

Re-used Boat Planking from a 13th-century Revetment in Doncaster, South Yorkshire

By S. J. ALLEN, D. M. GOODBURN, J. M. MCCOMISH
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AN EXCAVATION was undertaken during 1993–4 on a site at Low Fisher Gate, Doncaster. Urban archaeological deposits of 11th- to 18th-century date, together with evidence of an earlier course of the River Cheswold (the southern arm of the River Don), were uncovered. The excavations were among the largest ever to take place within Doncaster. Among the most significant finds was a riverside revetment, made from re-used portions of two medieval clinker-built boats. These have characteristics not recorded elsewhere which may represent features of a now lost, South Yorkshire boatbuilding tradition. This type of find is still rather rare and the Doncaster timbers add to knowledge of the variety of local vessels and construction features present in the medieval period. The rolls of fibrous material used to waterproof the vessels were also of interest for comparison with similar finds from England and Norway. The boat timbers have been fully conserved and are now on display in Doncaster Museum.

INTRODUCTION

By J. M. McCOMISH

Boats and ships played a key role in the life of medieval South Yorkshire and port facilities were clearly crucial to the operation of medieval trade and to the development of towns. Despite this, only a few excavations of ports have been published outside London.¹ This paper sheds some light on river-based trade in medieval Doncaster. In addition, the issue of medieval river levels in the town is brought into focus by the finds.

Doncaster is located at the highest navigable point of the River Don where the river divided into two branches, called the Don and Cheswold. A Roman fort was built to the south of the River Cheswold, around which a civilian settlement was established (*Danum*). Although relatively little is known about Doncaster in the Anglo-Saxon Period, a burgh with defensive ditches was constructed on the site of the Roman fort and a settlement at Doncaster in A.D. 764 is referred to in the *Historia Regum*, a 12th-century document attributed to Simeon of Durham.

The town underwent a number of major changes following the Norman Conquest. A motte-and-bailey castle was built on the site of the burgh and a new

¹ G. Milne, *The Port of Medieval London* (Stroud, 2003).

main street called French Gate was created, with associated burgage plots. The name of the street implies a deliberately planted Norman French colony in the town.² In the late 12th century a defensive ditch surrounded the town and a triangular-shaped market place was established adjacent to the parish church of St Mary Magdalene.³ The castle was demolished in the reign of Henry II and was replaced by the church of St George which may have originated as the castle chapel.⁴

Doncaster was clearly an important inland port in the post-Conquest period. Among the most notable exports from the town were the products of its potteries which have been traced to Hedon (Humberside) 72 km away, and possibly even to Bergen in Norway.⁵ Small suburbs developed beyond the town ditch during the Middle Ages, but overall the pattern of settlement remained little changed until the dissolution of the various religious establishments in the town in the mid-16th century.⁶

In 1993–4 the South Yorkshire Archaeology Service undertook archaeological excavations at a site on Low Fisher Gate (a site also known as ‘North Bridge’), on behalf of the Borough Engineering Department of Doncaster Metropolitan Borough Council. The site director was J. M. Lilley (now McComish) of York Archaeological Trust, who was seconded to the South Yorkshire Archaeology Service for the duration of the project.

Low Fisher Gate is located adjacent to the River Cheswold (now the River Don new cut), and was the obvious location for riverside trade (Fig. 1). The excavation was undertaken as part of a major road building operation called the Doncaster Gyrotory Scheme. Although there are relatively few pre-18th-century references to Fisher Gate, it is of interest that a shipwright is mentioned in 1620 and boatmen are mentioned in the Window Tax Assessment of 1788. In addition, a lane running between Fisher Gate and the river is referred to as Common Shore on a map of 1767, and the 1852 Ordnance Survey map shows this lane leading to Common Staithe.⁷ The terms shore and staithe are of medieval origin, and imply the ancient usage of the area for the loading and unloading of goods on to ships.⁸ It was hoped that the excavations would confirm the usage of the area as an inland port.

This article relates to the single most important aspect of the excavations, namely timbers from two medieval boats which were re-used to form a riverside revetment. Dendrochronology could only provide a date for one of the boats, which was late 12th-century. The second boat, though still clearly medieval, may have been slightly later in date. A brief summary of the stratigraphic sequence of the site is given by way of introduction, followed by a description and interpretation

² D. Johnson, North Bridge Project, Desk Top Assessment (unpubl. rep., Babcie Group, 1999), 7 and 12.

³ D. Hey, *Yorkshire from AD 1000* (London, 1986), 137.

⁴ J. R. Magilton, *The Doncaster District: An Archaeological Survey* (Doncaster, 1977), 34.

⁵ P. C. Buckland, J. R. Magilton and C. Hayfield, *The Archaeology of Doncaster 2: The Medieval and Later Town*, (BAR Brit. Ser., 202, Oxford, 1989), 39.

⁶ *Ibid.*, 37.

⁷ Buckland et al., *op. cit.* in note 5.

⁸ J. M. Lilley et al., Archive Report on Archaeological Excavations at Low Fisher Gate, Doncaster (unpubl. rep., York Archaeol. Trust, 1998), Appendix 18.

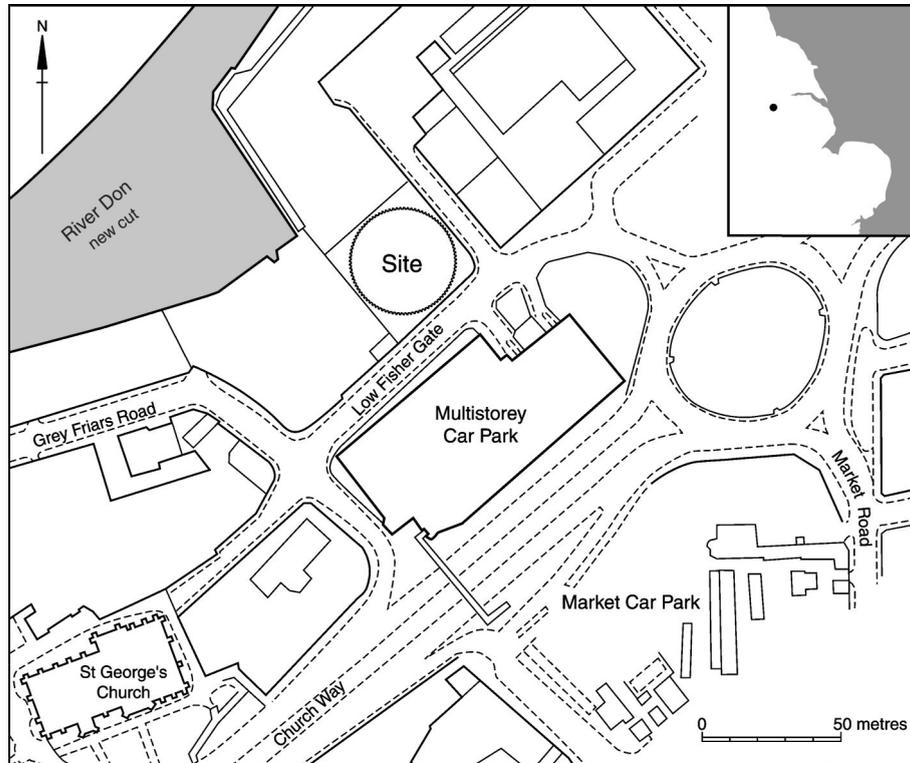


FIG. 1

Location of Doncaster and the site.

of the timbers and a report on the tarred animal fibres used to waterproof the boats. A glossary of technical shipbuilding terms is given as an Appendix to this article.

THE EXCAVATED REMAINS

Excavation took place within a circular coffer-dam 37 m in diameter. The uppermost 1.75 m of deposits were of 19th- to 20th-century date and were cleared by machine; the upper surface of these deposits was 10.00–10.17 m AOD. A further 1.50–2.75 m of deposits was hand-excavated and yielded a well-stratified sequence of 11th- to 18th-century date. Following a change in government policy, the Department of Transport withdrew funding for the Doncaster Gyrotory road scheme, of which the archaeological excavations were a part. Consequently, it was not possible to publish the results of the excavations, but a full archive was prepared with the generous help of Doncaster Metropolitan Borough Council. This archive is available for study at Doncaster Museum, the South Yorkshire Sites and Monuments Record and the South Yorkshire Archaeology Service.⁹

⁹ Lilley et al., *op. cit.* in note 8.

A few isolated features of 11th-century date were present on the site, though it was unclear if these pre- or post-dated the Norman Conquest. During the 12th century the site seems to have been largely open ground used for ironworking, with a number of external hearths and associated dumps of ash, charcoal and slag being present.

At some point in the first half of the 13th century, the site was sub-divided into tenements, each containing a timber building fronting on to Low Fisher Gate, with a yard to the rear that continued to riverside structures on the banks of the River Cheswold. This remained the pattern of land use until the late 15th century, though the tenement boundaries varied slightly through time and the timber structures fronting on to the street were rebuilt on numerous occasions. In addition, the river channel seems to have been infilled, probably through deliberate land reclamation. The tenements seem to have been primarily industrial in nature, being associated with ironworking from the early 13th century onwards, and with shoe manufacture and repair from the 14th century onwards. There is some evidence that the site was flooded in the late 14th or early 15th century, but land-use remained largely unaltered despite this.

During the late 15th century a circular cut, 8.5 m in diameter, was dug on the site. This was interpreted as a pond used for the watering of livestock and implies that the site had become a stock-yard by this date.¹⁰ Among the finds of late 14th- to 16th-century date were the remains of two waterproofing rolls and fragments of thick-walled pots with tar and fibres adhering. These items had almost certainly been used in the preparation of waterproofing material for boats and clearly imply that boatbuilding or repair was taking place nearby.

A few 16th- to 18th-century features were located: a copper-smelting furnace, some rubbish pits, and a number of stone-lined features including a well, cistern and drain. These features contained a small number of re-used post-medieval boat-timber fragments. Although these timbers lie outside the scope of this publication a few points are worthy of note. The timbers derive from a smooth-skinned 'carvel', constructed from sawn planking made from small, heavily knotted and twisted grained oak trees. The timbers were lined with a felted layer of animal hair (probably cattle hair) and the gaps between the board edges were filled with a plant fibre (probably hemp) and wood tar. The use of plant fibres dates these finds to the 16th century or later.¹¹ All of the 16th- to 18th-century features were sealed by Victorian deposits.

THE WATERFRONT STRUCTURES, A SLIPWAY AND REVETMENTS

As far as this report is concerned, it is the early to mid-13th-century phases of the site (Fig. 2) that are of particular interest, as they contained riverside structures. These represent both the deliberate reclamation of the river bank area and the creation of a waterfront where boats and barges could be offloaded with ease.

¹⁰ A. R. Hall, H. K. Kenward, and J. M. Lilley, 'Pattern in thinly-distributed plant and invertebrate macrofossils revealed by extensive analysis of occupation deposits at Low Fisher Gate, Doncaster, U.K.', *Environmental Archaeol.*, 8 (2003), 129–44.

¹¹ P. Walton Rogers, pers. comm.

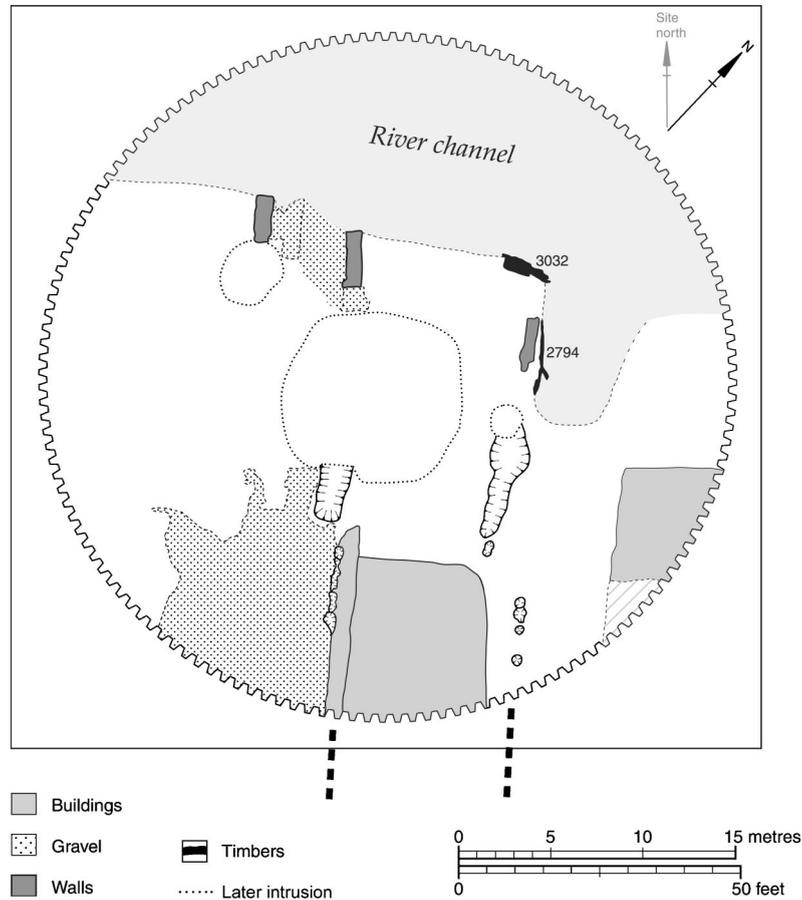


FIG. 2

Location of waterfront timbers on site.

Within the south-westernmost tenement a layer of limestone fragments was laid down above the sloping river-bank. A pair of dry-stone walls, each c. 3 m long, up to 0.8 m wide and 4 m apart was then constructed. The walls were aligned NW.–SE., i.e. at right angles to the river channel, and effectively created a walled passageway with a sloping stone surface. The lower end of this passageway (adjacent to the river) was at 5.25 m AOD and the upper end was at 6.41 m AOD. This structure (a slipway or possible ‘draw-dock’) gave access to the river channel. Rammed into the sloping stone surface was an isolated timber post, perhaps for the tying up of boats. A timber plank was also located to the south-west of the slipway walls which may represent a repair or some kind of shoring associated with construction. Curiously, the remainder of the waterfront in this tenement did not have any form of revetment parallel to the river channel and seems to have remained as a simple sloping bank. A 12th-century structure employed for unloading boats was excavated at Hartlepool, but otherwise there is little evidence

for this activity from northern England.¹² There were no structures adjacent to the street frontage within this tenement when the slipway was built, although there was an extensive gravel surface at a height of c. 7.44 m AOD. It is possible therefore that this tenement represented a yard for the unloading of cargoes, or possibly of estuary or sea fish, from boats tied up at the slipway, as at medieval 'Queenhithe' London, where formal quays were built during the 12th century.¹³

In the central tenement, c. 7 m to the north-east of the slipway, was a length of timber revetment (Context 3032) aligned roughly NW.–SE., i.e. parallel to the river channel, the base of which was at c. 4.13 m AOD. This revetment was only found on the very last day of excavation, and consequently was removed with great haste. In order to lift the timbers quickly they had to be sawn into smaller, easily portable sections. Only the north-easternmost 3 m of Context 3032 could be excavated within the time available, and the timbers clearly continued for an unknown distance south-westwards. An isolated timber just 1 m to the north-east of the slipway implies that the revetment continued for the full width of the tenement. Context 3032 was made from re-used clinker-built boat planks held in place by substantial upright timbers, and the revetment survived to a height of c. 1 m. It is possible that the structure was originally taller as the upper portions of the revetment were badly broken and decayed. Assuming this is the minimum height of the revetment, boats up to 0.75 m draft would have been able to use it. Evidence from both dendrochronology and the waterproofing materials suggested a late 12th-century date for the construction of the boat from which the revetment was made. There was a building fronting on to Low Fisher Gate within this tenement and no clear signs of any access routes leading from the building to the waterfront. It is possible therefore that this revetment represented an attempt to reclaim land within the tenement rather than an attempt to create a mooring for boats. It is impossible to be sure precisely how the slipway and this timber revetment related to one another, but the spatial relationship suggests they were contemporary.

The precise layout of the north-easternmost tenement is less clear, but it may have been a small inlet. A stone wall c. 3 m long and 0.7 m wide bonded with clay, at right angles to the river channel, was located along the property boundary between the central and north-easternmost tenements. A second section of timber revetment (Context 2794) lay immediately north-east of this wall. The timber revetment could either represent the replacement of the wall or it could be a protective fender between boats and the stonework of the wall (as seen at the 12th-century harbour at Hartlepool).¹⁴ Context 2794 was aligned NW.–SE., was 4 m in length, 0.4 m wide and survived to a height of 0.66 m. It consisted of portions of re-used boat planking, together with timbers which were not derived from boats, held in place by two upright wooden posts. The lowest level of this structure was 5.36 m AOD and the uppermost was 6.02 m AOD. The construction of the wall and revetment would have enabled the loading/offloading of boats. Context 2794 was located c. 2.5 m to the south-east of the north-eastern end of timber revetment

¹² G. A. B. Young, 'Excavations at Southgate, Hartlepool, Cleveland, 1981–2', *Durham Archaeol. J.*, 3 (1987),

15–55.

¹³ Milne, *op. cit.* in note 1.

¹⁴ Young, *op. cit.* in note 12, 15.

3032, but as there were no direct stratigraphic links between the two revetments it is impossible to know whether they represented part of a single phase of construction or not. Evidence from the fibres used to line the laps suggests that the parent vessel for Context 2794 was more recent than that of 3032.¹⁵ This would tend to suggest two separate stages of construction for the timber revetments.

None of these waterfront features remained in use for long, due both to rising river levels caused by deposition of silt within the river channel and to deliberate dumping in the area to reclaim more land. These processes effectively moved the river channel north-westwards beyond the limits of the excavation. The slipway was infilled and obliterated from the landscape as early as the mid-13th century, and both the timber revetments were sealed over by the late 14th or early 15th century.

EVIDENCE FOR CHANGING RIVER LEVELS DURING THE MEDIEVAL PERIOD

The excavated remains clearly show that river levels in Doncaster have risen between the medieval period and the present day. The area used for the construction of the waterfront must have been dry for a long enough period to accommodate any necessary building work. In the case of Contexts 2794 and 3032 this could have been a relatively quick task involving the sinking of the various supporting vertical timber posts followed by the insertion of the re-used boat fragments. The slipway, however, would have required a longer construction period. The lowest level recorded on the revetment structures was 4.13 m AOD at the base of Context 3032 which suggests that the low tide in the 13th century must have dropped to at least this level to enable construction of these revetments. Maximum high tide was presumably somewhere in the region of 6.41 m AOD, as this was the uppermost level recorded on the slipway ramp.

The level of the occupation surfaces immediately above the slope of the river channel is also of interest in this regard. As it is unlikely that people would have chosen to build in an area prone to flooding at high tide, the height of these occupation surfaces should indicate areas that were above the tidal levels and therefore considered safe from flooding. In the 12th century occupation surfaces along the street frontage were at c. 7 m AOD, by the 13th century at 7.44 m AOD and in the 14th–15th century at c. 7.8 m AOD. The fact that the street frontage area was flooded in the late 14th–15th century at a height of 7.96 m AOD implies that river levels had risen by nearly a metre during the medieval period.

There is some evidence from 16th-century documents to suggest that the river may have been relatively shallow at that date. In 1507 the vicar of Doncaster was taken to court for obstructing navigation in the 'water of the Dun'. In 1592 the inhabitants of Stainforth, 11 km downstream of Doncaster, blocked the passage of the river by placing stepping stones across for themselves and their sheep.¹⁶ It is impossible to know if the river was equally shallow in the preceding medieval period.

¹⁵ See below, page 00.

¹⁶ Buckland et al., *op. cit.* in note 5, 38–9.

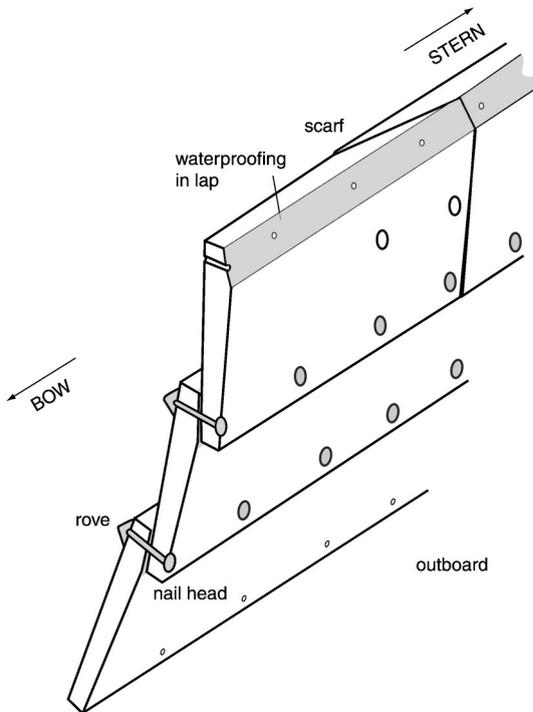


FIG. 3
Clinker construction.

THE BOAT PLANKING

*Interpretation by D. M. GOODBURN, and description of timbers by J. McCOMISH
based on information recorded by J. SPRIGGS and A. WALLACE*

This report discusses the timber revetments (Context 2794 and 3032) in turn, and sets the results in a national context. Whilst not unique in Britain, the boat fragments are very important regionally. They have characteristics not recorded elsewhere, such as the broken sheer line (the top edge of a vessel) apparent on Context 2794.

All the planking of nautical origin comes from vessels built in the clinker style, which predominated in medieval North European and English boat and shipbuilding.¹⁷ In clinker 'keel' construction the entire hull was built from overlapping planking (Fig. 3). In cog-type vessels some planking was laid edge to edge and the vessels were usually more flat-bottomed. There were many changes in the details of how planks for vessels were made during the medieval period, but most planks were made by controlled splitting and trimming with axes.¹⁸

¹⁷ G. Milne, C. McKewan and D. Goodburn, *Nautical Archaeology on the Foreshore* (London, 1998), 70.

¹⁸ D. Goodburn, 'An archaeology of medieval boatbuilding practice', 131–8 in *Medieval Europe, York Proceedings*, 2 (York, 1992).

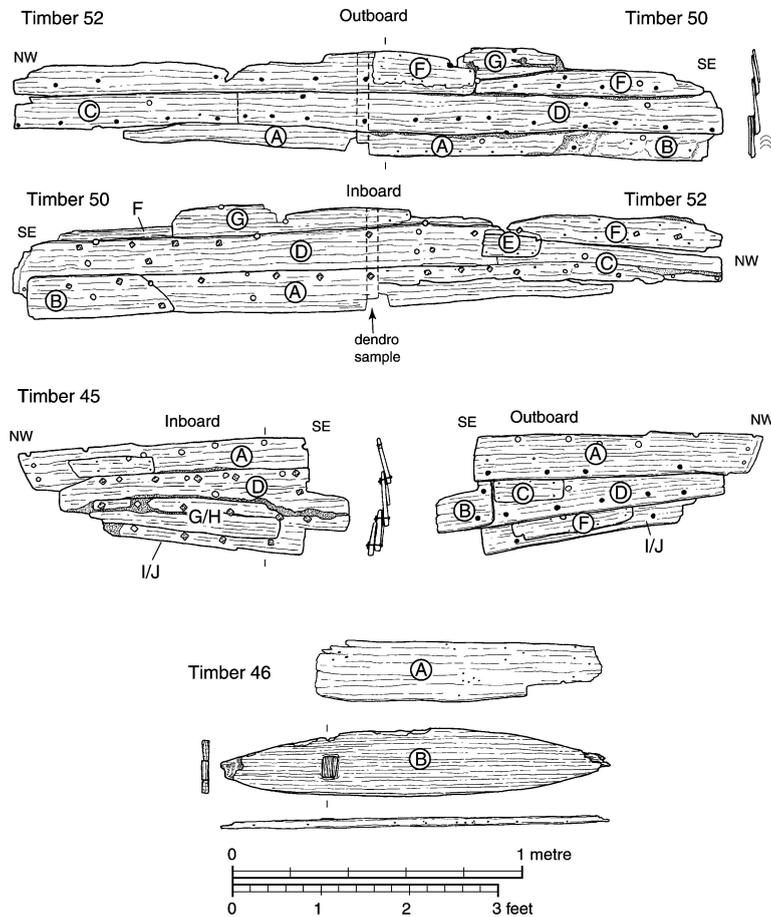


FIG. 4
Timbers from Context 2794.

DESCRIPTION OF THE TIMBERS IN CONTEXT 2794 (Fig. 4)

Context 2794 consists of two slabs of articulated planking which did not fit together but clearly originated from a single parent vessel. The first slab (Timber 45) forms part of the port side at the stern of the boat, while the second slab (Timber 50/52) is a section from nearer the middle of the hull above the bilges of the boat. Both slabs of planking were laid on edge within the revetment, but Timber 50/52 was placed upside-down in comparison to its original position in the boat. For the sake of clarity it is described here inverted, as if it were still part of a boat. The planks in the boat were of slow-grown, straight-grained oak, with radial conversion. There are relatively few surviving tool marks on any of the timbers as they are eroded by ancient decay and water abrasion. No tree-ring date could be obtained for any of the timbers as the planks do not contain sufficient rings to establish a sequence.

Timber 45 consists of three overlapping strakes, the lower two of which are scarfed. The uppermost two strakes have surviving 'hood ends' at one end (the very ends of the planks which were fastened to the sternpost), and the other ends were all sawn off (in

antiquity) but to different lengths. The planks of the upper two strakes were 25 mm thick, while those of the lowest strake were 18 mm thick. The strakes were fastened together with diamond-roved clenched-bolts which were unevenly spaced in the case of the overlap between the uppermost two strakes, but at 160 mm intervals on the overlap of the lower two strakes. Although the top edge of the uppermost strake (Plank A) is damaged it has a distinct rise in the profile starting at 240 mm from the hood end. Six 20 mm diameter trenail holes are ranged along the upper edge of this strake, one of which has its round-headed trenail surviving, another two are stuffed with tarred hair. The hood end is chamfered and is pierced by four round-headed iron nails. An incomplete axe stop-mark 52 mm long is located under the hood end. The scarf joint between Planks B and D of the middle strake is partly broken away, but survives to a length of 150 mm. It is fixed by two clenched-bolts and is associated with remains of felt waterproofing material. Plank D is damaged at the hood end, but has the remains of a nail hole through it. On the inboard side of the upper edge there are four unevenly spaced trenail holes c. 25 mm in diameter, three of which are blocked with tarred hair. A fifth trenail hole, with surviving trenail head, is located towards the top of the plank. The lower edge of the lowest strake was broken and trimmed back in antiquity, but is pierced by a row of four clenched-bolts that are evidence for a further strake, now missing.

Timber 45 shows clear evidence for extensive repairs. The upper strake was patched with a tingle (Plank E) applied to the inboard side, while the middle strake has a carefully trimmed and chamfered tingle (Plank C) nailed into a deliberately cut recess containing waterproofing material on the outboard surface. The lowest strake is the most heavily repaired as its original upper edge had sheared away along the line of the clenched-bolt holes. This edge was repaired by a 'sandwich' of tingles overlying both the outboard and inboard surfaces (Plank F and Plank G/H respectively). These tingles are fixed in place with four pairs of nails and are also fastened back to back with a row of five clenched-bolts that replaced the originals, re-using the original holes. The outboard tingle (Plank F) has an empty trenail hole, showing it was a re-used piece of wood. Beneath the inboard tingle are four waterproofing rolls, one of which is compressed flat and pierced by two of the replacement clenched-bolts.

Timber 50/52 is in poor condition, especially at the bow end, but consists of three overlapping strakes, the lower two of which were scarfed. The scarf between Planks C and D on the middle strake is 400 mm long, and the chamfered ends of the planks stand 2–3 mm proud of both the inboard and outboard surfaces. The scarf joint in the lowest strake (between Planks A and B) survives to a length of 300 mm, but was clearly originally longer and was held together with a pair of clenched-bolts. Both scarf joints are associated with felt waterproofing. Each strake is pierced by a number of trenail holes, c. 18 mm in diameter, which are consistently spaced 0.59 m apart. Two trenail heads survive, both 20 mm in diameter. One is located on the middle strake and is of oak, while the second is near the stern of the lowest strake and is split and wedged. Close to the eroded and damaged lower edge of the bottom strake (Planks A and B) are a row of nail holes, most containing the remains of irregularly shaped dome-headed nails. These are driven in from the inboard side, and presumably represent the fixing of the garboard to the keel assembly. The strakes were fastened together with unevenly spaced diamond-roved clenched-bolts. The clenched-nails on this section of boat have a maximum length of 48 mm (shank + head + rove) and the heads are about 20 mm diameter. The roves are mostly diamond-shaped, with a maximum width of 28 mm. Where the waterproofing is visible between the overlapping strakes, it appears that there are two compressed rolls of tarred hair which respect the clenched-bolts (i.e. waterproofing was applied after the drilling of the bolt holes). The rolls are set in the outboard side of each joint.

Timber 50/52 had clearly been repaired. Plank F was patched with a tingle (Plank G) fastened inboard with five pairs of nails, of which only the lower set survive. The strake is

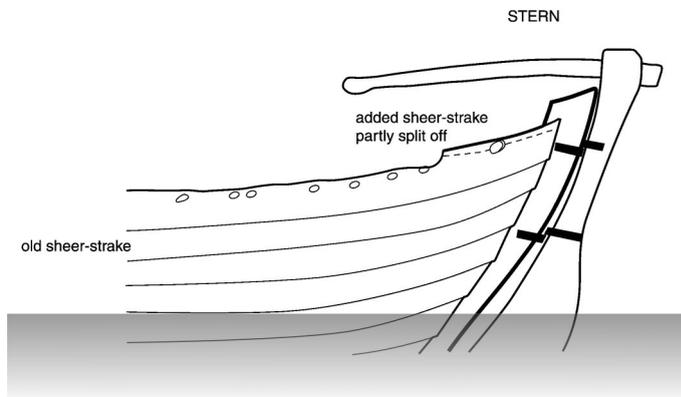


FIG. 5

Construction of the boat from which Context 2794 was made.

also pierced by nail holes towards the bow end, suggesting the position of another repair tingle. The middle strake is repaired with a tingle (Plank E) on the inboard side, which is fixed into position with three pairs of nails. Timber 50/52 had clearly been cut down and trimmed at the ends for use in the revetment.

In addition to the slabs of planking described above there were a number of disarticulated boards associated with abundant waterproofing material and a number of clench-bolts that had broken away from the revetment structure in antiquity (Timbers 47, 49, 54 and 63). These were too small and badly eroded to merit full description or illustration within this text, but they almost certainly originally formed part of the same vessel as Timbers 45 and 50/52.

The revetment also incorporated two timbers (Timbers 46A and 46B) that were not derived from a boat. Timber 46A is a roughly oblong radially split plank 25 mm thick, of uncertain function, with eroded surfaces and damaged ends. There are frequent, randomly scattered, drilled holes 5–8 mm in diameter on the plank, some with iron nails (with 4 mm wide square shanks and 10 mm diameter flat circular heads) *in situ*. Timber 46B is a roughly oval-shaped radially cleft oak board 18mm thick with a rectangular wooden plug set into a rebated hole on the midline of the plank. One edge has fourteen irregularly spaced iron tacks (26 mm long, with oval shanks c. 3 mm in diameter, and the heads missing) driven in along the midline. The other edge has a badly damaged 'V' shaped groove, up to 10 mm wide and about 10 mm deep, and eight irregularly positioned iron tacks. One grooved end appears not to have had tacks driven in. This timber may represent part of a static ironsmith's bellows.¹⁹ This would fit in with the evidence for ironworking recovered from the site and is in itself a find of some importance.

INTERPRETATION OF CONTEXT 2794 (Fig. 5)

The timbers in Context 2794 (with the exception of Timber 46) all seem to have originated from a single boat. There are three surviving strakes and originally the boat must have had at least five strakes. Most of the strakes were composed of two or more boards scarfed together. The arrangement of the scarfing and trimmed bevelled end of a plank indicates that the hull planking section was from the port side at the stern. The scarves in medieval English clinker boat finds were nearly always cut to allow the water to flow over the joint rather than into it.

¹⁹ D. Goodburn, pers. comm.

The lack of a bold upward swing in the strakes suggests that the vessel concerned had a gentle sheer rather than steeply curving ends. The stern of the vessel was almost certainly pointed, and fairly rounded at the sheer level, rather than sharp. A very interesting feature of this slab of hull side is that one lap has a series of blocked cut-off trenail fastenings in it. These appear to have been replaced with iron rove nails when the side of the hull was remodelled and raised during the life of the boat. Another plank with a set of trenail holes along it was added. It is likely that these trenail holes are relics of the fitting of a stringer or 'inwale' at this point. The upper edge of the probable replacement plank was worn, as if it had been part of the top course of planking or 'sheer-strake'. The profile of this plank would have given the parent vessel a 'broken sheer' (Fig. 5). The very archaic local barges or 'Humber keels' also have this unusual feature of a small section of raised hull at either end, although it is more commonly at the bow. Perhaps therefore this can tentatively be seen as a feature of regional boatbuilding of medieval origin.

The spacing of the trenail holes indicating where the framing timbers would have been fitted was roughly 0.56–0.59 m. This is not as close as in many other Late-medieval cargo vessels where a spacing around 0.45 m or closer is common, nor is it that of a small light vessel where a spacing of around 1 m might be expected.²⁰ It may be suggestive of a framing system of intermediate strength and weight. It is difficult to estimate the original length of the boat, and clinker-built vessels of this period can contain anything from five to twenty 'rooms' (spaces between frames). Since the frame spacing is consistent at between 0.58 and 0.59 m in both the stern section (Timber 45) and the side section (Timber 50/52), an estimate of original length could be anything from 4 to 20 m long. The proportions of the planking suggest that the parent vessel would have been either a fishing boat or perhaps a general-purpose river craft, capable of carrying people and small loads around the rivers and estuaries of the region. This sort of vessel was probably less than 15 m long, but longer than 5 m, and it would have been equipped for manual propulsion at least.

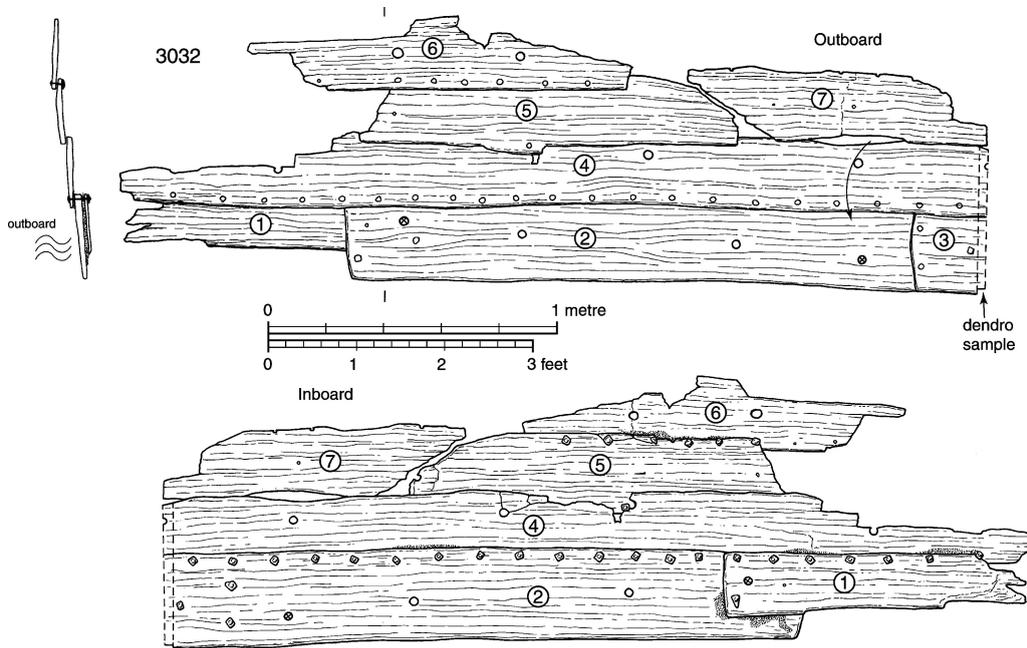
This vessel has been made waterproof with tarred rolls of animal fibre which are mostly cattle hair. A dyed wool felt was found with Timber 49. The tar used in association with the waterproofing material was a wood-based tar, which was the norm in medieval northern Europe.

A heavy degree of wear on the planking, both inboard and out, and the very frequent fitting of tingles, suggests that the parent vessel was rather old (possibly more than 20 years) when cut up for re-use.

DESCRIPTION OF THE TIMBERS IN CONTEXT 3032 (Fig. 6)

This context consists principally of one large section of clinker-built boat, four strakes high, from the centre of the starboard side of a boat. It was only possible to expose a 3 m length of this context within the excavation time available, and this had to be cut off on the

²⁰ S. McGrail, *Ancient Boats in North-West Europe* (London, 1987); D. Goodburn, 'New light on early ship and boatbuilding in the London area', 105–15 in G. Good et al. (eds.), *Waterfront Archaeology: Proceedings of the Third International Conference, Bristol, 1988* (CBA Res. Rep., 74 (1991)); idem, 'Rare fragments of a 13th-century clinker galley found in London and the use of the Irish wildwoods for shipbuilding', 289–95 in C. Beltrame (ed.), *Boats, Ships and Shipyards: Proceedings of the 9th International Symposium on Boat and Ship Archaeology, Venice 2000* (Oxford, 2003).



3032 continued

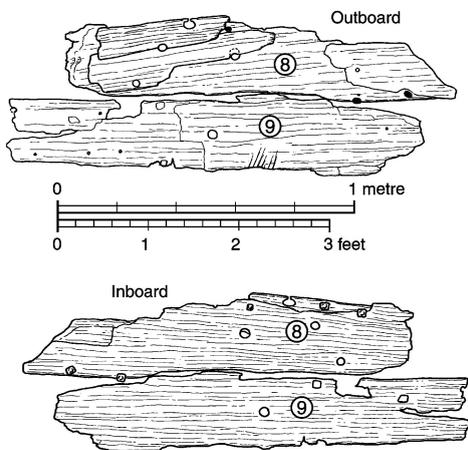


FIG. 6
Timbers from Context 3032.

north-western side for removal from site. The south-eastern end survives to its full original length but is eroded and broken. This boat was deliberately cut up to extract useable slabs of planking for re-use.

The surviving overlaps between the strakes are c. 58 mm wide and fastened with clench-bolts spaced 130–150 mm apart, or about eight per metre. The bolt heads and roves are now raised above the surface of the surrounding wood, indicating heavy erosion of about 2 mm on both inboard and outboard surfaces. The surviving frame fixing holes (trenail holes) are about 28 mm in diameter and the holes staggered between frames. The

frame intervals are a regular 0.55 m, with just one pair at the centre of the 'slab' having a spacing of 400 mm. No traces or impressions of frames survive to suggest their width. Examination of the trenail holes suggests that the appearance of countersinking of the inboard edges is actually due to compression. The only surviving trenail (in Plank 1) is converted from a larger piece of wood, probably alder, and is not wedged. No surface deposits were found on these timbers to suggest either cargo residue or surface treatment or painting.

Parts of four scarf joints survive, but only one (between Planks 1 and 2) was complete. This was 278 mm long, waterproofed with wool felt (which is especially noticeable on the inboard face) and fastened with at least three clench-bolts. The scarf is crudely made with the plank ends standing proud of the surface by about 5 mm. The scarf between Planks 2 and 3 (bow end) is similarly made and fastened with only three clench-bolts. The stern ends of Planks 4 and 5 are reduced in thickness to form one side of a scarf-joint, and there is wool waterproofing on the inboard surface of Plank 4. Few toolmarks survive due to erosion, but there are clear axe stop-marks on the outboard side of the scarf-edge on Plank 2, and a straight incomplete axe stop-mark 72 mm in length is present on the chamfered inboard edge of the scarf between Planks 2 and 3.

The damaged sternmost end of Plank 1, in the lowest strake, appears to have been burned, presumably when the boat was converted for use into a revetment. Plank 2 survives to its full original length of 2.15 m, and the lower edge is bevelled for a length of 190 mm on the inboard side to reduce its thickness from 28 to 21. It is unclear whether the bevel is part of the original construction of the boat or was associated with the conversion of the boat into a revetment. On the bottom edge there are the cut-away remains of two clench-bolt holes, indicating that c. 12 mm of the bottom of this plank had been trimmed after dismantling for re-use. The second strake up consists of one continuous board (Plank 4), the upper edge of which is compressed and buckled through burial. It has sheared along the line of the clench-bolts, and a faint impression about 10 mm wide survives indicating the former presence of waterproofing. Loose clench-bolts from this joint indicate a minimum combined plank thickness of 44 mm. These clench-bolt roves are set at an angle, indicating the original curvature of the boat-side at this joint. The lower edge of Plank 4 (where it overlaps the strake below) has a slightly rounded edge on the outboard face, but is not chamfered like the lower strake. The third strake up (Planks 5 and 7) is fragmentary, eroded and buckled, but there are the remains of one side of a scarf joint at the stern end. The plank survives to its full width of 290 mm and has a maximum thickness of 25 mm. The fourth and uppermost strake (Plank 6) is too fragmentary to provide much useful evidence. A number of fragments relating to this boat 'slab' were also recovered (Planks 8 and 9, Figure 6b), but are very eroded and have little information potential.

INTERPRETATION OF CONTEXT 3032

Most of the timbers attributed to this group appear to have formed a section of hull four strakes high, somewhat distorted after deposition. The lack of very marked taper and curve in the plank edges suggests that the slab planking came from the body of the vessel rather than the ends.

The frame spacing implied by trenail holes, at about 0.44 m centres (1 ell or cubit), is more suggestive of the strength needed for use as a heavy cargo vessel and is similar to that of clearly larger craft such as the Kingston numbers 2 and 3 boats.²¹ However, the fact that the planking was of more modest thickness than that in many other Late-medieval craft suggests that the parent vessel here may

²¹ Goodburn (1991), *op. cit.* in note 20.

have been strongly constructed but of only middling size. The remains could be very tentatively classed as probably from a small cargo vessel, between about 10 and 20 m long, certainly capable of river and estuarine operation and possible local sea trading. She may have resembled a small 'keel' used in recent times in Yorkshire, and was probably rigged with a simple square sail.

Dendrochronological dating was possible on the timbers as they contain a sufficient number of tree rings.²² The trees from which the boat was made were felled sometime after 1166 though the precise date of felling is unclear due to the lack of sapwood. If the trees were felled shortly after 1166 and used green (i.e. unseasoned), as was the custom, the boat was probably built in the last quarter of the 12th century. The planking in Context 3032 implies that the logs from which the boat was made would have been approaching 1 m in diameter as radially split boat boards can only reach about a third of the diameter of the parent oak.

Although the tool marking on the boat is very eroded it is clear that two different axes were used to shape the strakes. On Planks 2/4 the marks of an axe with a fine blade over 180 mm long were found in one of the broken laps. It is likely that this was made by a broad axe with a blade at least 200 mm wide. Shorter, slightly more rounded, axe marks were also seen in the scarf between Planks 2 and 3. They were 72 mm long and slightly curved, implying the use of a smaller axe. In addition, some of the scarfed boards showed axe faceting, a feature seen in many medieval clinker boat and ship boards excavated in London.²³

The scarf between Planks 1 and 2 was about 0.28 m long, with slightly protruding ends inboard and out, rather similar to the type used in the Kingston number 2 boat of c. A.D. 1300, from SW. London.²⁴ Considerable skill was required by the boatbuilders to make these long and close-fitting scarfs with the relatively simple tool kit used.

The use of twisted rolls of wool in between the strakes, as described below, fits the late 12th-century dendrochronology date for the construction of the boat. The tar in which the wool has been dipped is a wood-derived product.

THE WATERPROOFING MATERIALS IN THE TIMBER REVETMENTS

By P. WALTON ROGERS

Lining a ship's seams with tarred fibre in order to make the vessel watertight was an essential part of the medieval shipwright's craft. There is no surviving technical description of how this work was done, but there are documents relating to the building of galleys at Newcastle upon Tyne and York in 1294 which list the tars and fibres used by the boatbuilders, their sources of supply and the costs and timing of the procedure.²⁵ Loose rolls of fibre and tarred textiles excavated from medieval quaysides in ports of the NE. coast have generally been regarded as

²² C. Groves, Appendix 5 in Lilley et al., op. cit. in note 8.

²³ Goodburn (1991), op. cit. in note 20; idem, *An Archaeology of Early English Boatbuilding Practice c.900–1600: Based Mainly on Finds from South-East England*, 2 vols. (unpubl. Ph.D. thesis, UCL London, 2002).

²⁴ Goodburn (1991), op. cit. in note 20, 111.

²⁵ R. J. Whitwell and C. Johnson, 'The "Newcastle" galley, AD 1294', *Archaeol. Aeliana*, 4th ser., 2 (1926), 142–96.

examples of the craft and some similar material has been observed in position in ships' hulls excavated in London.²⁶ The two medieval revetments at Doncaster, made from substantial sections of clinker-built boats, with tarred fibre still in place, now present an opportunity to examine more closely how the medieval ships of the North-East were made waterproof. A catalogue of the material from the revetments appears below, together with some related finds from the site.

TIMBER REVETMENTS 2794 AND 3032

The fibrous materials found in the medieval revetments may be divided into (i) rolls, (ii) felts, (iii) loose wads of fibre.

*Fibre rolls*²⁷

In both revetments, flattened rolls of fibre lie horizontally along the overlap between the timber strakes. The best-preserved areas have three or four parallel rolls sandwiched between each overlap. In one case, two parallel rows have proved to be a single length doubled back on itself (2794, Timber 50). In general, the rolls work round the clenched nails which fasten the strakes together (e.g. 2794, Timber 45, Timber 52; 3032, Planks 1–4). Only those rolls associated with repairs have been pierced by nails (2794, Timber 54 and Timber 63), presumably as a fresh piece of timber has been hammered into place over the original tarred fibre.

Each roll has been constructed by twisting fibres in the S-direction; no plied cords have been recorded. The rolls appear to have been originally circular in cross-section and approximately 10 mm in diameter, but they have been squashed flat or compressed into rectangular and rhomboid shapes. There must have been considerable variation in the length of rolls, as two complete examples are 340 mm (2794, Timber 45) and 170 mm (2794, Timber 47) long, but one incomplete piece is over 600 mm (2794, Timber 45) and another 530 mm (3032, Planks 1–4).

The material of the fibre rolls in revetment 3032 is consistently wool. One roll, from Timber 69, includes blue-dyed wool and is therefore likely to represent waste from the textile industry. The rolls in revetment 2794 are all cattle hair, apart from a single roll of wool from Timber 52. This roll has hair roots present, indicating that it came from a dead sheep; this would have made it a low-grade wool in the eyes of the textile industry.

Felts

A single layer of fine wool felt had been sandwiched between the two parts of a scarf joint in Planks 1/2 and Planks 2/3 of 3032 and the remains of another felt, at the worked end of a timber, Plank 4 in 3032, probably also represents the lining of a scarf joint. A much thicker and more uneven felt between two timbers in 2794 (Timber 49) appears to form part of a repair. The finer felts are typical of the material used in the medieval hatting industry.²⁸ The coarser example is more unusual and yet it must have been originally intended for use in clothing or furnishings, since it has been dyed deep blue.

²⁶ P. Marsden, *Ships of the Port of London, Twelfth to Seventeenth Centuries AD* (London, 1996).

²⁷ The term for these rolls of fibre in most European literature is 'caulking rolls' or 'caulking cords'. In recent years some English archaeologists have started to use the term 'luting', which can cause confusion with the medieval (and later) term for a sealant made from a resin/tar/clay paste.

²⁸ P. Walton, 'Caulking, cordage and textiles', 78–92 in C. O'Brien, L. Bown, S. Dixon and R. Nicholson, *The Origins of the Newcastle Quayside: Excavations at Queen Street and Dog Bank* (Newcastle, 1988), 83; E. Crowfoot, F. Pritchard and K. Staniland, *Textiles and Clothing c.1150–c.1450* (London, 1992), 75–6.

Wads of fibre

Loose wads of fibre without any obvious structure had been stuffed behind repair patches, or 'tingles', in 2794 (Timber 45, two examples, and Timber 63); similar remains were found with the loose fragments of wood, associated with 2794, Timber 50. These, like most of the fibre rolls from 2794, are cattle hair.

Ship repair

Remains of two tar-pots found near the revetments indicate that boats were being repaired there in the 13th century. Sherds from two thick-walled pots, one with a wooden bung still in position in a bung-hole in its side, have on their inner surfaces remains of a tar paste which incorporates disaggregated animal fibres and straw (context 1456 and context 1378, sf278). Further examples of cattle-hair rolls, sfs10611 and 10975, and loose wads of cattle hair, sfs10615 and 11916, may come from similar refitting work, or from the breaking up of ships. A length of heavy plied rope made from a shrubby plant material, sf10978, is also a typical shipyard or quayside find.

COMMENT

The Doncaster material finally provides a context for the quantity of sausage-shaped rolls of fibre excavated along the medieval waterfronts of Newcastle upon Tyne, Hartlepool, Hull, Grimsby and York (Tab. 1). These rolls had been identified as coming from ships' seams on the basis of a small number of examples found attached to fragments of timber.²⁹ It can now be shown that the main function of these fibre rolls was to line the horizontal overlap between the lengthways strakes in clinker-built ships.

The medieval ship must have required a substantial number of such rolls, if, as seems likely, they ran the full length of the vessel and were applied at three or four parallel rolls per overlap. Indeed, according to the accounts kept for the building of a galley on the Tyne in 1294–5, 42½ stoncs of this material — known as 'wilding' at Newcastle and 'sy' in the parallel document for York — was required for the galley and 7½ stoncs for its tender.³⁰ The wilding was sold to the shipbuilders by women, often wives of the men involved in the project, who probably produced the rolls as an adjunct to their domestic craft of spinning.³¹ The process began as soon as the keel had been laid and continued for 17 of the 44 weeks it took to build and rig the galley, the work keeping pace with that of the shipwrights for as long as the outer shell was being built.

At Doncaster, offcuts of felt have been used to line the scarf-joints, where a smooth, close-fitting join was essential. This helps explain the felts sometimes found in association with tarred fibre rolls at Quayside, Newcastle.³² Similarly, the pads of loose fibre from Quayside,³³ and other sites, may be compared with the handfuls of fibre stuffed behind repair patches in one of the Doncaster revetments, 2794.

²⁹ P. Walton, 'Caulking cords and yarn', 48–9 in Young op. cit. note 12.

³⁰ Whitwell and Johnson, op. cit. in note 25.

³¹ Walton, op. cit. in note 28, 85.

³² *Ibid.*, 83.

³³ *Ibid.*, 78; Walton, 'Caulking, textiles and cordage', 167–76 in C. O'Brien, L. Bown, S. Dixon, L. Donel, L. J. Gidney, J. P. Huntley, R. Nicholson and P. Walton, 'Excavations at Newcastle Quayside: the Crown Court site', *Archaeol. Aeliana*, 5th ser., 17 (1989), 141–205.

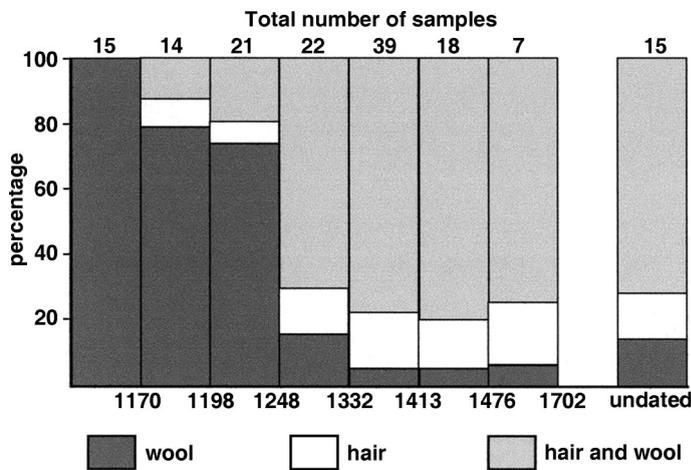


FIG. 7
The use of fibre in the Bryggen waterproofing cords: distribution in chronological order, according to the main fire intervals (after Schjølberg, *op. cit.* in note 37).

Both felt and fibre can be found among the lesser purchases for the Newcastle galley, where they appear as 'feutre' and 'burre' respectively.³⁴ In the second week of construction there is also an entry, *Item in ollis terre emptis pro Ter et Blare calefaciendis — iid*,³⁵ that is, '2d. for earthenware pots bought for the heating of tar and blare'. Blare is a paste of tar and hair, which matches the material found on the inside of the potsherds. No great quantity of blare was used in the construction of the galley, but 'earthenware pots for melting pitch' recur frequently in the London Bridge accounts for the later 14th century, in relation to boat repair.³⁶

Finally, the Doncaster tarred fibre makes a useful comparison with the large quantity of similar material, arranged in a closely dated sequence, from Bryggen, the medieval docks area of Bergen in Norway.³⁷ The Bryggen material, like much of the English evidence, has lost its original association with timbers, although the imprint of nails along the edges of rolls, but not penetrating them, suggests that the process was similar in both countries. Much of the Bryggen material was made from two or more rolls plied together (termed 'caulking cords' in the report). One such cord was found at Newcastle, in association with Norwegian or Norse rope and textile,³⁸ and there are some further examples from London in the timbers from a sea-going vessel built of Baltic oak.³⁹ The Doncaster S-twist single rolls (without ply) are the more usual type for England.

The Bryggen sequence has also produced evidence for a change in raw material, from wool to animal hair, over the 12th–15th centuries (Fig. 7). This change can be matched in the rolls from northern England (Tab. 1) and may also occur in the London material, although rolls are not easily distinguished from felts

³⁴ Whitwell and Johnson, *op. cit.* in note 25, 151.

³⁵ *Ibid.*, 162.

³⁶ B. Spencer, 'Expenditure on shipbuilding and repair by London Bridge, 1382–98', 209–12 in Marsden, *op. cit.* in note 26.

³⁷ E. Schjølberg, 'The hair products', 73–91 in *The Bryggen Papers, Supplementary Series 1* (Bergen, 1984), 75–7.

³⁸ Walton, *op. cit.* in note 28, 81–2.

³⁹ Marsden, *op. cit.* in note 26, 118–20 and 188–9.

and repair work within the London report.⁴⁰ At Doncaster, the all-wool rolls in the timbers of Context 3032 fit the mid-12th-century date given by dendrochronology for the construction of the boat. There were no dendrochronological dates for the timbers of Context 2794 (see above), but the use of cattle-hair in the rolls tends to suggest that this revetment was constructed from the timbers of a ship somewhat later in date than that in revetment 3032.

TABLE I

CHANGES IN THE RAW MATERIAL OF WATERPROOFING ROLLS FROM
NORTH-EASTERN ENGLAND OVER THE 12TH TO 15TH CENTURIES

Note: these figures represent exact numbers of rolls; they exclude the loose raw fibre included in previous publications.

<i>Site</i>	<i>Date</i>	<i>Caulking</i>	<i>Fibre</i>
North Bridge, Doncaster Riverside revetment 3032	Timbers = mid-12th century	6 S-rolls	All wool
Southgate, Hartlepool ⁴¹ Dock wall	Timbers = 12th century Dock = early 13th century	4 S-rolls	All wool
Queen Street, Quayside, ⁴² Newcastle upon Tyne Riverside dumping	Dump = 13th century (redeposit)	c. 80 mainly S, some plied	50% wool, 50% hair (cattle and goat)
Crown Court, Quayside, ⁴³ Newcastle upon Tyne Riverside dumping	Dump = mid-13th–14th century (redeposit)	c. 97 mainly S (1 plied)	56% wool, 39% hair (cattle, dog, goat and human), 6% plant
Coppergate, York ⁴⁴ Revetment	Timbers = late 14th century	> 8 S-rolls	All hair (mostly goat, some cattle)
Monkgate, Hull ⁴⁵	Deposit = early 14th–15th century	c. 40 S-rolls and 1 Z-roll	33% wool, 66% hair (cattle and goat); Z- roll = plant fibre
Baxtergate and Riverhead, Grimsby ⁴⁶ Timber waterfront riverside dumping	Waterfront = 14th/15th century, some dumping = later	26 S-rolls	14% wool, 79% hair (cattle), 7% plant fibre
North Bridge, Doncaster Riverside revetment 2794	Undated	c. 25 S-rolls	All hair except for 1 wool (cattle)

⁴⁰ M. L. Ryder, 200–7 in Marsden, *op. cit.* in note 26.

⁴¹ Walton, *op. cit.* in note 29.

⁴² Walton, *op. cit.* in note 28.

⁴³ Walton (1989), *op. cit.* in note 33.

⁴⁴ D. Goodburn and P. Walton Rogers, 'Re-used medieval boat timbers found at Coppergate', 2379–82 in C. A. Morris, *Wood and Woodworking in Anglo-Scandinavian and Medieval York* (The Archaeology of York, 17/13, York, 2000).

⁴⁵ P. Walton, 'Medieval and 17th century textiles from High Street/Blackfriargate', 227–32 in P. Armstrong and B. Ayers, 'Excavation in High Street and Blackfriargate', *East Riding Archaeologist*, 8 (1987), 227–32.

⁴⁶ P. Walton Rogers, unpublished data.

CATALOGUE OF WATERPROOFING MATERIAL

Dyes were analysed by absorption spectrophotometry (visible spectrum) of solvent extracts. Fibres were identified using a transmitted-light optical microscope with magnification up to $\times 400$. Animal fibres were viewed as whole mounts and as cross-sections, and casts were prepared of the cuticular scale pattern. Nine samples were also examined by H. M. Appleyard, a specialist microscopist. His identifications are noted here as (HMA).

Timber revetment 2794

Timber 45

All waterproofing rolls run parallel to strakes.

(i) At overlap between tingle G/H and strake D, four parallel S-twist waterproofing rolls; three rolls above clenched nails, one below. Waterproofing rolls respect clenched nails.

Top roll = 340 mm long (complete), 10 x 10 mm thick, flattening to 22 x 4 mm.

Middle roll = >600 mm long, from 14 x 5 mm to 30 x 2 mm thick.

Bottom roll = similar to middle.

All rolls are cattle hair (HMA).

(ii) Between lower edge of G and strake behind (I/J), at least one more S-twist roll visible in side view: not possible to measure. Cattle hair.

(iii) At the north-west end of the overlap between I/J and G/H, the ends of two parallel S-twist rolls, 15 x 5 mm and 15 x 3 mm are visible. Cattle hair. Further fibres visible at SE end.

(iv) At overlap between Plank I/J and G/H the side of an S-twist roll visible. Cattle hair.

(v) At overlap between Plank D and A an S-twist roll visible through trenail hole.

(vi) Behind repair patch (tingle) E, flat open wads of fibre, 2–3 mm thick; areas 50 x 30 mm, 60 x 10 mm, etc. Nails pierce wads. Cattle hair (HMA).

(vii) On Plank D, fibres around pegs. Cattle hair.

(viii) Behind repair patch (tingle) G/H, flat open wads of fibre, 2–3 mm thick (area not known).

(ix) At scarf-joint B/D, fibres visible at edge of joint.

Timber 47 (Not illustrated)

(i) At overlap between strakes A and B, one S-twist waterproofing roll, 170 mm long (complete), 12 x 8 mm thick; another, longer roll visible behind first; the end of a third visible between strakes B and C. All three are cattle hair.

On outboard side of strake C, a few loose fibres around head of clenched nail. Cattle hair.

Timber 49 (Not illustrated)

(i) Along bottom edge of (b), one S-twist roll 60 mm long, c. 8 x 8 mm thick. Cattle hair.

(ii) Between (a) and (b) an uneven felt 220 x 50 mm, varying thickness, up to 6 mm. Wool, dyed with woad (indigotin).

Timber 50

(i) Plank A consist of two timbers joined by a scarf joint and the edges of waterproofing rolls are visible at the joint: not possible to measure. Cattle hair (HMA).

- (ii) At bottom edge of Plank F (north-western end), one S-twist roll, c. 100 mm long, 10 x 10 mm thick, folded in half: area covered by folded roll is 60 x 30 mm. Cattle hair.
- (iii) At bottom edge of Plank F (south-eastern end), one S-twist roll, c. 10 x 10 mm thick, with rhomboid cross-section from pressure of timbers; length not measured. Cattle hair.
- (iv) One of two loose fragments of wood (from outside top at south-eastern end of Timber 50) has, on one face, a flat layer of fibre, 40 x 35 mm, c. 2 mm thick. Cattle hair.

Timber 52

At overlap between A and C, two parallel S-twist waterproofing rolls, 12 x 15 mm and 12 x 10 mm thick. These respect the clench-nail. Length not measured. Fibres clearly different from other waterproofing rolls in this revetment: wool (HMA).

Timber 54 (Not illustrated)

Three parallel S-twist caulking rolls, 12–15 x 3–5 mm thick. Waterproofing pierced by clench-nail and by ordinary nail. Cattle hair.

Timber 63 (Not illustrated)

- (i) Flat layer of fibre 1.5–2.0 mm thick, on outboard side of two smaller pieces of timber, area 180 x 60 mm and 65 x 10 mm; further traces of same fibre-layer on outboard side of larger fragment (probable tingle).
- (ii) At overlap between larger (probable tingle) and smaller timbers, two S-twist waterproofing rolls, now 260 mm long, probably originally longer; both rolls roughly 10 x 10 mm. Clenched nails pierce waterproofing rolls. Cattle hair.
- (iii) Loose: three S-twist waterproofing rolls, 180, 160 and 130 mm long; irregular, but mainly 10 x 10 mm thick. Cattle hair (HMA).

Timber revetment 3032

- (i) Between Planks 1 and 4, one S-twist waterproofing roll: not possible to measure at this stage. Wool. Fibres dyed with woad (indigotin).
- (ii) Layer of fibre, remains of a wool felt, on inboard side of one strake, representing one side of a scarf joint. Also loose wads of fibre, also wool.
- (iii) At overlap between Planks 4 and 1/2, at least two flattened S-twist waterproofing rolls, 560 and 530 mm long (incomplete), 28–30 mm wide. Rolls respect clenched nails. Both wool (HMA).
- (iv) Between the scarf joint on Planks 2 and 3, a single layer of wool felt.
- (v) At cut end of overlap between Planks 2 and 4, flattened ?S-twist waterproofing roll visible in cross-section. Hairy wool.
- (vi) At cut end of overlap between Planks 2 and 4, flattened ?S-twist waterproofing roll, visible in cross-section, 32 x 4 mm thick. Wool.
- (vii) Layer of fibre, almost certainly a felt, at scarf joint between Planks 1 and 2. Wool.

sf10978 [1969]

Five fragments of rope, now single strands and Z-twisted, possibly originally plied, Z3S. Raw material is a shrubby plant fibre, c. 1.0 mm wide and flat. Tested for tar, but none detected. L: 120, 90, 80, 50 and 50 mm.

sf11916 [2642]

Loose fibres in a layer 40 x 30 mm, 2–3 mm thick. Some intact fibre staples present, 25 mm long, pointed. Fibres not identified.

sf10975 [1456]

Two joining pieces of S-twist waterproofing roll, 90 and 80 mm long, 20 x 6 mm thick. Fibres not identified.

sf10615 [1378]

Loose tufts of fibre, c. 80 x 30 mm. Fibres not identified.

sf10611 [1410]

Two pieces of S-twist waterproofing roll, 85 and 55 mm long, 15 x 5–6 mm thick. Fibres not identified.

Sherds from tar-pots

[1456]

Potsherd with wooden bung. Loose fibres adhering to inner face of potsherd and lapping on to broken edge; also on bung. Cattle hair (HMA).

[1378]

Thick-walled potsherd. Thick layer of tarred fibre, straw and silt on inner face of sherd. Only slight overlap on to broken edge. Cattle hair (HMA).

CONCLUSIONS

By D. M. GOODBURN and S. J. ALLEN

Both of the boats represented by these sections of planking were clinker built. Almost all archaeological evidence from medieval England to date suggests that the clinker approach to planked-boat construction was the predominant one.⁴⁷ The exceptions were small dugout boats under 5 m in length and some fragments of a cog-type ship from Westminster.⁴⁸ Indeed, this method of construction still survives, using more modern materials, in traditional Yorkshire boatbuilding, for example, the cobbles of the east coast.

The planking, including repair patches, was made from radially cleft oak boards. In finds from the south of England cleft oak board was gradually replaced by sawn oak and elm planks in clinker boatbuilding during the 16th and early 17th centuries.⁴⁹ All the scarf-joints seen on both revetment sections are variations on the simple 'through-splayed with projecting ends' type.⁵⁰ The lap, scarf and repair patch fastenings were of iron. The lap and scarf fastenings are rove nails with

⁴⁷ I. Friel, *The Good Ship: Ships, Shipbuilding and Technology in England 1200–1520* (London, 1995), 67; Goodburn, op. cit. in note 23.

⁴⁸ Goodburn (1991), op. cit. in note 20.

⁴⁹ Goodburn (2002), op. cit. in note 23.

⁵⁰ Goodburn (1991), op. cit. in note 20, 109.

quadrilateral, roughly diamond-shaped, roves. The frequent repair patches were fastened with a mixture of rove nails and smaller turned nails.

The frame timbers and other strengthening members were fastened to the planking by wooden pegs (trenails), but only a few rather abraded examples remained *in situ*. They appear to be of the headed type, that is, cut so as to have a bulbous head outboard and to be expanded with a wooden wedge inboard in the manner of a wooden rivet. On current evidence it would appear that this type of fastening fell out of use in England in post-medieval times.⁵¹ The typological features of these plank sections all suggest a medieval date and dendrochronology confirms a 12th- to 13th-century origin for these planks.

Doncaster is not usually thought of as a major port. Its location at the point where the Great North Road crosses over the River Don, however, means it would have been a major centre for the trans-shipment of goods between South Yorkshire and North Sea ports. Boat finds might therefore be expected in the vicinity. Some of the timbers, however, suggest that boats were not just visiting Doncaster but were being built or repaired there. This adds weight to the suggestion that the articulated plank sections derive from a local boatbuilding tradition.

Friel gives two examples of boats from Doncaster or the River Don being requisitioned for royal expeditions to France during the Hundred Years War.⁵² The first is in 1345, a 'tiny vessel with a crew of 10', which was one of 443 vessels assembled for three separate descents on the French coast. The second example took part in Henry V's 1417 invasion fleet. In both cases, the point being made by Friel is that English shipping resources were being stretched to the limit: these boats would not normally have been so employed. However, the fact that these vessels were requisitioned shows that the royal officers responsible considered these vessels to be sufficiently seaworthy to make a channel crossing. It cannot therefore be assumed that boats from Doncaster were limited to inland riverine uses.

The importance of these finds is twofold. Firstly the waterside structures demonstrate the need at Doncaster for a formal quayside structure for landing and loading vessels. The slipway or draw-dock is of critical importance to this interpretation. While the timber revetments on site could simply represent retaining walls associated with land reclamation and need not necessarily have been part of a trading wharf, there is no doubt that the purpose of the slipway was to enable vessels to be drawn up for unloading and trading. Boats could also have been drawn up adjacent to Context 2794 if it is interpreted as an inlet. Such quayside features are normally associated with major ports such as Hull and King's Lynn. In the Middle Ages Doncaster may have been a more important port than has hitherto been recognised. Secondly, as boat remains, these planking sections are tangible examples of a local boatbuilding tradition, whose practitioners could produce vessels capable of coastal and cross-channel voyages, as well as local river transport.

⁵¹ Goodburn (2002), *op. cit.* in note 23.

⁵² I. Friel, 'Winds of change? Ships and the Hundred Years War', 183–94 in A. Curry and M. Hughes, *Arms, Armies and Fortifications in the Hundred Years War* (Woodbridge, 1994).

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APPENDIX: GLOSSARY OF SHIPBUILDING TERMS

Carvel A method of boatbuilding where the planks are butted or laid together edge to edge, normally associated with skeleton-first-built boats.

Clench-bolt A rivet used to hold two overlapping planks together in conjunction with a rove on the interior.

Cubit Medieval unit of length approximately equal to the length of the forearm.

Garboard The first strake against each side of the keel.

Inwale A stringer reinforcing the sheer-strake at its upper edge, attached directly to the inner surface of the strake.

Rove Small pierced metal plate generally rectangular over which the point of a clinker nail is clenched.

Scarf An end to end joint between two timbers.

Sheer The top edge of a vessel.

Sheer-strake The uppermost strake of the planking.

Strake A run of planks from bow to stern.

Stringer Longitudinal internal timber providing strength to the structure usually attached directly to the inner surface of the planking.

Trenail A wooden fastening with a convex external head and an internal wedge.

Tingle A repair patch.