

PART OF A 13th-CENTURY BARGE FROM LEAMOUTH AND OTHER VESSELS FROM THE LOWER LEA VALLEY IN THE LONDON BOROUGH OF NEWHAM

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SUMMARY

During March 2012 as part of the Crossrail project fieldwork at Limmo Peninsula, close to the mouth of the River Lea, the excavation of two large circular shafts was archaeologically monitored. In the westernmost shaft deeply buried within a sequence of fluvial deposits a section of articulated timbers was recorded and recovered for further study. This proved to be part of a 13th-century clinker-built barge hull, which may have been used on either the Thames or the Lea. This article aims to describe and discuss this discovery, plus provide an up to date summary of boat finds from the lower Lea Valley. Comparisons are made with other similar medieval boat finds from Greater London to shed light on the original use and status of the 'parent vessel'.

INTRODUCTION

Between 2010 and 2012 Museum of London Archaeology (MOLA) carried out a series of archaeological and geoarchaeological investigations at Limmo Peninsula, in East London, E16 (site code XRW10; Fig 1). The site is located on the eastern side of the present course of the River Lea, close to its confluence with the Thames; the River Lea is tidal and estuarine. Part of the fieldwork involved excavating two large circular shafts, which were archaeologically monitored and

recorded during March 2012 (Harrison 2015, 4–5). The westernmost 'main shaft' (NGR 539422 180991) was located *c.*50m inland of the present eastern bank of the River Lea at Leamouth (also known as 'Bow Creek') within a zone of historic estuarine deposits. It was within this shaft that the section of boat hull was discovered.

Blackened and well-preserved waterlogged timbers were found within a sequence of fluvial sediments at a depth of between -3.65m and -4.17m OD (Fig 2). It was recognised that these articulated timbers were part of a boat's hull built in the 'clinker style'. The hull was enveloped within the estuarine alluvium of the Lea floodplain that comprises a series of grey silts and clays containing occasional beds of sand, gravel bands and peat lenses. Geoarchaeological investigation suggests that this was a highly active channel zone, as the clays directly overlay gravels denoting that scour and erosion were taking place until the medieval period or later (Corcoran *et al* 2011; Spurr in prep). The boat remains are thought to be part of an abandoned vessel, which was subsequently moved either by the flow of the Lea or by its tidal currents to this location (discussed below).

The upper face of the hull section was excavated and planned, and it was recognised

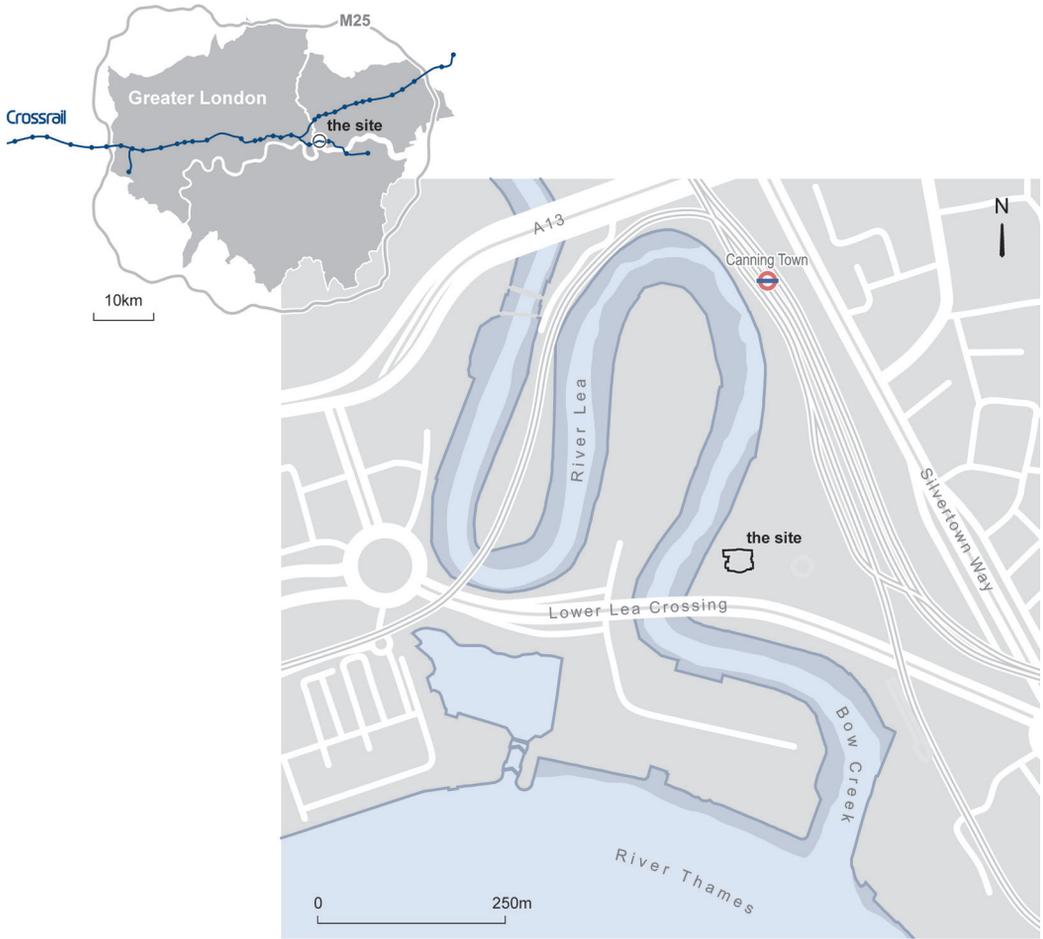


Fig 1. Location of the site and details of the Leamouth area at the confluence with the Thames; inset, position of the site (XRW10) on the Crossrail route through Greater London (scale 1:10,000, inset 1:1,250,000)

that this was the internal or ‘inboard’ face in the parent vessel. Unfortunately, the articulated planking protruded beyond the limits of the shaft to the north and had to be cut free at that point. The hull slab was taken off-site for further detailed cleaning, recording and sampling. This included a detailed drawing of the other, ‘outboard’ face of the hull section. Although the accessible section of hull planking was relatively small, at *c.*2m long, it clearly represents a significant discovery, which has been radiocarbon dated to the 13th century (discussed below). This discovery is hereafter referred to as the Leamouth boat to avoid confusion with the 19th-century boat discovered at the same site (discussed below).

Within the text, numbers in square brackets ([1] *etc*) refer to contexts. The complete site archive (site code XRW10) will be available for study at the Museum of London’s Archaeological Archive (LAA), Mortimer Wheeler House, 46 Eagle Wharf Road, London N1 7ED and can be consulted by prior arrangement.

GEOARCHAEOLOGICAL AND HISTORICAL BACKGROUND

Geoarchaeological study of the confluence of the River Lea with the Thames has revealed that prehistoric and historic Leamouth consisted of a series of braided channels that migrated across a marshy floodplain, where



Fig 2. Clinker-style boat hull section as found on site with trench edge to the left and machine-damaged edge to the right, looking east (1.0m scale)

alluvial sediments were deposited whenever the river flooded (Corcoran *et al* 2011, 44–54). The section of hull was found deeply buried within fluvial sediments, which formed part of what was until the medieval period an active channel. As these braided river channels constantly migrated, they reworked earlier infilled channels and overbank flood deposits. The presence of deposits of coarse sands and gravels demonstrates the highly active nature of the channel mouth. Marine and brackish water diatoms show that by the medieval period the lower Lea was strongly tidal, with freshwater species presumably introduced from the upstream Lea on the ebb tide (Spurr in prep).

The site which forms part of the parish of West Ham is naturally very low lying. Over half the land in the western and southern part of the parish lies below the level of the ordinary level of the spring tides. During the medieval period these areas of low lying marshland were protected from floods by embankments and drained by ditches. In 1336–9 there was a dispute concerning the

maintenance of a river wall called ‘Prioress Wall’, which probably was located to close the confluence of the Thames and the Lea. By the early 16th century considerable progress had been made in reclaiming these marshes, and consequently the course of the estuarine Lea had been restricted by the construction of embankments (Powell 1973). On John Rocque’s map of Greater London in 1762, the site formed part of ‘Abbey Marsh’ and consisted of reclaimed farmland protected by a substantial embankment (Corcoran *et al* 2011, fig 9).

MEDIEVAL AND POST-MEDIEVAL BOAT AND SHIP BUILDING TECHNOLOGY

Redevelopment and gravel extraction within the Lea Valley has produced extensive evidence of the range of craft that plied the Thames and its tributaries during the medieval and post-medieval periods (see below). The building of medieval boats, barges and ships using planks strengthened by framing timbers

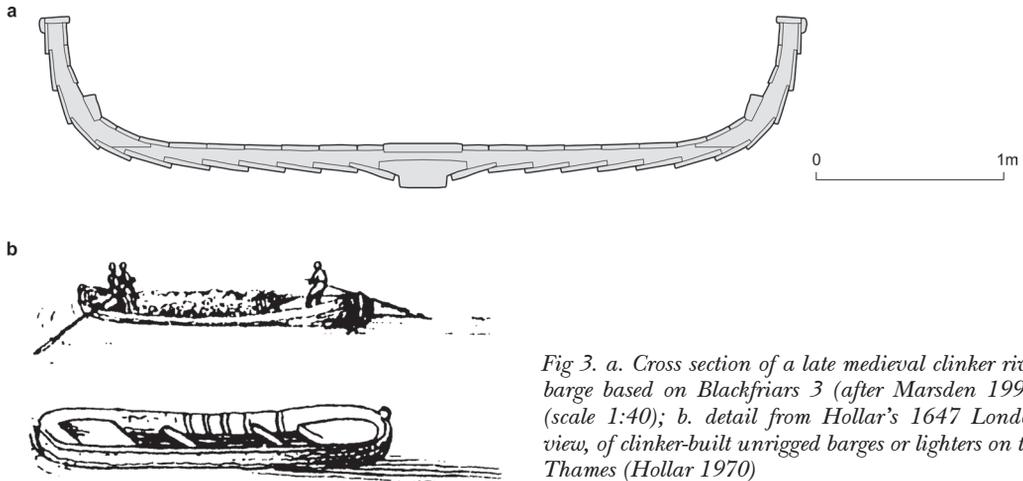


Fig 3. a. Cross section of a late medieval clinker river barge based on Blackfriars 3 (after Marsden 1996) (scale 1:40); b. detail from Hollar's 1647 London view, of clinker-built unrigged barges or lighters on the Thames (Hollar 1970)

has also been archaeologically documented in the historic core of London in the form of a few largely complete vessels and many more fragmentary and reused timbers derived from them (Goodburn 1991; 2002a; in prep; Marsden 1994; 1996). Detailed investigations of the timbers have shown that the principal method of construction used was that normally termed 'clinker built' (sometimes also 'clencher', or 'lapstrake'; Fig 3a). In this system planks used were carefully shaped to partially overlap to form the hull shell, then strengthened by internal frame timbers. At the overlap the planking was strongly fastened, most commonly using forms of iron rivets or 'rove nails', but the use of specialised wooden pegs or 'treenails' or a combination of both is also known in some examples. The English evidence shows variation through the medieval period, but it is clearly part of the tradition of clinker construction used across north-western Europe.

All the current archaeological, pictorial and documentary evidence clearly shows that from the early medieval period until the 16th century English craft built in the clinker tradition were pointed at both ends; the term 'keel'-type craft is often used as an umbrella term for these vessels. The building of such elaborate planked craft required the use of a wide range of skills and volume of raw materials, and appears to have been reserved for medium-sized to large craft in the medieval period. A key feature of vessels

built in the keel style until the 16th century in the London area was that most, if not all, of the hull planking was made of carefully split out ('cleft') and axe-trimmed planks (or 'boards'). These planked craft were, in materials and labour terms, clearly of higher status than dugout boats.

Other traditions of planked vessel construction have been documented in north-west Europe that could have been used on the Thames and Lea estuaries (Crumlin-Pedersen 1983). These building traditions include the 'Kog' (or 'Cog') tradition with smooth, rounded bottoms of planks laid edge to edge but overlapping on the sides, with particular suitability for shallow water use. Currently only a few 13th-century re-used planks from a craft built in this style have been found, such as those discovered at Westminster (Goodburn 1997). Also suited to shallow water use were a range of vessel types built with totally flat bottoms and shallow straight sides, resembling modern river punts and Thames steel cargo lighters. In European nautical archaeology literature these are usually termed 'praams' (Crumlin-Pedersen 1983). This type of craft is not evidenced from medieval England, even in shallow water river systems like the lower Lea, where the usage of such a hull form would have been very advantageous. However, there is evidence of this type of craft being used in the London region by the 16th century. These vessels were built in a radically new style with wide flat bottoms

of sawn planks, joined at their edges with pegged free tenons and appear to be what was termed ‘West Country’ or ‘western barges’ in the London region (Divers 2002; Goodburn 2002b). The remains of one such craft has been recorded in the Lea Valley at Dace Road (Fig 4).

Medieval and Post-Medieval Boat and Barge Finds from the Lower Lea Valley

The range of boat and ship building technologies found in craft that plied the Lea and its tributaries in the medieval to post-medieval periods is considerable (Fig 4). In the early medieval period small dugout boats were in use. One 10th-century example, found in 1987 at Clapton, has been studied in detail (Marsden 1989). This craft was only *c.*3.8m long by 0.65m wide and 0.4m deep amidships. An authentic replica of the craft was built and it proved capable of carrying around three medium-sized adults in calm water (Goodburn & Redknap 1988; Goodburn 2002b). This craft was clearly of modest status and probably multipurpose. A total of four dugout boats of closely similar form have now been found in the Lea; the other three vessels were discovered during either reservoir construction or gravel extraction between 1900 and 1952 at Sewardstone, Walthamstow and Waltham Cross (McGrail 1978, 268, 280). The Sewardstone and Walthamstow examples have been radiocarbon dated to cal AD 805–1025 and cal AD 620–885 respectively (Marsden 1996, 222). It is not certain when dugout craft finally passed out of use in the Lea Valley. It might have been quite late in the medieval period, as the hinterland of the Lea was moderately well wooded and dugout boats are known to have been built in some areas

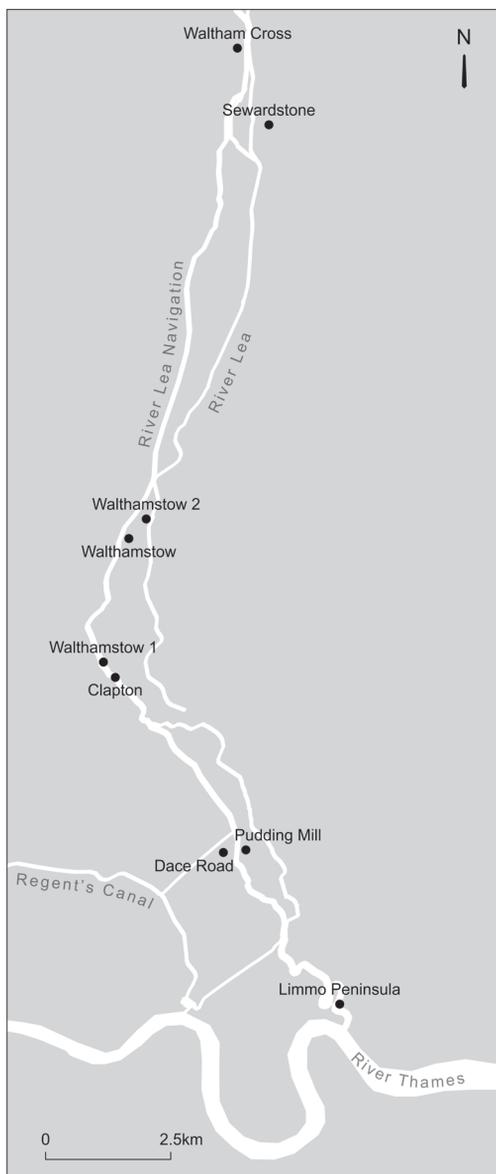


Fig 4. The lower Lea Valley with significant boat finds mentioned in the text: dugout boats from Waltham Cross, Sewardstone, Walthamstow and Clapton; 16th- to 17th-century clinker barge finds, Walthamstow 1 and Walthamstow 2; the small early 19th-century clinker boat from Pudding Mill; the western barge from Dace Road; the Leamouth medieval boat and small 19th-century boat from the Limmo Peninsula (scale 1:150,000, inset 1:1,250,000)

of England well into the later medieval period and occasionally later (McGrail 1978; Goodburn 2002a).

It appears that all these dugout boats were abandoned, then moved by river currents and then buried within channel (or infilled channel) sediments. Oak dugout boats are particularly heavy and require little water-logging to sink.

Prior to the Crossrail excavations, the extensive collection of boat finds from the Lea contained a large gap extending from the 10th century to the 16th or 17th century, which is now partially filled by the finding of the Leamouth hull section (described and discussed below).

Two clinker-built barge wrecks of 16th- or 17th-century date were found further upstream within the vicinity of Walthamstow (Fig 4; Fenwick 1978). The first, 'Walthamstow 1', was found in 1830 in an 'old course of the River Lea' (Fenwick 1978, 188). Unfortunately, few details were recorded apart from that it was *c.*6.1m long with a width ('beam') of 1.84m and depth of roughly 0.46m and waterproofed with 'cement and cow hair'. The remains of a second clinker-built vessel were found nearby in 1900. This vessel is known as 'Walthamstow 2'. It was recorded in more detail (Fenwick 1978). It was found bottom-up below 1.65m of alluvium within an infilled river channel. It was described as being *c.*14m long, with a width of 2.15m. Some more technical details were also noted about the construction of the lower part of the hull. The clinker bottom planking was fastened to a shallow central plank keel timber (described as elm (*Ulmus* sp)) and the planks were *c.*0.3m wide and 25mm thick, and fastened at the overlap with iron rivets set *c.*110mm apart. Specialised wooden pegs or treenails were used to fasten the notched framing timbers into the hull shell of planks. Traces of close-fitted, hold lining planks set over these timbers were also found, showing that the vessel was built to carry cargoes. It is clear that this was some form of narrow, shallow barge with a relatively flat bottom, probably one of the local 'shouts' or 'showts', a term known from the 13th century (Halsey & Watson 2011, 14). Some of the details recorded, such as the central, shallow, elm plank keel and plank widths, match clinker barge elements

found reused on a number of Southwark sites dating to the 16th and 17th centuries; this suggests that the date range proposed by Fenwick is broadly correct (Marsden 1996; Goodburn 2002b).

Both these barges appear to have been lost accidentally, possibly during severe flooding. If these craft were old and worn then the costs of salvage may have been considered too expensive. These two finds indicate that there was a continuing tradition of using small clinker-built barges on the River Lea into at least the 17th century. It is suggested that the Leamouth fragments may be evidence of an earlier form of clinker river barge or shout used on the Lea and Thames, plus adjoining rivers and sheltered portions of their estuaries. Wenceslaus Hollar's London panorama of 1647 shows a number of clinker-built barges or lighters on the Thames; these vessels developed from medieval shouts or barges (Fig 3b; Hollar 1970).

At Dace Road (Fig 4), north of Bow, excavations revealed evidence of several late 18th- or early 19th-century timber-lined industrial tanks. One of these tanks was largely built out of timbers salvaged from a western barge-type craft including tenon-joined sections of elm bottom planks and an oak (*Quercus* sp) frame timber (Goodburn 2008). This discovery suggests that this type of vessel was used locally during the 18th century. Eventually this style of simple, flat-bottomed hulk form was also adopted for barges built specifically to operate on the River Lea and the tidal Thames and estuary. An early 20th-century example even survives in restored condition today – the *Lady of the Lea* – which was built to carry gunpowder from the Waltham Abbey works.

The ancient clinker system of boatbuilding continued to develop in the Greater London region during the post-medieval period, but was latterly reserved for use in small vessels, including pleasure craft. A Georgian period small, clinker-built craft was found alongside the Pudding Mill river branch of the Lea, just east of Bow, where the 2012 Olympic stadium now stands (Fig 4; Goodburn 2012; Fairman 2011). This boat was *c.*75% complete, though distorted by overburden. It was *c.*4.5m long with a beam of 1.51m and original depth of over 0.5m. It was planked in sawn elm with fine, notched ('joggled') oak frame timbers.

Although clearly a rowing dinghy as first built, it was adapted for sailing and ended its life as an improvised wild-fowling boat. This boat possessed some design features seen in earlier examples of local craft. For example, wrought iron rove nails and waterproofing of tarred hair were used in repairs to the hull, though the original lap nails in the Pudding Mill boat were handmade of copper. This old, worn and repaired boat was abandoned by the foreshore and incorporated into landfill during the 19th century.

The lower Lea channels were generally shallow and evidence for the use of large, seagoing vessels appears to have been limited to the deeper estuarine portion. Indeed, around the confluence with the Thames, several shipyards developed from the 17th century onward, including the British East India Company yard at Blackwall and a smaller yard at what became known as 'Pierhead' to the south-west amongst others (Banbury 1971; Pitt *et al* 2003). As ship breaking and repair took place in the Leamouth area, it is not surprising that recycled ship timbers from larger 'carvel built' (a system of vessel construction with a strong framework supporting hull planks laid edge to edge) vessels have also been discovered in the lower Lea Valley. However, these have generally been found as reused timbers in the 18th- and 19th-century waterfront, as far north as Temple Mills (Powell 2012, 283–4). In *c.*1846 the Thames Iron Works shipyard was established on the site at the Limmo Peninsula (Harrison 2015). Archaeological fieldwork carried out here as part of the Crossrail project revealed structural evidence of the ironworks and also a section of the bottom of a mid to late 19th-century, small, simple, flat-bottomed wooden boat (*ibid*, 82–3).

This brief survey of the nautical archaeology of the lower Lea shows that this river system contains a substantial amount of material that comprises a corpus certainly of regional and possibly even national, importance.

THE LEAMOUTH HULL SECTION

Recording the Vessel Hull

The initial recording of the hull (XRW10; context [79]) took place on-site and

principally comprised the making of a detailed 1:10 plan of the upper face of the timbers (Fig 5b). With help from MOLA conservators, the hull was further cleaned and carefully turned over. Off-site the underlying organic sandy alluvial deposits were gently cleaned away using water. The lower 'outboard' face was then drawn and photographed (Fig 5a). Written records were made of technological details such as the method of conversion of the timbers, form of jointing and waterproofing used. The timbers were sampled for tree-ring study and dating, where applicable samples were also taken of the tarred hair waterproofing material. The recording methodology used was in line with standards laid out in the English Heritage Guidelines (Brunning 1996).

The Articulated Hull Planking or 'Boards'

The part of the Leamouth boat section that lay within the shaft extended north-south *c.*1.75m (Fig 2), which would have been roughly parallel to the tidal flow. The planking slab was *c.*0.95m east-west, parallel with the vessel's original frame timbers (Fig 5). The hull section had no remaining frame timbers, but did have part of five runs of slightly overlapping boards or sections of 'strakes'. These included sections of two strakes with end-to-end joints or 'scarfs', so that those strakes included two separate boards in the part of the hull found. These scarfs were a simple bevelled overlap *c.*150mm long (*ie* 'plain' or 'through-splayed' scarfs) and were secured with two or three iron rivets or rove nails. The two scarfs were staggered so as to avoid creating a point of weakness in the hull. Their orientation was set to allow the water to flow over them, rather than into them, on the moving vessel. This regular practice indicates that the articulated hull section derives from the starboard side (right looking forward), fairly near the bow (front end of the hull), and the general shape of the board edges suggests it was probably about halfway down the side of the hull (Fig 6b).

A repair board or 'tingle' had also been fitted, rather weakly, on to one board and was secured with small iron nails with hooked-over tips (Fig 5a). The boards varied in width and shape slightly, so as to fit the original complex curved hull of the parent

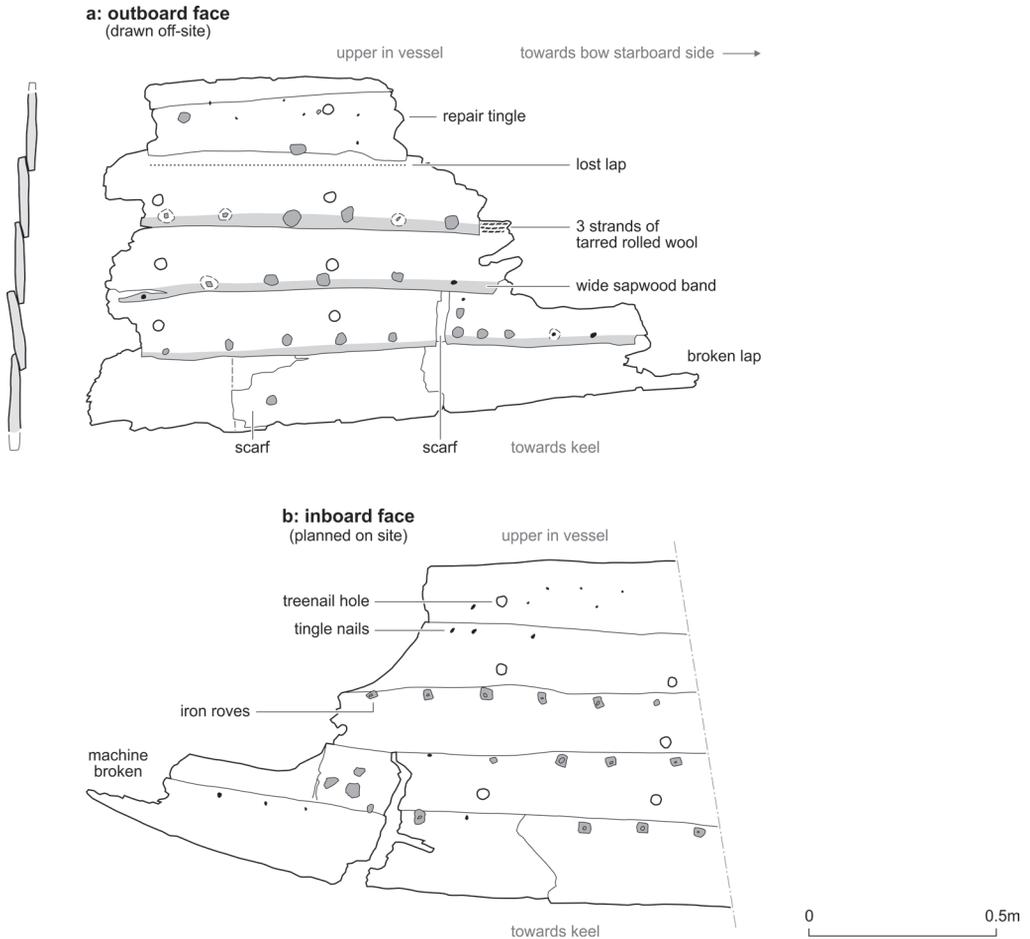


Fig 5. Leamouth hull section from the starboard bow area of the barge: a. outboard face of the hull; b. inboard face of the hull (scale 1:20)

vessel, and were up to 220mm wide and up to *c.*25mm thick, where least eroded, and would have been a little thicker originally. In Fig 5 the cross section of the hull has been flattened out by the great weight of overlying deposits. The boards were made of radially split or 'cleft' native oak (Fig 6a). The boards must then have been axe-trimmed, though wear and surface erosion had removed the original tool marks in this case, except for faint axe marks inside the scarf joints. Radially cleft oak boards were particularly strong and shrunk less than sawn oak planks and so were particularly suitable for boat and ship building. This was well suited to clinker-style construction, where slight irregularities in the boards mattered less than in other

systems of building. Their use continued into the early 17th century in the London region in some vessels, but was eventually superseded by sawn planking.

The laps between the strakes were fastened with iron rivets or rove nails set at *c.*150mm intervals. The nails were corroded and concreted, but it could be seen that they had large, sub-rectangular heads on the outboard face of the hull and roughly square washers or 'roves' on the inboard end of the rivet with a maximum dimension of *c.*35mm across. The roughly square shanks were up to *c.*6–7mm across. The overlap or 'land' and the scarf joints were trimmed smooth and flat, and further waterproofed or 'luted' with tarred animal hair rolled into loose strands,

with up to three in the 'lap' (Fig 5a). This approach to waterproofing is well known in most other London finds of the period, such as in the reused slabs of clinker planking found at Kingston upon Thames (Surrey), west of London, dating to *c.*1300 (Goodburn 1991; 2002a). The laps varied in width from *c.*40mm to *c.*50mm, but were eroded as were all the timbers, so presenting very accurate dimensions here would be misleading. No traces of tar or paint survived.

A distinctive, and surprising, feature of the hull section was that a large amount of perishable and rot-prone sapwood was left along the lower overlap of most of the boards (Fig 5a). This would have made the outboard strake edges rather vulnerable to damage. It is quite clear that the parent log used was large and straight-grained, but not quite as large as that used in most other medieval clinker boat boards recorded in detail in the region (Fig 6a). This presumably indicates

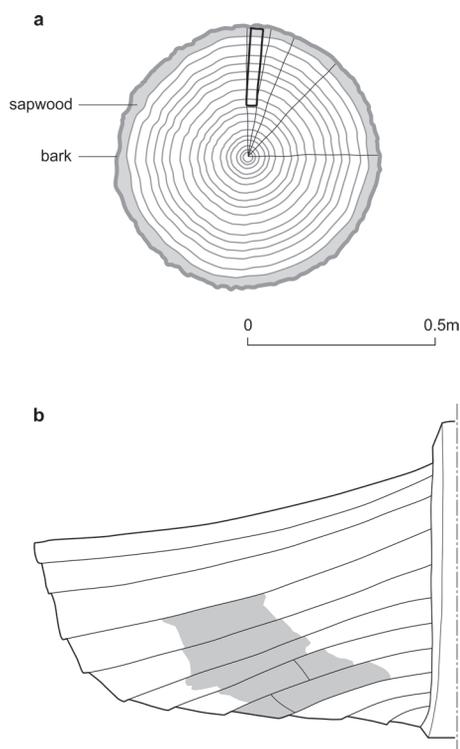


Fig 6. a. Section of the parent oak log used for the radially cleft oak boards from the Leamouth boat (scale 1:20); b. approximate point of origin of the hull section in the parent vessel viewed from the bow (not to scale)

the usage of relatively low cost materials, as smaller sappy boards would be cheaper, but not as durable as entirely heartwood boarding.

Secondary Evidence for the Framing Used

There was no surviving framing found attached to the slab of hull side, but its original location is indicated by lines of trenail holes once occupied by tight fitting wooden pegs or trenails that held the framing in place (Fig 5). These holes were set between *c.*0.40m and *c.*0.45m apart, showing that the original framing was set fairly close together for strength. Most of the trenail holes were *c.*20mm in diameter, but some were clearly larger at *c.*25mm diameter. This difference of size may indicate a phase of major repair of the upper part of the parent hull at this point. A faint impression of the outboard ends of the holes being slightly expanded or 'countersunk' suggests that the trenails used once had expanded heads, as have been found on many other boat finds from Greater London of similar date.

Dating and Provenance of the Leamouth Boat Timbers

The technological features described above suggest a late medieval date was most likely (*c.*13th–15th century). Several of the boards retained extensive sapwood (over the 50 annual rings required for tree-ring dating); five samples were taken. Unfortunately two samples had too few rings for analysis and none of the other three samples could be matched to reference curves, despite one having as many as 114 rings (Tyers 2012). The samples did not match each other, confirming that they were not derived from the same oak tree. The lack of a match also prevented the sourcing of the boards to a particular region.

A sample of the tarred hair waterproofing material was taken for radiocarbon dating in order to provide a date representing the last stages of construction or subsequent repair and so most closely related to the last use of the boat. The results provided the date range of cal AD 1220–90, dating the boat to the early part of the age range given on technological grounds (Table 1).

Table 1. The results are conventional radiocarbon ages (Stuiver & Polach 1977) and are quoted in accordance with the international standard known as the Trondheim convention (Stuiver & Kra 1986); calibrations relate the radiocarbon measurements directly to the calendrical time scale and are calculated using the datasets published by Reimer et al (2013) and the computer program OxCal v4.2 (Bronk Ramsey 1995; 1998; 2001; 2009). The ranges have been calculated according to the maximum intercept method (Stuiver & Reimer 1986) and quoted in the form recommended by Mook (1986)

MOLA ref	Lab no.	Material	Pretreatment	$\delta^{13}\text{C}$	Radiocarbon determination	Calibrated date (cal years AD) (95% probability)
XRW10_<79>_hair	UBA-21608	Tarred animal hair	Acid only	-25.1‰	743±31 BP	1220–90

Analysis of the section of hull indicates that the point at which the tarred hair sample was taken was associated with the fitting of the repair tingle (Fig 5). This implies that the date bracket for the parent craft must have been a little earlier perhaps *c.*1200–70.

Comparison of the Leamouth Boat with Other Medieval Clinker-Built Boats from Greater London

The Custom's House 1 boat find recovered from the City of London waterfront comprised large sections of articulated planking taken from a medium-sized clinker vessel or river barge, with a beam of *c.*3.5m and length of over 9m (Marsden 1996, 41–54). It was tree-ring dated to 1160–90, at least 30 years earlier than the parent vessel of the Leamouth boat. The tree-ring study also shows that it was built of boards derived from the south-east part of the country (Tyers 2012). Several constructional details were similar to those of the Leamouth boat, such as the general clinker construction, spacing of the framing at *c.*0.41–0.45m centres and the use of three rolled strands of tarred hair waterproofing material in the laps. However, the radially cleft oak boards used were subtly different, being a little wider and from much older (*c.*250 years old) oaks. Also, the builders clearly had access to boards with a suitable width of heartwood; sapwood was only found on one board edge even though far more survived than in the Leamouth find. The wider significance of this difference in the oak boards is discussed below.

Three discoveries of large sections of reused clinker vessel sides discovered at the Kingston Horsefair (Surrey) site and sections

of a large oared ship or 'galley' reused in fish pond linings in Southwark provide some comparative evidence of larger seagoing craft of the period (Goodburn 1991; 2003). The mainly radially cleft oak boards used in the two larger Kingston finds (Horsefair 2 and 3, dated to *c.*1300) varied in maximum thickness from 45mm to 50mm, but were only slightly wider than those of the Leamouth find. The frame treenails were also larger. The main cleft hull boards of the Southwark clinker galley fragments were of *c.*40–45mm maximum thickness and traces of very heavy framing were found. That vessel has been shown by tree-ring study to have been built of Irish, wildwood-type oak boards dating to *c.*1270. This vessel was subsequently extensively repaired in England, probably within the London region, where she was eventually broken up for reuse.

Finally, some comparisons can be made with the Blackfriars 3 vessel, found in the City of London, which was a largely complete clinker barge (or showt, shout) built in *c.*1400 (Marsden 1996, 55–104; Fig 3b). This craft was of keel type, pointed at both ends and was *c.*14.5m long with a beam of 4.3m, and was thought to have been *c.*0.9m depth of side amidships. It had a broad plank keel and flattish but rounded bottom, and was clearly built for use as a river and estuary barge. The framing was spaced slightly further apart than in the Leamouth example at *c.*0.46m centres, but the radially cleft oak hull boards were a maximum of *c.*250mm wide and varied from 25mm to 50mm thick. Showts were clearly used to bring cargoes such as timber down the River Lea to London, as shown by a record of 1316–17 in which timber foundation piles were carried

to the City from Waltham (Marsden 1996, 99). Earlier documentary evidence suggests shows were also used to carry grain down the Lea from the agricultural hinterland to the Thames as early as 1295–6 (Halsey & Watson 2011, 14).

The comparatively close spacing of the framing elements, shown by the spacing of the treenail fastening holes, implies a moderately robust construction, if on a relatively modest scale. This would currently seem to fit best with the use of the parent vessel as a small cargo carrier or river and estuary barge rather than a fishing vessel or a light speedy passenger carrier, which would have possessed a wider spacing of framing timbers.

The large amount of sapwood present, together with the considerable wear of the planking seems to indicate that the hull section derives from a relatively cheaply built barge or showt designed for work on the River Lea and estuarine Thames.

Trees Used in the Leamouth Boat and Their Type of Environment

The exceptionally large amount of sapwood left along the vulnerable plank edges, and relatively weak repair patch installation, imply economies in the use of boards not really wide enough for the job (Fig 6a). It would appear that straight-grained parent oak logs of only 0.65–0.70m in diameter would have been large enough for the boards used. The latter is true if the aim was to produce *c.*32 boards a log, as indicated by the archaeological evidence (Goodburn 2002a). However, if only 1/16th split sections were aimed for, a smaller diameter log could have been used, but much more axe shaping ('hewing') would have been required to finish the boards. Though quite large, these suggested parent logs would have been cut from smaller oaks than were used for the planking of most other London-region clinker boat finds of this period (Goodburn 2002b; 2003). The bulk of the boards also seem to have been cleft from logs cut from trees of moderate, rather than the slow (narrow-ringed), growth typical of wildwood-type woodland (Goodburn 1998; 2003). It seems likely that some of the parent trees used for this boat's boards were growing in

more open managed woodland of typical later medieval type. This contrasts with the much slower-grown and narrower-ringed oak timber used in the mid to late 12th-century Custom's House boat, for example (Tyers 1996). Early documentary sources for large-scale ship building in the Greater London region show that woodland along the upper Lea Valley and its tributaries were important sources of timber (Friel 1995, 51; Johnson 1927, 432).

The Likely Origin of the Leamouth Boat

The lack of an immediately local medieval settlement or any evidence for an *in situ* timber structure suggests that this particular section of boat hull was probably not reused in a riverside revetment. Perhaps it is more likely to have been derived from a dismantled or abandoned old vessel. The evidence of wear and insubstantial repair probably indicates that, on balance, a beached, worn-out, abandoned, old hulk was the most likely source of this section of hull, which became detached and was probably swept away and buried during the break-up of the vessel. This event probably took place during the late 13th or early 14th centuries.

CONCLUSIONS

The Leamouth find fits within a long-lived tradition of clinker-built, small cargo vessels used in London's hinterland on the Rivers Lea and Thames. It was clearly not large enough to be part of a large seagoing vessel, although too little of it survives to be able to reconstruct its overall size or form. It is also just possible that it might have been employed in the 'fishery' controlled by the local abbey and recorded in the Leamouth area (Barber *et al* 2004, 118). Even if that fishery was one of static fish weirs, the produce had to be transported to market which would have been easiest by water, so watercraft would have been part of the infrastructure needed.

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