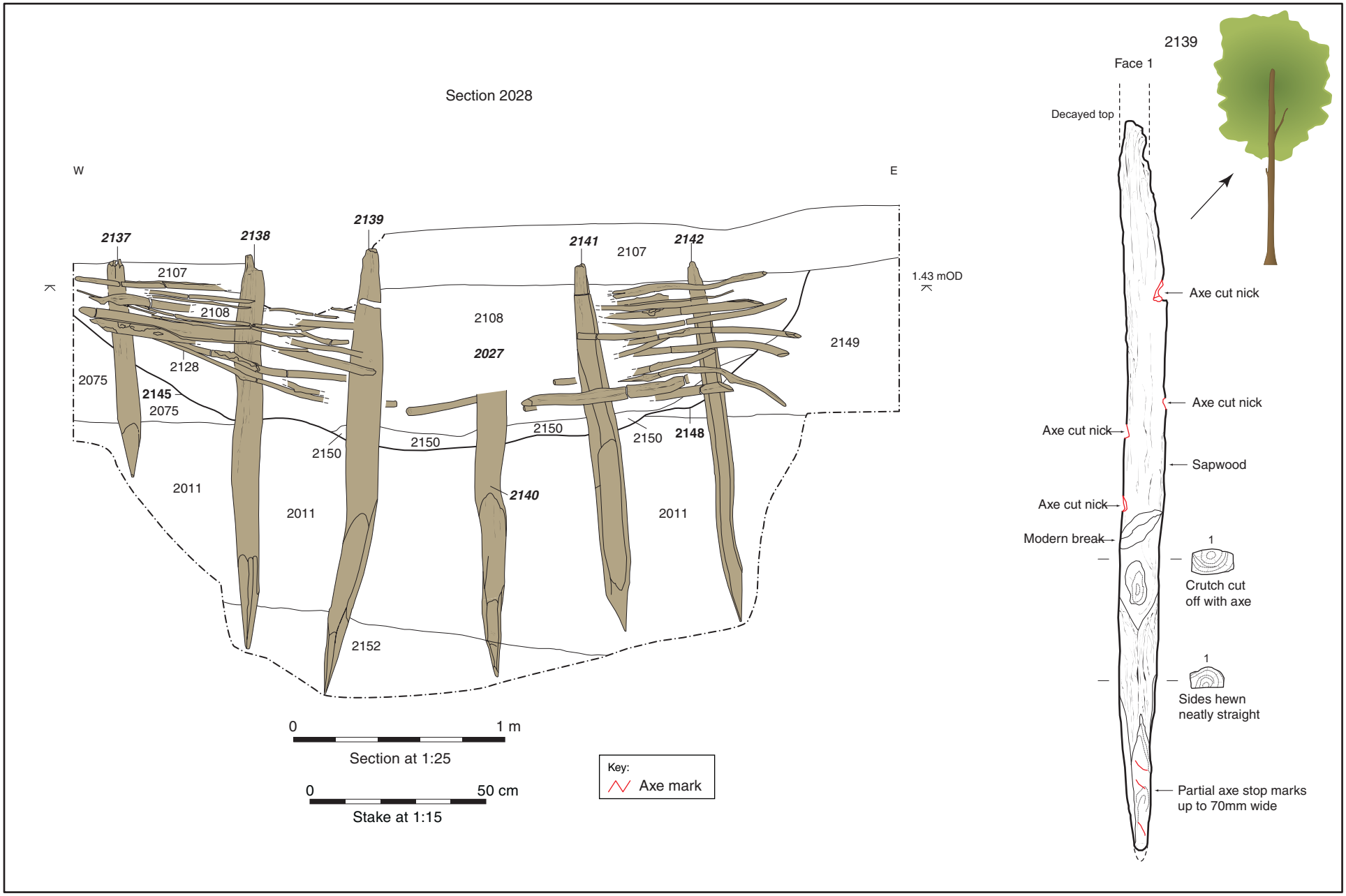


Figure 14.6: Wattlework panel 2027

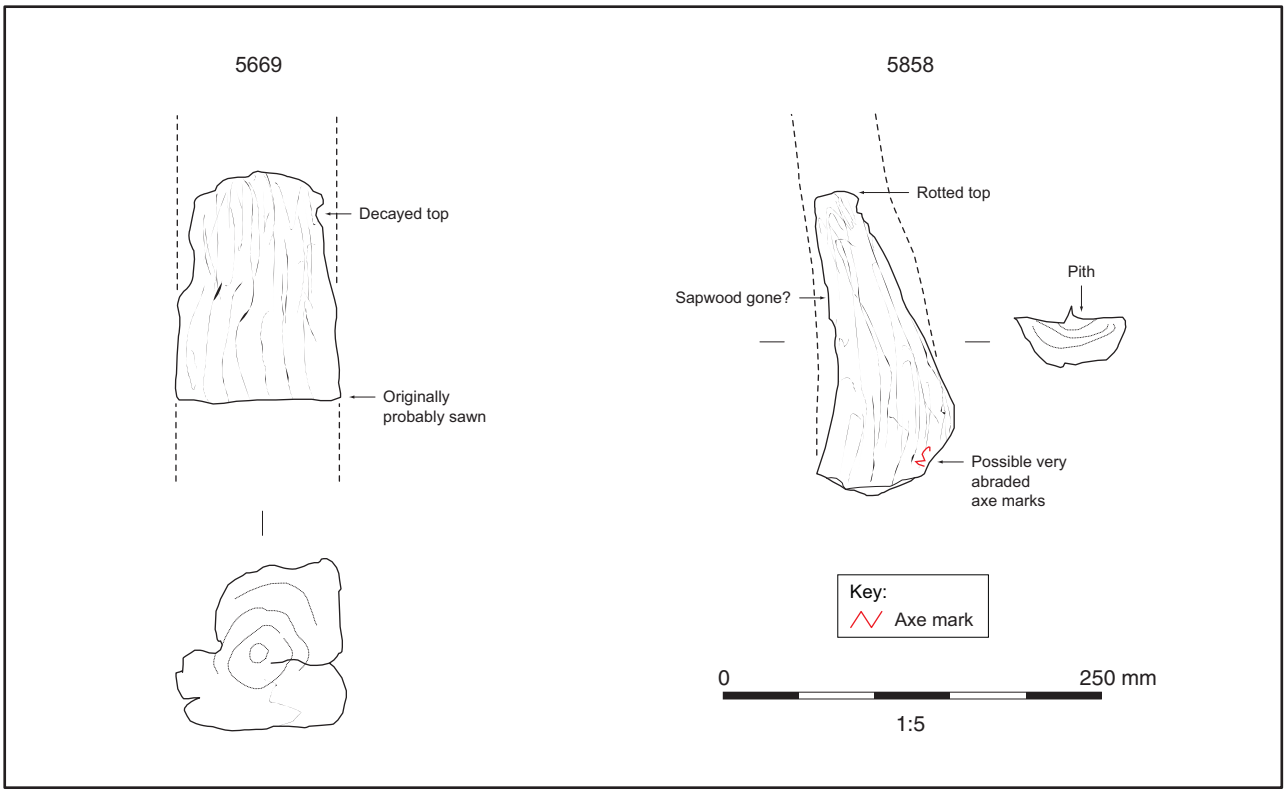


Figure 14.7: Wooden post bases 5858 and 5669 within postholes of fence-line 9502

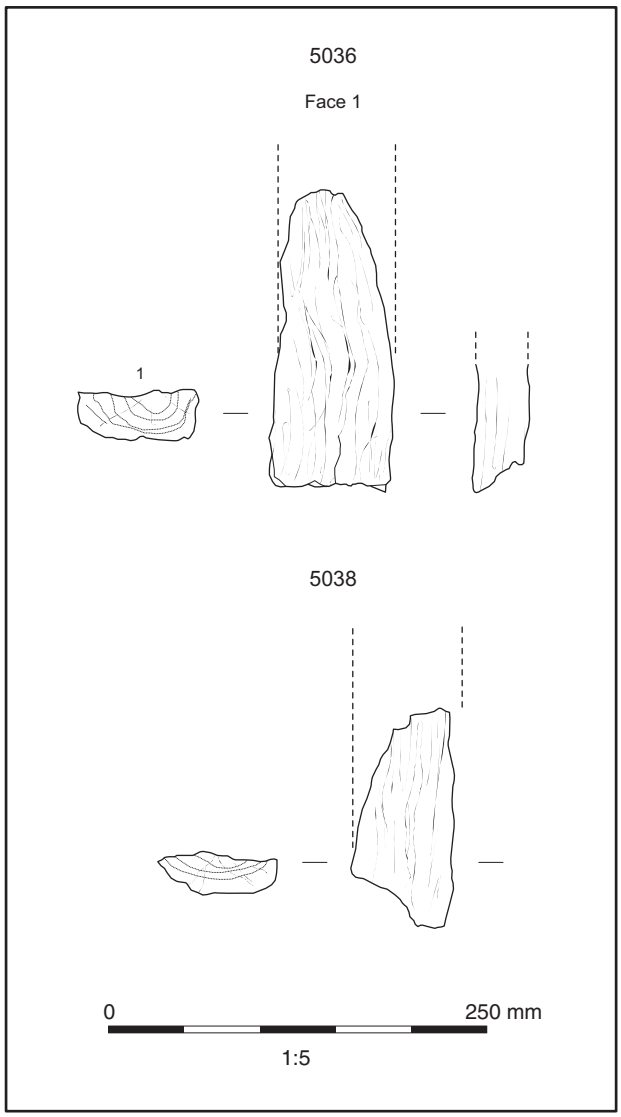


Figure 14.8: Wooden posts 5036 and 5038

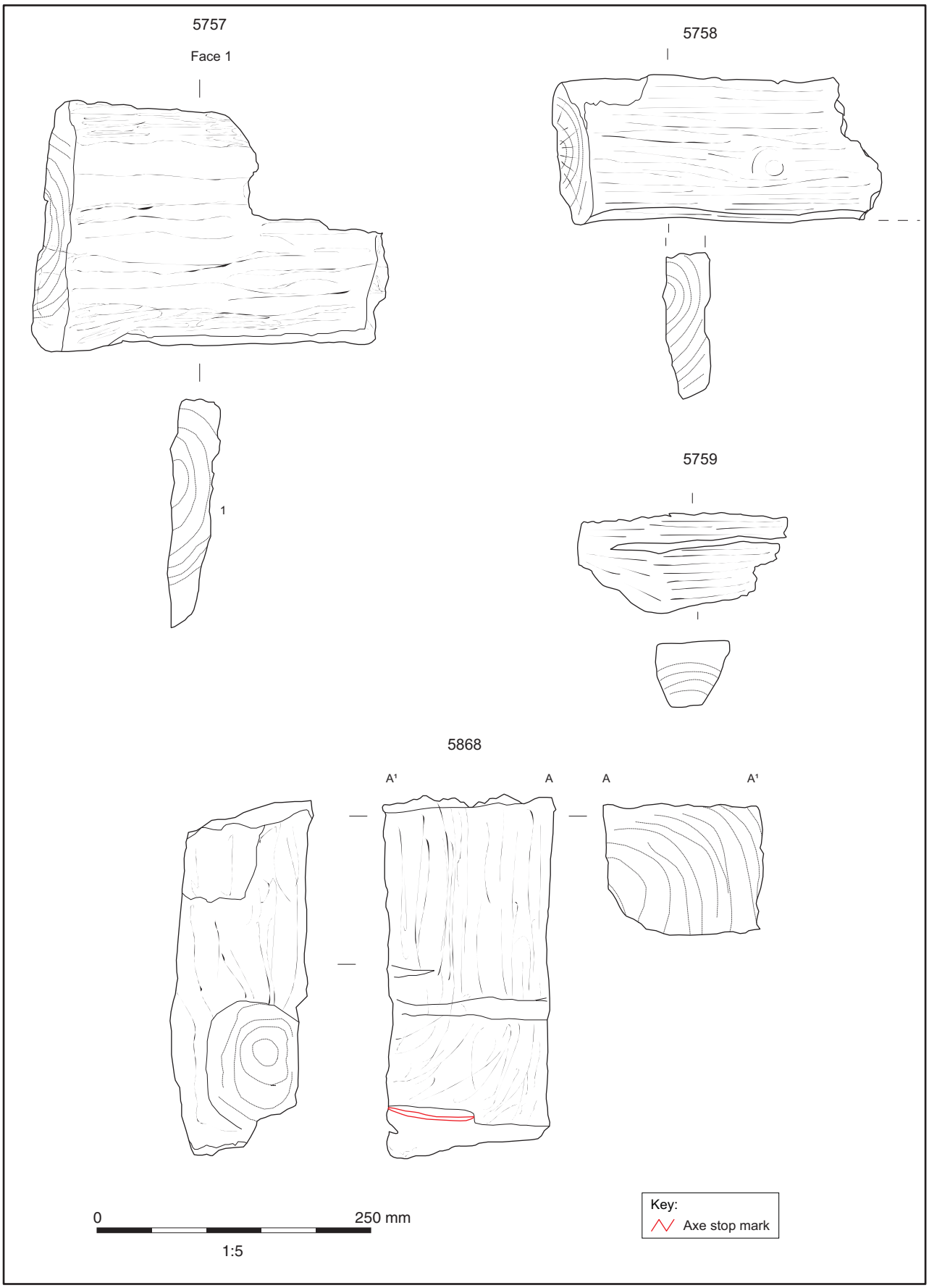


Figure 14.9: Timbers 5757 and 5868, off-cuts found in a post-pad in building 5760

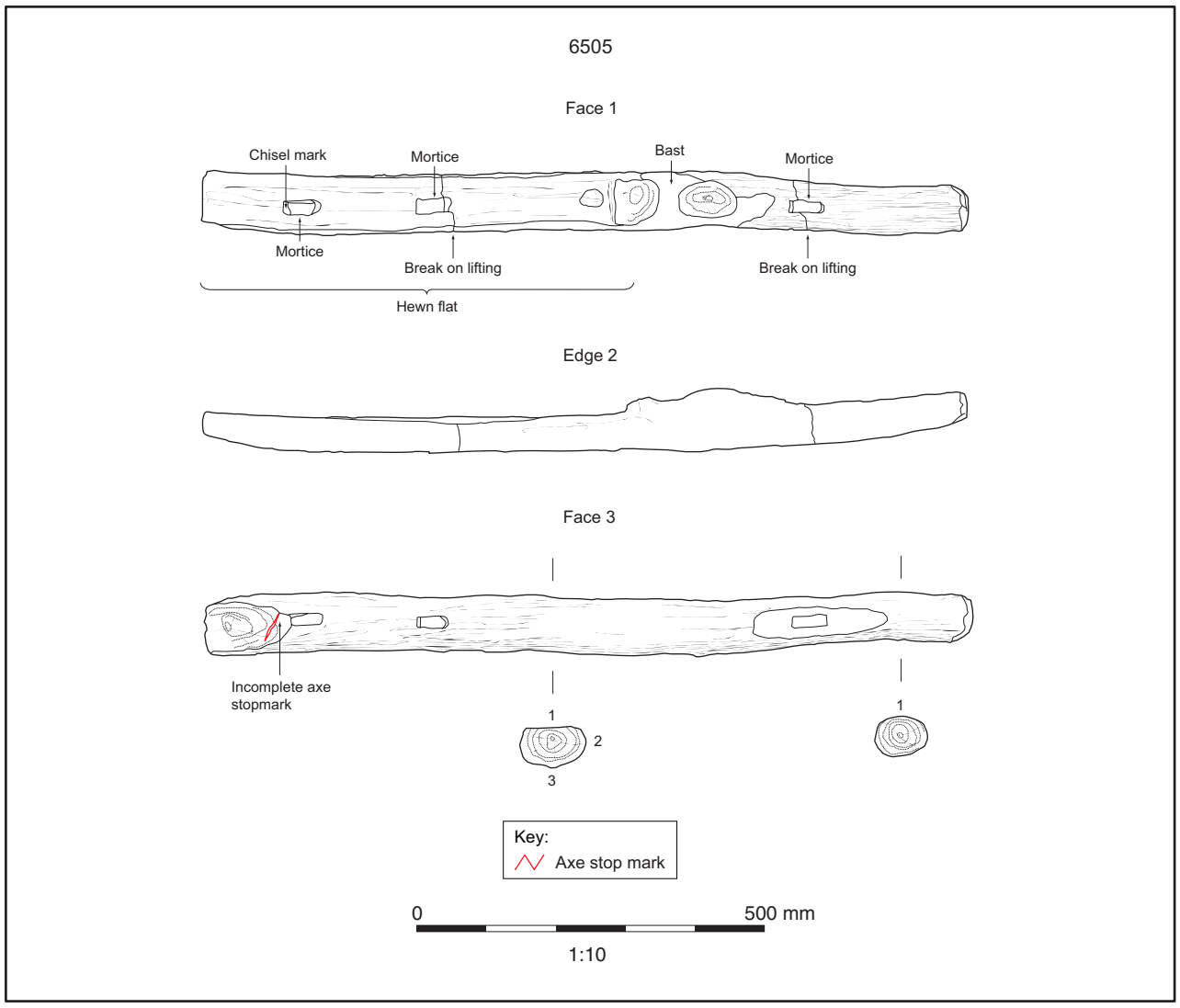


Figure 14.10: Timber 6505 from pit 1249, part of a ladder or litter

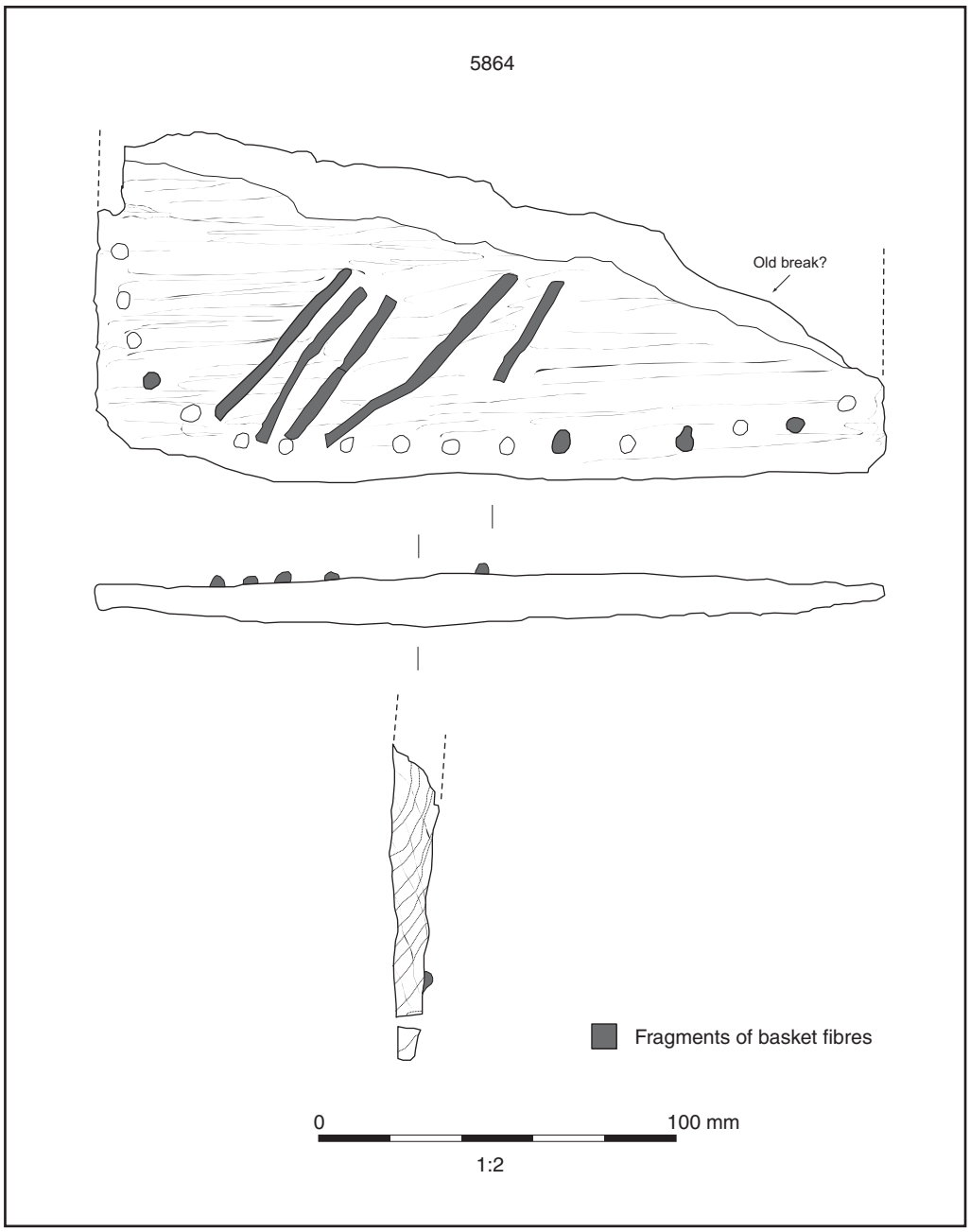


Figure 4.11: Timber 5864, part of a finely woven basket

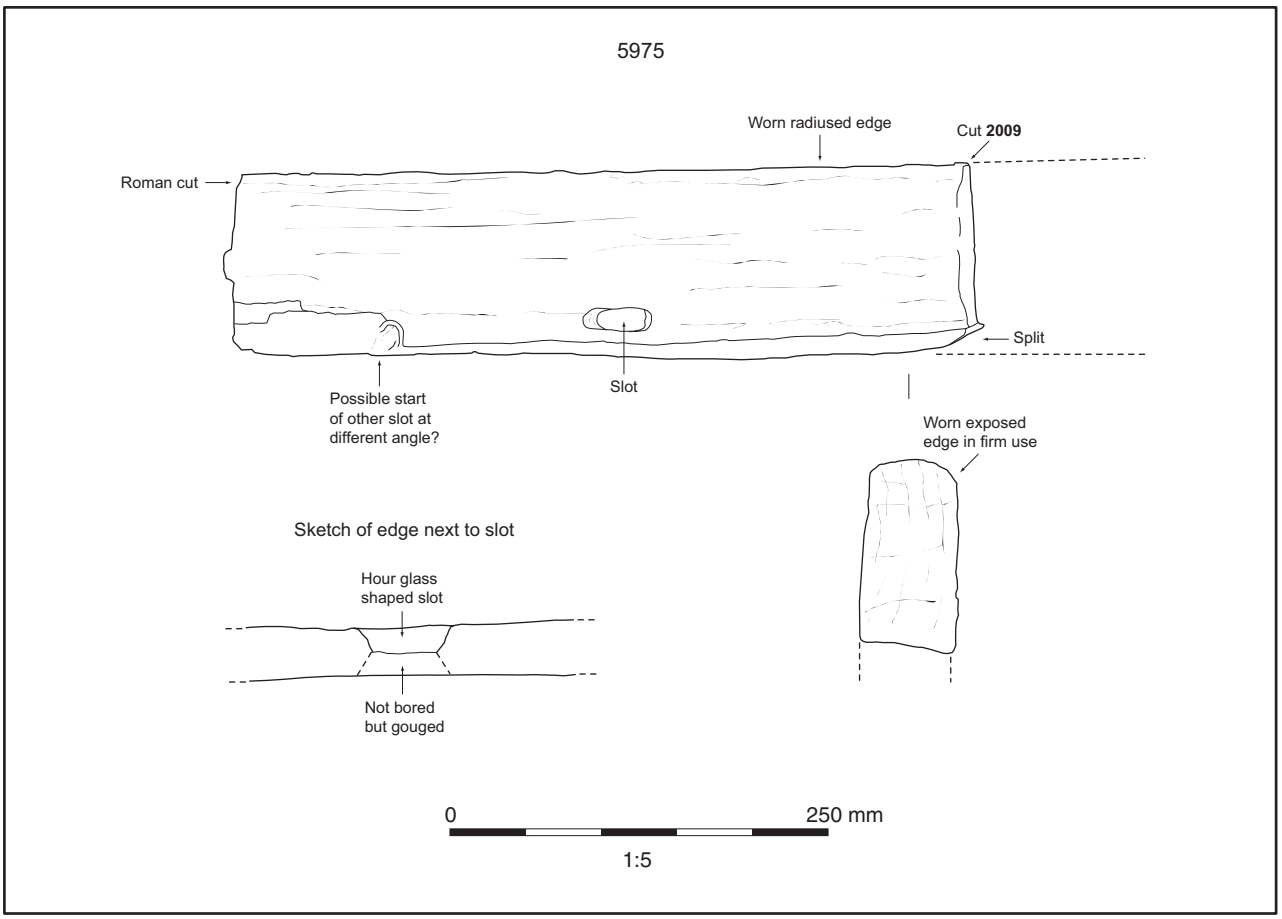


Figure 14.12: Timber 5975, originally part of a boat or a ‘salt ship’

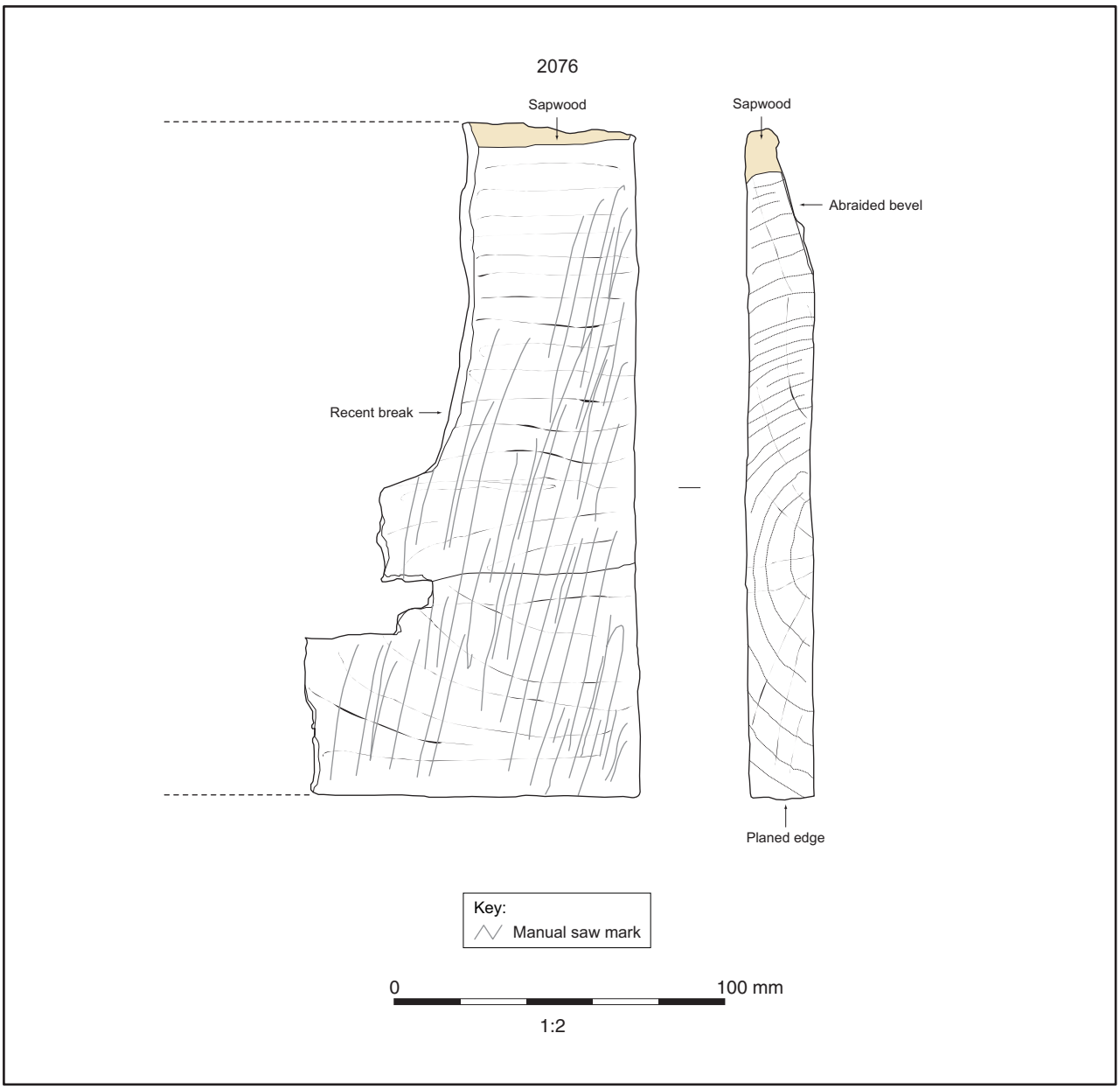


Figure 14.13: Timber 2076

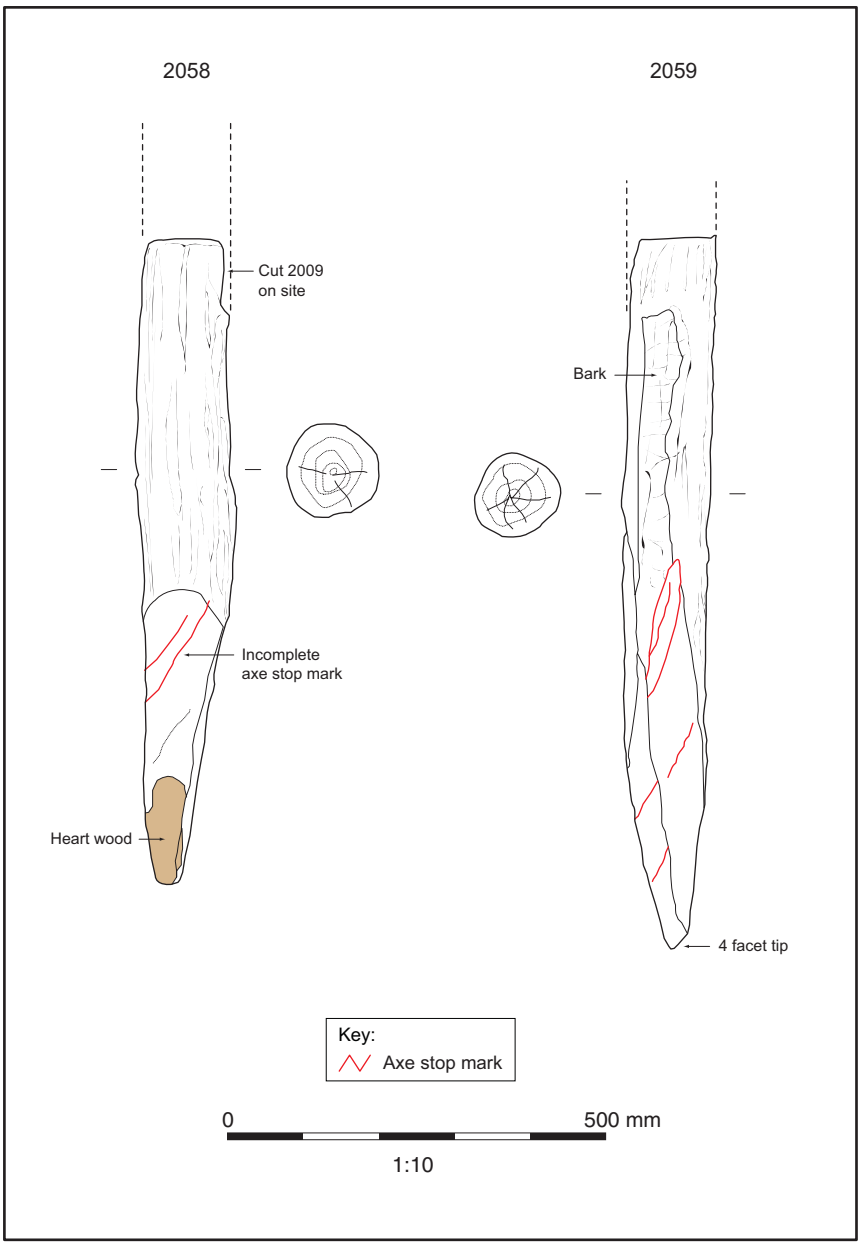


Figure 14.14: Middle Saxon oak piles 2058 and 2059

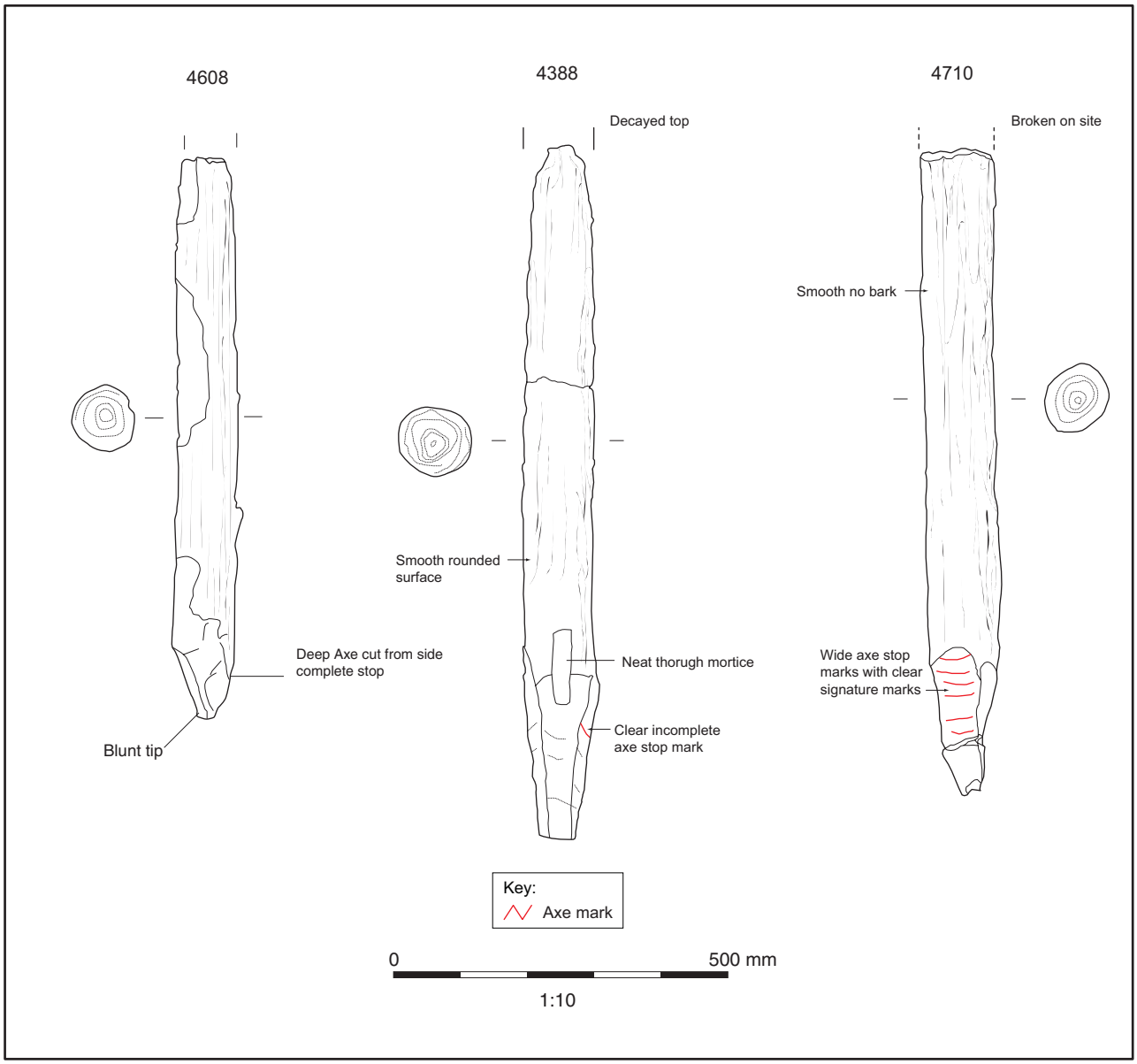


Figure 14.15: Timber piles from structure 9517

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