

Excavations on the Thames Waterfront at Trig Lane, London, 1974–76

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EXCAVATION OF THE 500 sq. m. waterfront site at Trig Lane in the City of London revealed a well-preserved series of timber and stone revetments on the medieval foreshore. They survived to heights of up to 3 m. and had been erected during the piecemeal reclamation and subsequent consolidation of the riverfront between the mid 13th and late 15th century.

The structures are described in detail, and their form and function discussed. Ninety-four oak samples were submitted for dendrochronological analysis, the results of which enabled a relative chronology for part of the revetment sequence to be established and absolute dates postulated.

IN 1973 the Department of Urban Archaeology was set up under the auspices of the then Guildhall Museum to conduct a programme of excavation and research into various aspects of the City's origins and development. The objectives adopted were basically those set out in *The Future of London's Past*,¹ a document which stressed the importance of large-scale excavation of the London waterfront, where deep archaeological deposits were being destroyed by major redevelopment schemes. A study of this area is obviously very necessary for archaeologists intent on understanding the growth of the nation's premier port, but prior to 1972 little detailed work had been possible. Five years later, however, the results of a series of major excavations from Baynard's Castle in the W. to Custom House in the E. have transformed this picture (FIG. 1).

Waterfront structures of Roman date were located in the bridgehead area,² as well as at the Custom House site,³ while the City's Roman riverside wall was located beneath the northern wall of Baynard's Castle.⁴ Substantial evidence of activity by the river in the Saxon period was recorded during excavations at New Fresh Wharf,⁵ and a remarkable series of later medieval structures was examined at the Custom House,⁶ Seal House⁷ and Trig Lane sites.⁸

It had been apparent for some time that the natural pre-Roman bank of the Thames ran approximately along the line of what was to become Upper and Lower Thames Street: for example, Prof. Grimes had sectioned it N. of Trig Lane in 1962.⁹ It therefore follows that the 20 acres (8 ha.) S. of this street should be considered as an artificially created tract of land reclaimed at the expense of the river.

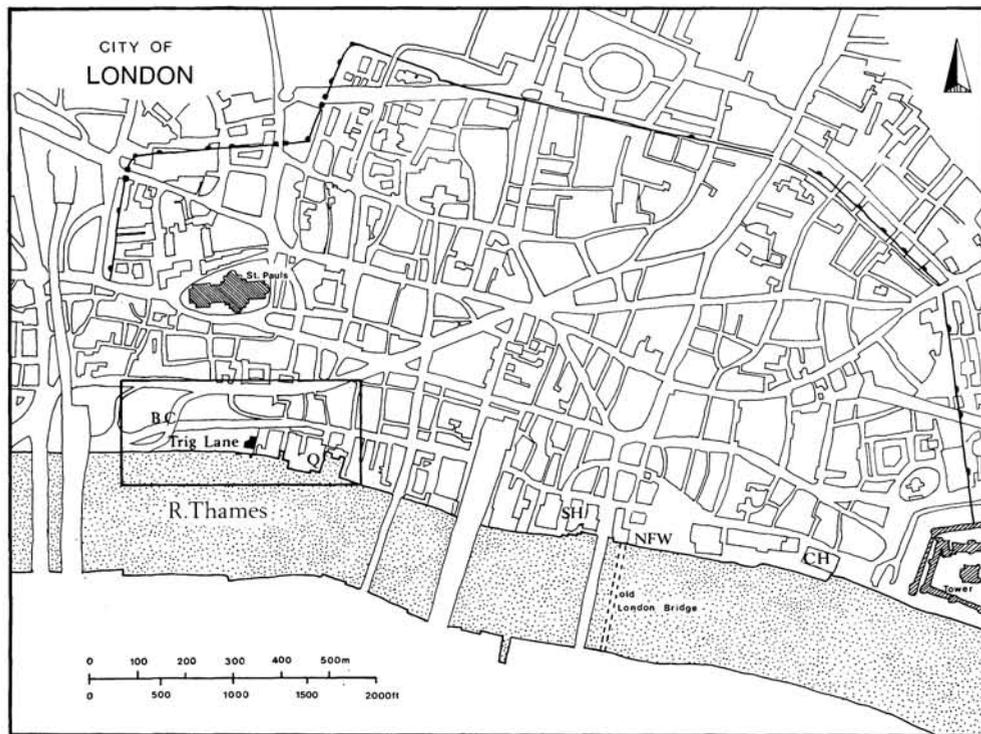


FIG. 1

TRIG LANE, CITY OF LONDON

Site location. Key: BC, Baynard's Castle; Q, Queenhithe; SH, Seal House; NFW, New Fresh Wharf; CH, Custom House (for inset, see FIG. 2)

The excavation at Trig Lane attempted to establish how and when this extensive reclamation took place in the W. of the City. The changing riverfront is a neglected aspect of urban topography in England (two of the most widely read publications on medieval townscape studies ignore it completely),^{10, 11} so this opportunity to examine the mechanics and chronology of waterfront development is clearly of more than local significance.

THE SITE (FIG. 2)¹² AND THE EXCAVATION

The site lies on the W. side of Trig Lane, one of the many alleys which ran southwards from Thames Street to the river between Southwark and Blackfriars Bridges, some 800 m. upstream from London Bridge. To the W. is the site of Baynard's Castle, excavated for the Guildhall Museum in 1972 by Peter Marsden, where the 13th-century castle had been built on reclaimed land.¹³ 100 m. to the E. is Queenhithe, an important port mentioned in the 9th century.¹⁴

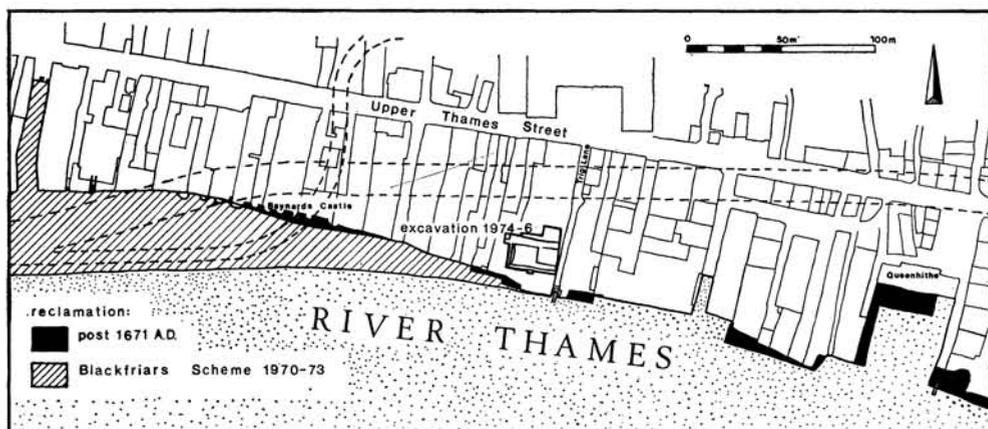


FIG. 2

TRIG LANE, CITY OF LONDON

Site in relation to river and pre-1970 line of Upper Thames Street. New street alignment shown by dotted line. Before work began on Blackfriars Bridgehead Improvement Scheme (cross-hatched), line of waterfront had only been subjected to minor modifications since surveyed in 1671

Excavation of the site began in April 1974 and a total of some 500 sq. m. had been examined by December 1976. Substantial traces of occupation from the medieval and post-medieval periods were found to overlie a series of timber and stone revetments, which survived to heights of up to 3 m. (PL. XVIII). Ninety-four oak samples were submitted for dendrochronological analysis, the results of which enabled a relative chronology for the revetment sequence to be established, and absolute dates postulated. The provisional dating used in this report is based on the dendrochronological evidence, and not upon a detailed assessment of the pottery, which has yet to be completed.

The deeply stratified lower levels produced evidence of continuous, piecemeal land reclamation on the N. bank of the Thames during the medieval period. This process was achieved by erecting a timber or stone revetment upon the foreshore which had formed to the S. of the existing frontage, and filling the intervening area with contemporary refuse (FIG. 3). Thus an unusual stratigraphic sequence was encountered in which the earliest structures and their associated deposits were found in the northern (inland) part of the site; the latest in the southern — in contrast to the standard vertical stratigraphy of the upper levels.

Just over 3,000 features or contexts were recorded during the excavation, and these were subsequently divided into eighteen groups, numbered G1 to G18. The first fifteen groups comprised the series of structures built on the foreshore, forming part of the riverfront. Of these, G2 to G8, G10 to G12, and G15 incorporated structures which were directly associated with the reclamation process or the consolidation of the frontage itself: their description and assessment will form the basis of this report. The structures within each group are referred to hereafter as revetment G2, structure G12 etc.

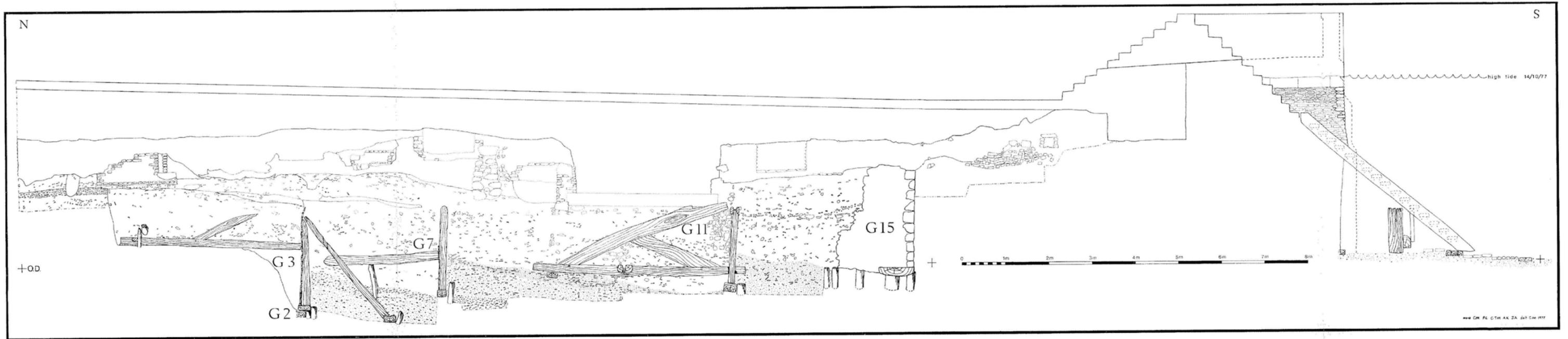


FIG. 3
TRIG LANE, CITY OF LONDON

N.-S. section looking E. across eastern edge of excavation extending on to modern foreshore, showing succession of riverfront revetments and associated deposits from 13th to 15th century. Note level of modern high tide.

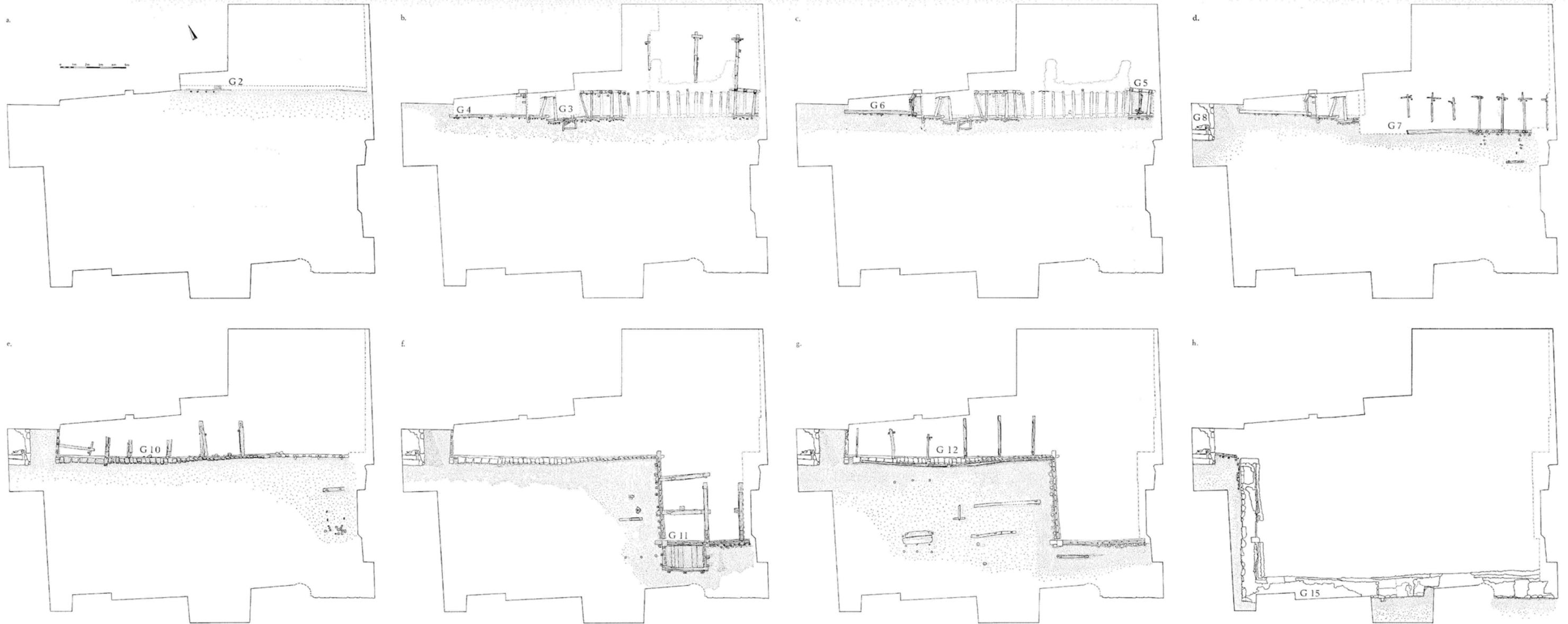


FIG. 4
TRIG LANE, CITY OF LONDON

Plans showing development of waterfront from 13th to 15th century. *a*, mid to late 13th century (?); *b*, late 13th to early 14th century (?); *c*, c. 1325; *d*, c. 1350; *e*, c. 1370; *f*, c. 1385; *g*, c. 1420; *h*, c. 1500 (all dates provisional)

G₁, G₉, G₁₃ and G₁₄ included structures such as landing stages and jetties located within sealed foreshore deposits, while G₁₆ to G₁₈ relate to the occupation deposits from the upper levels of the excavation. These seven important groups will be discussed in detail in the final report.¹⁵

THE FEATURES

REVETMENT G₂ (FIG. 4, *a*)

The earliest evidence for reclamation examined at Trig Lane concerned the construction of the G₂ timber revetment, possibly in the third quarter of the 13th century. This was clearly earlier than structure G₃ which directly succeeded it (FIG. 3). It was aligned E. and W. across the northern part of the site and was traced for 13 m. from the main E. section, although it is not known how much further W. it extended. The associated dumping and surfaces survived, but the revetment superstructure had been robbed down to base-plate level. However, as the pattern of pegged mortises at 0.70 m. intervals in the upper edge of the G₂ base-plate was similar to that noted on the later G₃ revetment, a horizontally planked front-braced structure similar to the latter was postulated for G₂.

The deposits to the N. were principally of an organic nature with a rich dark brown colour and a strong smell. E. to W. tip lines were interpreted as indicating a deliberate dump of refuse thrown behind an upstanding revetment, rather than the result of a more gradual accumulation of debris on a rubbish tip. A levelling layer of oyster shell up to 0.15 m. thick and a thicker deposit of brown earth and gravel overlay the organic dumps — no doubt sealing the smell of rotting vegetation — while also providing a suitable bed for a gravel surface. The latter was subsequently overlain by a noticeably thicker and more substantial floor made up from stone chippings tentatively identified as Purbeck marble. The change of floor type may indicate increasing commercial activity in this area, while the source of this rather unusual flooring medium was probably a nearby marbler's yard: such craftsmen are known to have settled and worked in the City from the 13th century onwards.¹⁶

Later disturbance had removed the surfaces associated with most of the other revetments recorded on the site, so their survival in this phase is of especial interest (FIG. 3). Their level is also of importance, as it demonstrates that the Thames was unlikely to have risen repeatedly much above +2.00 m. O.D. in this period, about 2 m. lower than modern high tides.¹⁷

REVETMENTS G₃ AND 4 (FIG. 4, *b*)

In the late 13th or early 14th century, the superstructure of revetment G₂ was totally removed and replaced by revetment G₃, the new base-plate being laid directly on top of the old. The structure was traced for a length of some 16 m., and survived in an excellent condition to a height of over 2 m. in the central and eastern parts of the site, where its southern face was fully exposed from the

top of the vertical posts to the bottom of the base-plate (FIG. 5). Between these two areas, the later construction of a massive chalk foundation obscured the revetment face, only the shores being visible (PL. XVIII).

The structure comprised a base-plate composed of several separate timbers joined with edge-halved scarfs with square vertical butts (FIG. 5, f), and retained to the S. by a series of oak and elm piles. Squared vertical posts, usually of about 0.20 m. in width and some 2 m. high, were set in the upper edge of the plate with a central tenon edge-pegged into a mortise (FIG. 5, d). The interval between the posts was just over 0.50 m. Five or six levels of horizontal planking were laid edge to edge on their northern faces with round or oval-headed nails up to 0.11 m. long, or set in some instances into rebates cut down the NE. and NW. corners of the posts. Every post had been supported to the S. by a shore, to which it had been joined by a chase mortise and tenon (FIG. 5, c). The shore itself ran diagonally southwards, and its foot was cut to form a bird's mouth abutment (FIG. 5, e), wedged against the northern shoulder of a subsidiary base-plate. The latter ran parallel to the principal plate already described but some 1.60 m. to the S.: the northern half of its upper face had been cut back to form the shoulder against which the toe of the shore butted. Dovetail housings suggested the position of timbers which could have served no structural function in the revetment as found: the base-plate was therefore a timber re-used from an earlier structure. It is important that such obvious instances of the re-use of timber are taken into account when samples for dendrochronological analysis are being selected, as they could act as a useful control to determine if other less explicitly marked members are also re-used (cf. PL. XIX, B)

To the N., set within the deposits dumped behind the planking, three back-braces were located at intervals of some 3.40 m. Each one comprised a horizontally laid tie-back 3 m. long which had originally been centrally tenoned into the vertical post at its southern end, some 1.60 m. above the base-plate. At the northern end, stability was provided by half-lapping and double pegging a cross-member over the tie-back (FIG. 5, a), and driving retaining piles against its southern edge. An additional strut, chase-tenoned into the centre of the face of the tie-back, ran diagonally upwards and southwards, but the presumed junction with the revetment face did not survive in any of the examples recorded.

The G₄ revetment was only partially examined in the time available to the excavators. It ran E. and W. for 7.70 m. from the western end of structure G₃, to which its planking had clearly been married; both revetments therefore functioned together. It was not possible to determine archaeologically which one was built first, but the results of dendrochronological analysis suggested that they were constructed within five years of each other, and could even be exactly contemporary. Although both were horizontally planked front-braced revetments, there were significant differences in style and alignment. For example, the G₄ subsidiary base-plate, on to which the feet of the shores butted, had three horizontally laid transverse members joined to it from the N., spaced at 2 m. intervals (FIG. 4, b). A similar bracing technique was observed on one of the 14th-century structures from the Custom House site.¹⁸

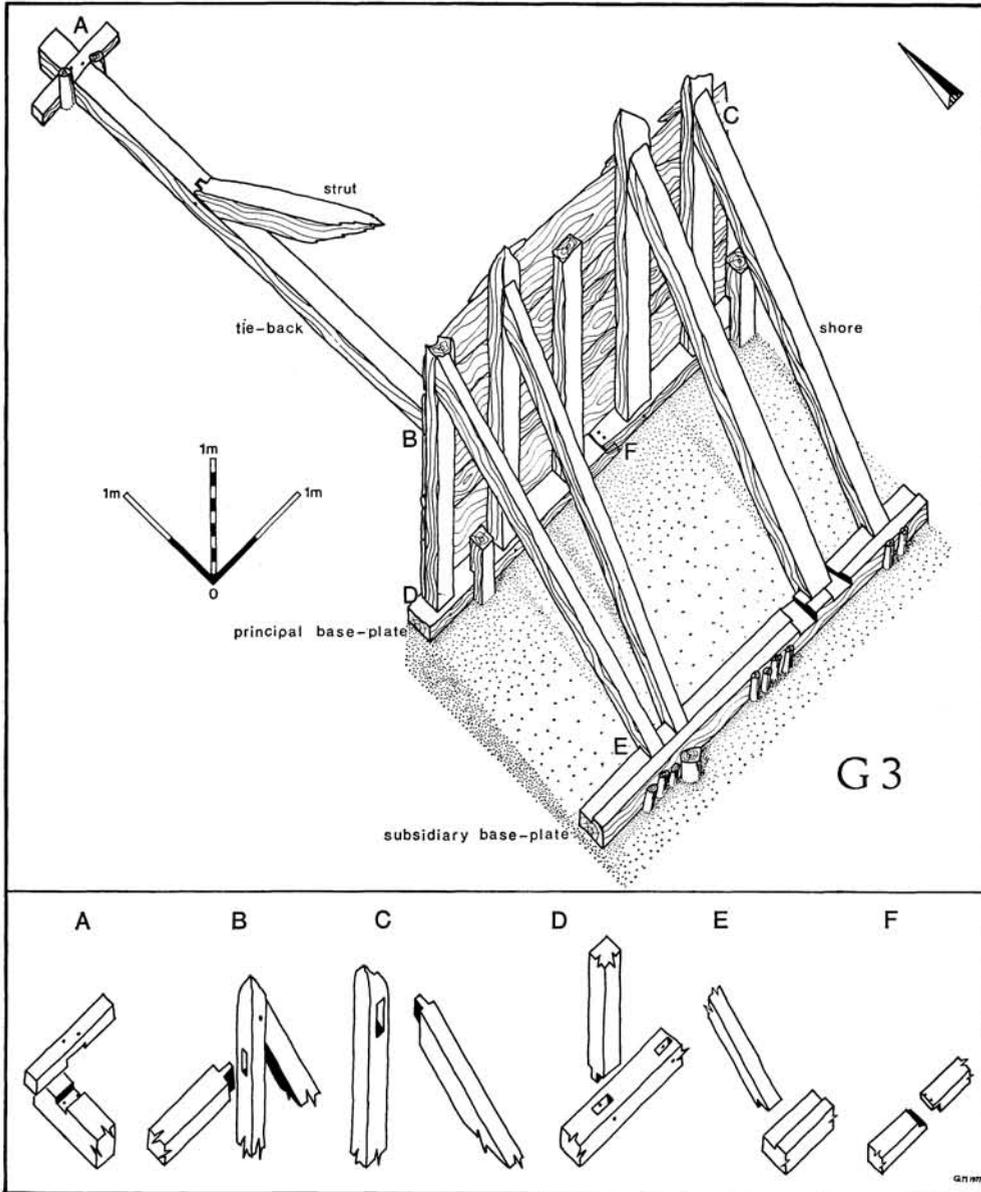


FIG. 5

TRIG LANE, CITY OF LONDON, REVETMENT G3

Semi-reconstructed projection to show both front and back-bracing. Revetment face as excavated in centre of site: back-brace modelled on only complete example found (FIG. 4*b*). River to S. Joint details: *A*, pegged half-lap; *B*, central face-tenon; *C*, chase-tenon; *D*, pegged central tenon; *E*, bird's mouth abutment; *F*, edge-halved scarf with square vertical butts and two face pegs

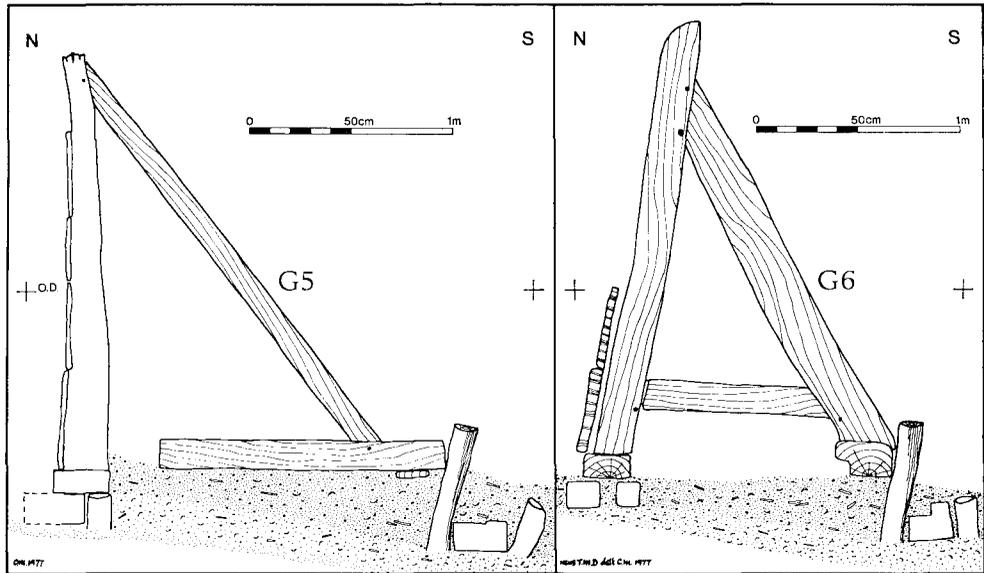


FIG. 6

TRIG LANE, CITY OF LONDON, STRUCTURES G5, G6

Side elevation looking E. of front-braced repair structures. Note remnants of earlier revetments. River to S.

It was thought significant that the style of revetting used on the waterfront should alter at this point, between structures G3 and G4, even though both were contemporary. This division was considered to reflect a property boundary dividing owners of different means or inclinations. Documentary evidence for the site demonstrates that the property was in fact subdivided from at least *c.* 1290.¹⁹ It is worth observing that the point which marked the westernmost extent of revetment G4 was respected by the succeeding structures of G6, G10, G12, G14 and G15 — clearly a well-defined boundary — while persistent if less permanent property divisions were postulated to explain the change in revetment alignment or style in the centre of the site associated with revetments G12, and the return walls of structures G7 and G11 (FIG. 4).

REPAIR STRUCTURES G5 AND G6 (FIG. 4, *c*)

Before further reclamation incorporating revetments G7 and G10 took place in the mid 14th century (FIG. 4, *d, e*) the frontage was repaired at least twice. A minor repair in the E. part of the site (G5) involved a bracing technique similar to that noted on the Custom House site²⁰ and at Seal House²¹ (FIG. 6), in which the shore was tenoned into a transverse base-plate. The amount of foreshore which had accumulated over the G3 subsidiary base-plate before the G5 base-plate was laid suggested that the repair was effected at a relatively late stage in the life of the frontage.

In the W. part of the site, a 5.50 m. length of revetment G4 had been completely refaced, following the removal of the superstructure down to base-plate level. Revetment G6 was then superimposed upon the earlier base-plate (FIG. 6). The structure comprised a principal base-plate into which were tenoned vertical posts with horizontal planking nailed to their northern faces. Diagonal shores were chase-tenoned into the head of the posts, and ran southwards to abut a subsidiary base-plate parallel to the revetment. An additional member tied the feet of the posts to the shores.

REVETMENT G7 (FIG. 4, *d*)

By *c.* 1350 a 14 m. stretch of the waterfront in the E. part of the site was advanced by 3 m. with the construction of revetment G7, behind which substantial quantities of contemporary refuse were tipped. The revetment comprised at least two sections of a pile-founded and pile-retained base-plate joined by an edge-halved scarf with squared vertical butts. Into it, a series of vertical posts had been pegged through full or half tenons. The posts were arranged with alternate pairs being either coupled or spaced at 0.40 m. intervals, and adjacent edges of each coupled pair had been trenched to accept the southern end of a tie-back (FIG. 7). The latter, which was itself edge-trenched, passed between the posts at a height of 1 m. above the base-plate. The tie-back was stabilized at its northern end by passing a cross-member through it, forming a cruciform shape, and driving retaining piles to the S. of the arms. Four or five levels of horizontal planking laid edge to edge were nailed to the northern edge of the posts to retain the dumped material, which a longitudinal section showed had been tipped from E. to W.

This act of reclamation was directly associated with the construction of a substantial building with deep chalk foundations,²² perhaps indicating the increased prosperity of the owner of the eastern property plot. The central plot was not advanced at this time, and its much patched and repaired frontage incorporating parts of the G3, 4 and 6 front-braced revetments, remained in use with the new G7 back-braced structure until *c.* 1370.

RIVER WALL G8 (FIG. 4, *d*)

The owner of the property at the extreme W. of the site, in marked contrast, had sufficient resources to face his frontage, not in timber, but in stone. The construction of wall G8 was dated by dendrochronological analysis of its associated piles — and on the stratigraphic evidence — to *c.* 1330. 3 m. of the E. face and 1.65 m. of the slightly battered S. face were located in the excavation, forming the well-defined corner of a wall bounding a 2 m. wide inlet to the E., between the wall and the return of revetments G4 and G6.

The wall was built on to pile-retained timber planking in the S. (similar to wall G15, FIG. 12) and a chalk rubble raft 0.50 m. thick in the N. Its top had been disturbed by its incorporation into later buildings but at least eight irregular ragstone courses of the original build survived intact to a height of 2.83 m.

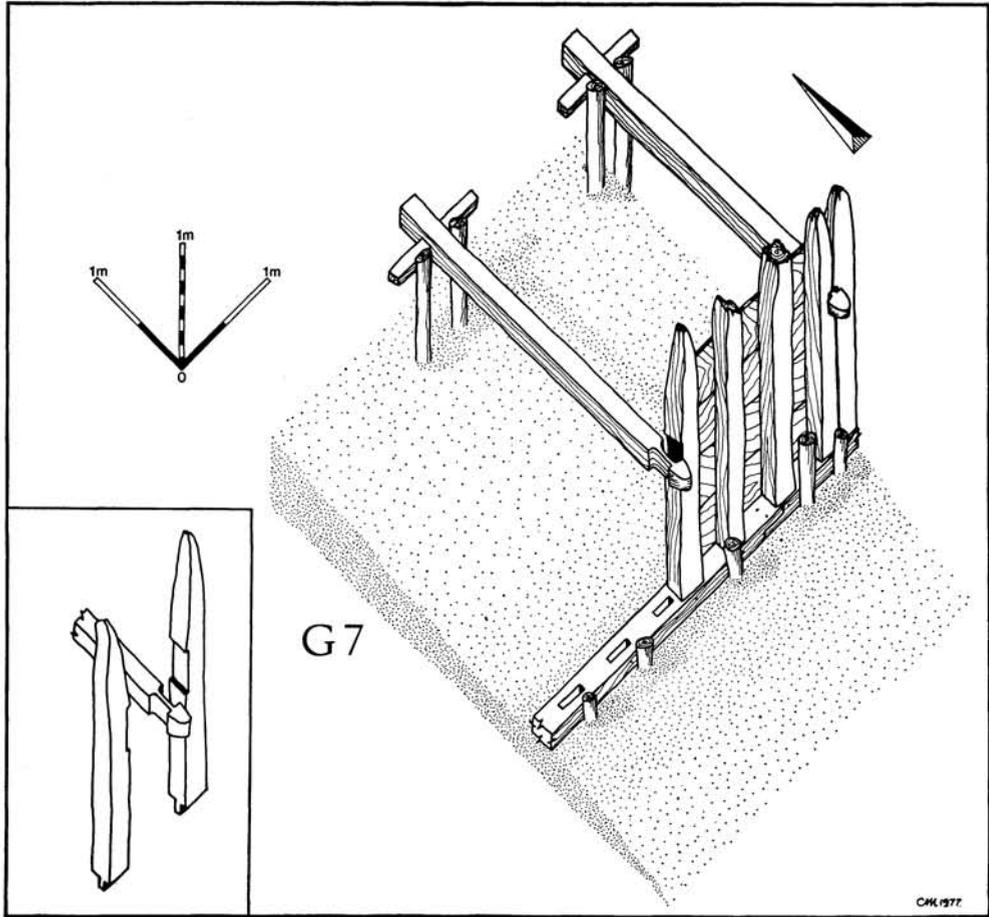


FIG. 7

TRIG LANE, CITY OF LONDON, REVETMENT G7

Projection of part supported solely by back-braces, to show method of construction. River to S. Inset, detail of edge-trenched joint between tie-back and vertical posts

REVETMENT G10 (FIG. 4, e)

In *c.*1365 another major modification of the frontage took place, when the indentation formed by the differing alignments of revetments G6 and G7 was reclaimed. Structure G10 which achieved this also replaced the western 8.40 m. of revetment G7 — which was presumably in need of repair at this stage —, but was married to the remaining section of structure G7, and functioned with it until *c.*1390.

The G10 back-braced revetment comprised a series of six base-plates joined together with edge-halved scarfs with squared vertical butts, into which forty-five dressed vertical timbers had been placed. The latter were set into a deep squared

groove in the plate, stood some 1.40 m. high, and were on average 0.30 m. by 0.15 m. in cross-section. When first exposed — i.e. before considerable shrinkage took place — the edges and southern face of each vertical member were flush with its neighbour, forming an impressive 'stave-wall' (PL. XIX, A). An examination of the southern face revealed twenty-eight samples of incised marking, interpreted as assembly marks. The designs incorporated lines cut parallel or crossing each other, sometimes with an additional circle or half circle. Assuming that the lines bear some relation to the Roman system of numerical notation, they indicated a W. or E. direction of construction for the revetment.

Support for this structure was provided by five irregularly spaced back-braces 2.60 m. long laid out N. to S. behind the revetment. Each one comprised a pile-founded base-plate into which two timbers were chase-tenoned at either end, inclined towards each other. The southern strut was similarly tenoned into the underside of the northern shore, forming a triangular shape, but the latter continued to run southwards towards the revetment face itself (cf. back-brace of G11 on FIG. 3). Unfortunately later activity had severed all the braces at this point, so the actual method of joining is unknown. Four of the brace base-plates had been edge-trenched at their southern ends where they passed between two vertical members of the revetment wall, the relevant pairs of staves being likewise edge-trenched to accommodate them. To ensure that the two vertical members did not move apart — and thus allow the base-plate to withdraw — an additional plate of wood 0.20 m. by 0.20 m. by 0.03 m. was completely housed half in each of the paired members' abutting edges and subsequently pegged. Such extra timbers are normally known as 'free tenons' (FIG. 8).

The fifth back-brace base-plate was tenoned directly into a vertical member, to the W. of which the revetment face was composed of six plain sawn timbers of 0.30 m. by 0.10 m. cross-section, but of a similar height to the split members to the E.

REVETMENT G11 (FIGS. 4, 8, 9)

In c.1385 the eastern property plot was advanced with the construction of the G11 vertically planked back-braced revetment behind which was dumped some seventy cubic metres of refuse.²³ It projected 6 m. S. of the previous alignment and superseded the G7 structure. The N. and S. return wall of revetment G11 was married to structure G10 to the W., with which it continued to function for about a century. It comprised a series of pile-laid and pile-retained base-plates joined with edge-halved bridle-buttetted scarfs (FIG. 10), into which plain-sawn vertical planks were tenoned: the planks averaged 0.45 m. by 0.07 m. in cross-section, and stood up to 1.60 m. high. Each one was joined to its neighbour by a 0.03 m. square dowel, 0.09 m. long, set into a circular hole bored into the adjacent edge of the vertical member, which was then butted flush (FIG. 8). Tenons on the head of each plank accepted a top-plate with mortises in its upper face, suggesting that the structure originally had carried a second level of vertical planking, none of which survived. The four back-braces which supported the

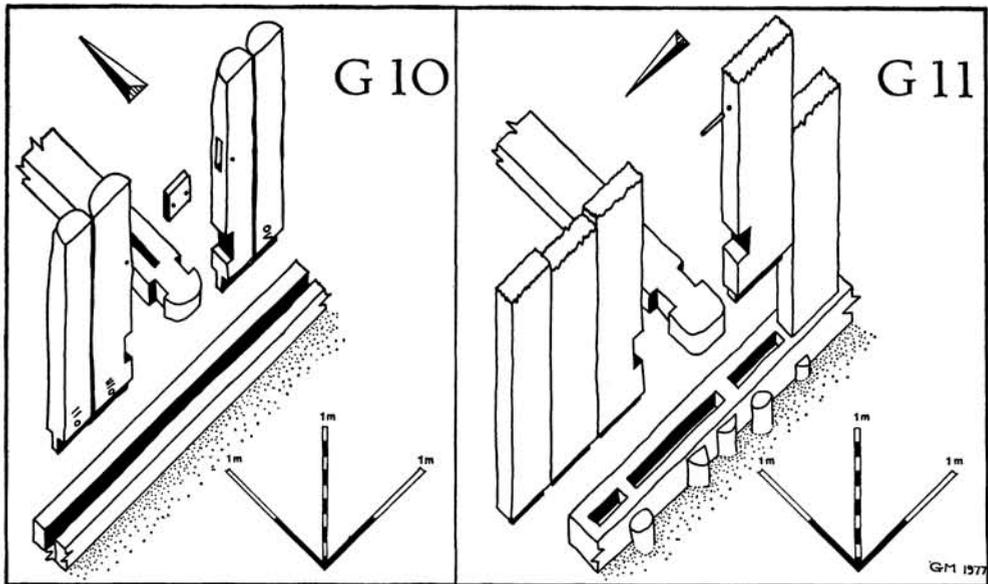


FIG. 8

TRIG LANE, CITY OF LONDON, REVETMENTS G10, G11

Projection of part of back-braced revetments, to show similar but not identical methods of construction. River to S. for G10, to W for G11

structure were similar in type to those already described for revetment G10 but exhibited a higher standard of workmanship and utilized only primary timber (FIG. 3).

Joined to the revetment and extending 2 m. S. of it was a platform 3.40 m. wide. It consisted of three squared, pile-laid frame members mortised and tenoned together at their SE. and SW. corners, and retained externally by piles. Three regularly spaced joists were centrally tenoned into the internal edges of the eastern and western frame members, and well-fitted planking up to 0.04 m. thick was nailed to them, with edges set into the rebates cut on the upper face of the frame. Individual mortises in the upper face of the eastern and western frame members and a groove cut for almost the entire length of the southern member were suggestive of a tank-like superstructure.

A series of three tie-backs had been laid at about top-plate level within the deposits dumped behind the revetment. Although much decayed they were clearly of cruciform type, that is to say aligned at right angles to the revetment wall, with a cross-member passed directly through their northern ends and retained to the S. by piles.

STRUCTURES G12 (FIG. 4, g)

No further reclamation took place on this section of the waterfront until c.1500, although revetment G10 was heightened in c.1420, with the addition of

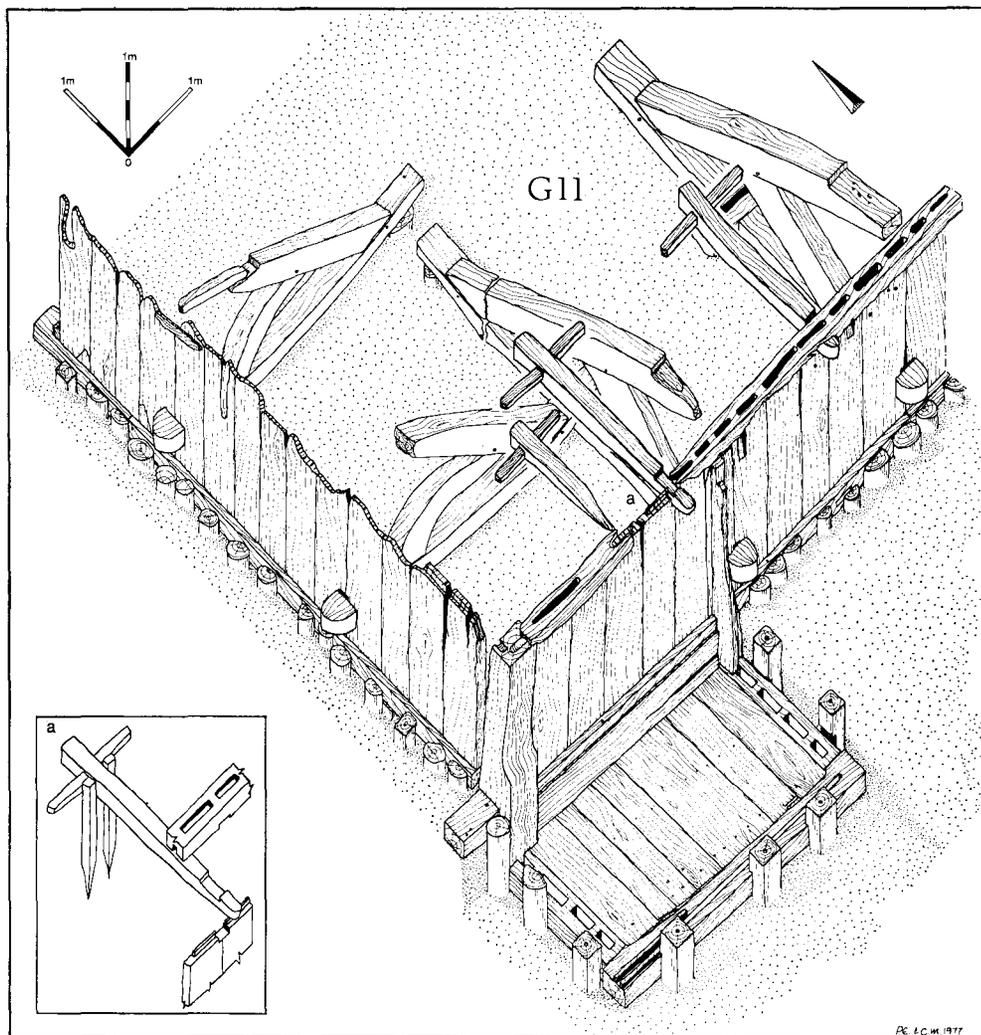


FIG. 9

TRIG LANE, CITY OF LONDON, REVETMENT G11

Projection of back-braced revetment, with base of water tank (?) in SW. corner. River to S. and W. Inset, detail of junction of tie-back, top-plate and revetment face, semi-reconstructed

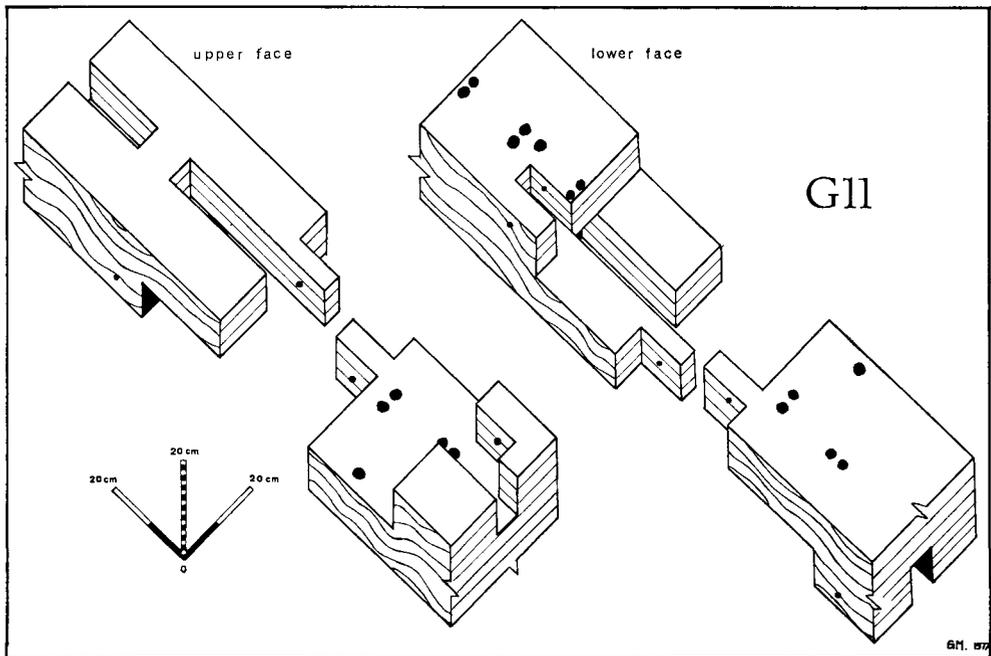


FIG. 10

TRIG LANE, CITY OF LONDON, REVETMENT G11

Detail of edge-halved bridle-buttet scarf with two edge pegs, joining two sections of base-plate. Mortises cut in upper face housed tenons on feet of vertical planking, while dowel holes in lower face contained pegs driven into foundation piles

structure G12. This was constructed in two similar but distinct sections, comprising a top-plate laid directly on to the staves of G10 into which a wall of vertical planks some 0.50 m. high had been set (FIG. 11): a series of six tie-backs braced the structure from the north.

The western three tie-backs were simply horizontally laid timbers with a pile-retained cross-piece passed through the northern end, and an assumed tenon joining the southern end to the top-plate. The eastern three were of more complex type, and comprised a tie-back some 3 m. long horizontally laid N. to S. at top-plate level. A tenon at the southern end was passed through a mortise in the top-plate's northern edge, and secured to the S. with a vertical peg: such a joint is known as a 'tusk tenon'.²⁴ A vertical member 1 m. long had been passed through a mortise in the face of the tie-back just N. of the junction with the revetment itself: to prevent this member slipping through, an E. and W. retaining piece had been inserted horizontally through its head. At its foot, it was pegged to a diagonal strut which ran northwards to be halved and pegged to the tie-back's eastern edge, forming the hypotenuse of a right angled triangle with the vertical and horizontal members. A second diagonal strut was similarly lapped and pegged to the western edge of the tie-back but ran southwards and upwards. Its junction with the revetment face did not survive as this end of the timber had completely decayed.

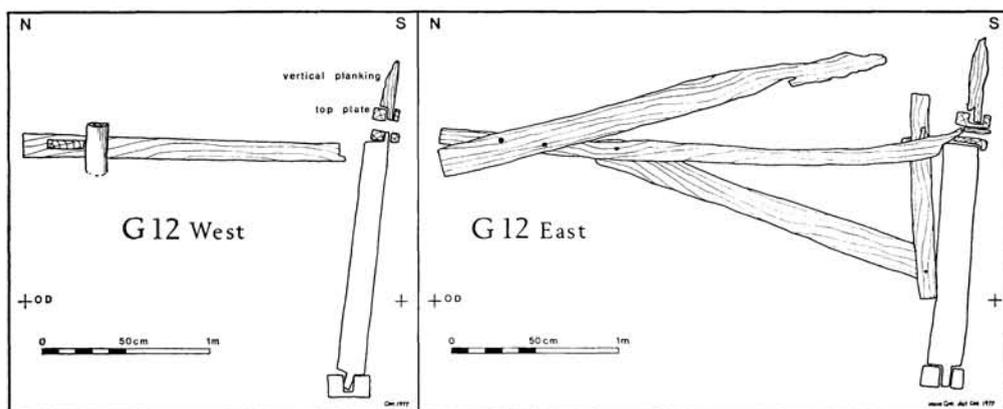


FIG. 11

TRIG LANE, CITY OF LONDON, STRUCTURES G₁₂

Side elevation looking E. of back-braced structures, whose tie-backs supported wall of vertical planking superimposed upon top of revetment G₁₀ (FIG. 8). Eastern and western structures contemporary. River to S.

The G₁₂ additions to the frontage clearly functioned as a unit, even though constructed in two distinct styles. The alteration in building practice was probably the result of two neighbouring tenants approaching a common problem with differing preferences and resources.

FIG. 4, g, shows the three property plots defined by the structurally distinct G₁₁ and G₁₂ revetments. Each one was associated with a different access point, suggested by the remnants of trestles and platforms recorded on the contemporary foreshore: they were pegged to their foundation piles, and were therefore still *in situ*.

RIVER WALL G₁₅ (FIG. 4, h)

By c. 1500, the frontage had been transformed by the construction of a faced stone wall 2.50 m. high, which ran the 24 m. length of the southern edge of the excavation, returning northwards for 10.55 m. The western half of the return wall was seated on a timber raft which was pegged to and retained by elm piles up to 0.35 m. in diameter. The piles driven into the foreshore beneath the eastern half were slighter, up to 0.15 m. in diameter (FIG. 12). The external face comprised at least ten courses of ragstone ashlar blocks, varying in depth from 0.15 m. to 0.20 m., and up to 0.65 m. wide, bonded with a yellow sandy mortar. The vertical face of the stones had been dressed by punching with a $\frac{1}{4}$ in. punch (6 mm.), and ten examples of masons' marks were recorded. The core of the wall, which was up to 1.70 m. wide at the base, was principally of uncovered chalk rubble, although some flint and ragstone was included. The internal face was stepped in a series of three offsets, causing the wall to diminish to a width of 1 m. at the surviving top. The offsets were built mainly from dressed chalk rubble, while the uppermost

courses were wholly ragstone like the facing, as these were exposed to the elements, a situation for which chalk was not suitable.

A single access point was recorded in the centre of the southern section, built into the thickness of the wall, replacing the three access points noted in the earlier phase (FIG. 4, *g*). It comprised two sets of opposed faced blocks 2.65 m. apart, with the remnants of two corbels projecting from the external wall face below them. A wooden stair probably extended southwards into the river at this point.

In 1481 the Armourers' Company, who had recently acquired the site, asked permission of the Court of Common Council to extend their new property southwards.²⁵ The G15 wall is in all probability the structure involved, as its position accords well with that stipulated in the request for permission to build; the associated ceramic evidence points to a late 15th-century date, and the wall must have been constructed later than *c.* 1440, the postulated felling date for a re-used timber sealed beneath it.

RECLAMATION AND REFUSE DISPOSAL

The area between frontage G10 and G11 and wall G15 had been filled by dumping some 300 cubic metres of contemporary refuse in it: all the medieval reclamations examined to date in London seem to have utilized this material rather than the rubble, faggots or clay which were especially purchased for Edward III's well-documented waterworks at Calais.²⁶ It is a sobering reflection on medieval urban life that rubbish tips accumulated to such sizes; anyone intending to extend his property riverwards was clearly doing the City a service by carting the refuse away. The distance involved may not have been very great, as the City records make frequent mention of rubbish dumped in the riverfront area from at least the late 13th century,²⁷ while Ogilby and Morgan's map of London in 1677 shows a street at Brooks Wharf known unequivocally as 'Dunhill Lane'.

DENDROCHRONOLOGICAL ANALYSIS

The broad chronology for the complex construction sequence outlined above was refined by dendrochronological study. Ninety-four oak samples were taken, of which seventy-six were analysed by D. W. Brett of Bedford College, London, assisted by Miss C. Harding. Although the Trig Lane programme was one of the largest mounted for an English medieval site, it was by no means as comprehensive as the work at Novgorod,²⁸ for instance, where 1,389 specimens were examined. Ideally, all 450 structural timbers from the Trig Lane site should have been sampled, but this was not considered practical in the circumstances. An intensive dendrochronological study should attempt more than just the dating of the relevant features. Thus it may be employed to isolate instances of repairs and the re-use of timber within a structure. Important information on woodland management can be deduced from a knowledge of the age and size of timbers, while the method of dressing, by squaring, splitting or sawing, can also be assessed.

0.10 m. to 0.20 m. samples were cut in the field and removed to the laboratory where they were sanded down. Annual growth rings were then counted

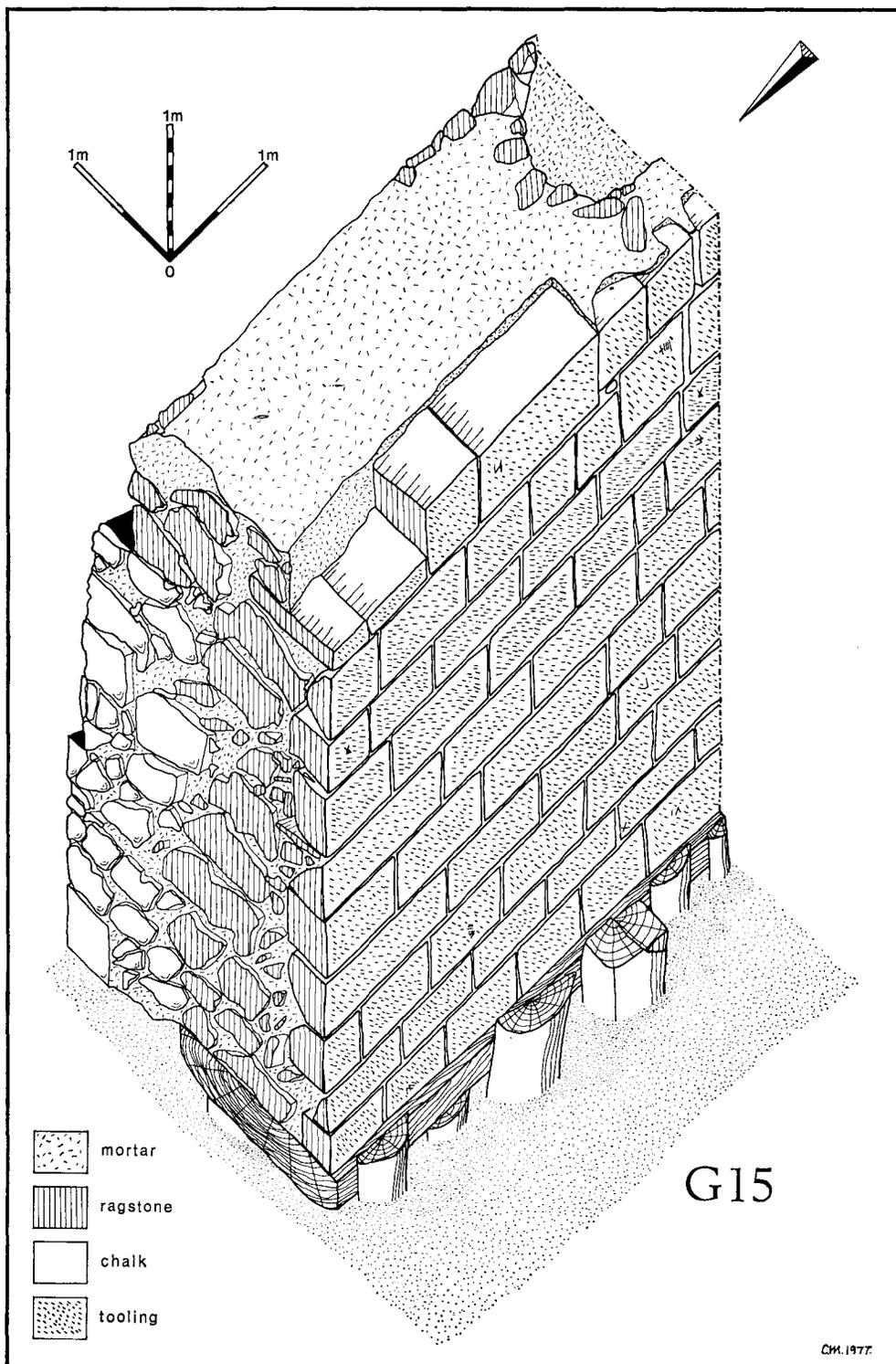


FIG. 12

TRIG LANE, CITY OF LONDON, WALL G15

Projection of part of river wall showing piles, timber raft, rubble core, off-set rear face, and dressed front face. River to W.

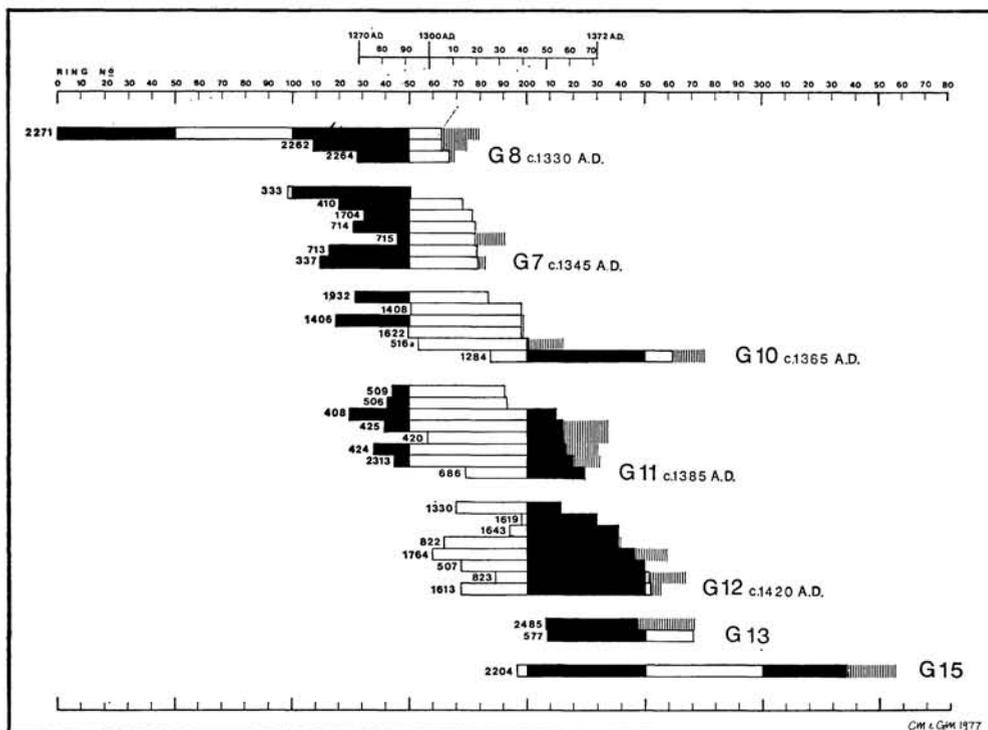


FIG. 13
TRIG LANE, CITY OF LONDON

Bar diagram to show provisional results of dendrochronological analysis. Each timber labelled with context number on right, and structure number on left. Small vertical lines on end of timbers indicate sapwood rings; black vertical bands spaced at 50 year intervals. Calendar date for construction of each revetment calculated by extrapolation from dates suggested by acceptable matching of G11 sequence to German chronologies (see upper calibration)

and measured microscopically, graphed, and the results processed by computer, utilizing both the *Cross* and the *Ringsync* programmes. Although most of the samples had less than 100 rings, the provisional position of thirty-five from G7 to G15 have been established in a 356 year sequence (FIG. 13). It was then possible to suggest relative dates for each successive structural phase, and therefore, by implication, the working life of each structure.

The analysis also assisted in resolving a number of constructional problems. For example, the construction date for structures G12 was seen to be fifty years later than that suggested for the underlying G10 stave wall, indicating two quite distinct structural phases for this waterfront. The G10 corner post (1284) was also seen as a later repair to the G10 revetment (FIG. 13).

Acceptable matching of the 102 year oak ring series from structure G11 (FIG. 13) with the German chronologies of Hollstein²⁹ and Huber³⁰ was achieved with a value of 63.4% for the match with the W. German chronology, and 68.8%

with the S. This enabled tentative calendar dates of 1270 to 1372 A.D. to be postulated for the London series (see calibration on FIG. 13). This dating is consistent with the associated ceramic evidence, and is also being cross-checked by C.14 determinations. Terminal dates of 1141 to 1497 A.D. for part of the Trig Lane oak series were then suggested by extrapolation.

Thirteen elm piles were also sampled, for an elm ring series may provide a rainfall record for much of the 14th century, as Brett's study of recent elms grown in London shows that elm ring widths are influenced by seasonal rainfall fluctuations.³¹

THE REVETMENTS: DISCUSSION

The most dramatic visual aspect of the excavation was the preservation of the medieval timber structures, which were worthy of detailed study. Even though the revetments were all constructed within 150 years of each other, and all were intended to serve much the same function, each one was different. Although it is clear that the differences between contemporary revetments may be attributed in part to the differing financial status of the separate property owners, the differences between successive revetments shows that constructional techniques were subjected to constant innovation and development. A development sequence for London waterfront structures can thus be suggested in which the revetments change from the front-braced horizontally planked type to the vertically planked type with more widely spaced back-braces; subsequently the timberwork was replaced by stone. However, this tentative classification must be seen as typological, rather than chronological. For example, it will be remembered that in *c.*1350 a stone-built river wall and both front and back-braced timber revetments all existed contemporaneously at Trig Lane (FIG. 4, *d*).

One of the simplest types of revetment found in London so far, dated between the mid 13th and early 14th century, comprised horizontal planking laid edge to edge against front-braced earth-fast posts.³² The 13th-century Waterfront II at Seal House was very similar, but enjoyed the sophistication of a base-plate into which the vertical posts were set.³³ The use of both principal and subsidiary base-plates was noted on the mid 14th-century(?) waterfront at Custom House,³⁴ as well as on revetments G3, G4 and G6 at Trig Lane (FIG. 4, *b*, *c*). Of these G3 is especially interesting as it also incorporates a back-brace joined to the vertical post with a pegged central tenon (FIG. 5).

However, the later G7 structure was able to use back-braces to the exclusion of front braces for the first time (FIG. 7), and this important development was respected by all the succeeding revetments. The modern 'barge-road' or 'campshed' revetments on the present day Thames foreshore are all back-braced, a system which provides a frontage clear of all obstructive front-braces.

Efficient back-bracing was dependent upon the development of a strong joint between the tie-back and the revetment facing. The use of a central tenon on the back-braces of G3 (FIG. 5, *b*) was clearly not strong enough for the task, as it snapped when the tie-back subsided into the unstable deposits dumped behind the revetment. In King's Lynn, a pegged dovetail was used to secure a horizontal

tie-back to a vertical post on a structure dated 13th-century,³⁵ but such an arrangement has not been noted in London as yet. At Trig Lane, it was the ingenious joining of brace to upright by edge-trenching — which produced an unwithdrawable joint of exceptional strength — that enabled revetments to be braced successfully from the landward side. The earliest examples were recorded on the tie-backs and posts of revetment G7 (FIG. 7), dated *c.*1345, but the triangular braces of both revetments G10 and G11 (dated *c.*1365 and *c.*1385 respectively) also used this splendid joint (FIG. 8). There are no known parallels for this method of double edge-trenching in any timber-framed structure on dry land: archaeology has therefore discovered a joint which was common in at least the late 14th century, but whose popularity subsequently waned. A useful comparison can be made between the earliest horizontally planked revetments (G3, G4 and G6), which incorporated vertical posts mortised into base-plates, and the recently-excavated pre-Conquest timber buildings from Coppergate, York.³⁶ These also comprised horizontal planks laid edge to edge behind vertical posts on a base-plate but mortise and tenon joints were not used.

The use of the 'stave wall' in revetment G10 markedly at variance with the more common horizontally planked style of revetting, is also a point of considerable interest. According to the Zippelian classification,³⁷ it incorporated an apparently early type of stave wall — using split rather than sawn timbers — in a typologically later base-plate, and cannot be readily paralleled on dry land. The search for an earlier English use of this style invariably leads to Greensted Church³⁸ and Anglo-Saxon building practice, suggesting — superficially — that an archaic technique survived into the 14th century. However, the use of such a stave-type technique in a revetment is quite consistent with its traditional reputation for strength: what is remarkable is that the 14th-century carpenter in an age of timber-framing should still be so conversant with the method.³⁹

However, a suggested reconstruction of a 12th-century revetment from Seal House incorporates vertical boarding,⁴⁰ and a similar technique was recorded during the excavation of a 13th-century building at Weoley,⁴¹ while stave churches were built in Norway throughout the medieval period, according to Hauglid.⁴² Further work may show that the two accomplished instances of 14th-century stave building afforded by revetments G10 and G11 at Trig Lane are not as atypical of later medieval practice as they appear to be at present.

The use of lap-joints and tusk tenons in the G12 structure (FIG. 11) was considered by Hewett to be both unusual and anachronistic in a 15th-century context: again no firm parallels could be found in surviving landbound structures. Rigold's recent discussion of medieval timber bridges concluded that bridge building was basically "a special application of timber framing",⁴³ but the lack of close parallels outside their context shows that the same cannot be said for the London riverfront revetments; a more specialist type of structure requiring unique structural attributes. Their importance to students of vernacular architecture — in its widest sense — cannot therefore be over-estimated.

Because the revetments are closely datable, their archaeological value is increased. For instance, a late 14th-century date for the bridled-butted scarf of G11

(FIG. 10) is noteworthy, as this was the "principal scarf joint of the 15th and 16th century" in Essex,⁴⁴ although earlier examples are suggested from Berkshire.⁴⁵ Of even wider significance is the fact that the artifacts in the associated deposits dumped behind the revetments are also thereby dated, and these deposits include large assemblages of both English and imported pottery.

CONCLUSIONS

The recent excavations at Trig Lane have thus thrown new light on a neglected aspect of urban topography — the medieval waterfront — by demonstrating that the frontage was being advanced and consolidated continually during this period. The manner and extent of reclamation was seen to be the prerogative of the owner of each narrow property plot — rather than a corporate concern — and this produced a waterfront that was structurally varied and much indented. The state and style of the waterfront itself is seen as an indicator of the economic health and aspirations of those living immediately behind it.

The excavations also have shown how exceptionally rich waterfront deposits can be, and how much research into construction and carpentry techniques, topography,⁴⁶ nautical archaeology,⁴⁷ dendrochronology,⁴⁸ climatology,⁴⁹ and changing river levels⁵⁰ — as well as artifact studies — can benefit from their investigation.

The pioneer work at King's Lynn,⁵¹ as well as investigations in several other towns such as Plymouth⁵² and York,⁵³ demonstrates that the advancing medieval waterfront was not just a feature of topographical development in London: indeed, considerable continental research (for example in Bergen⁵⁴ and in the Netherlands⁵⁵) has shown that it is an international phenomenon. It is therefore important that the archaeological potential of these often deeply stratified deposits should be fully realized.

ACKNOWLEDGEMENTS

We wish to acknowledge the work of the excavation team — without which this report would not have been possible — especially Peter Ellis, John and Cathy Maloney and John Burke-Easton. We are also most grateful to Donald Brett and Charlotte Harding for the dendrochronological study, to Cecil Hewett for advice on the carpentry and to Brian Hobleby who encouraged us with the report. Thanks are also due to John Bailey and Trevor Hurst for the photography.

NOTE

The Society is much indebted to the Department of Urban Archaeology, Museum of London, and to the Department of the Environment for grants towards the cost of publishing this paper.

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