

# THE REDEVELOPMENT OF 20 DEAN'S YARD, WESTMINSTER ABBEY 1975-77

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From February to May 1975 the Inner London Archaeological Unit carried out an excavation at the rear of 20 Dean's Yard, Westminster Abbey, in the eastern third of the sub-vault of the Abbey misericorde. The results of that excavation were published in the Transactions of the London & Middlesex Archaeological Society Volume 27, for 1976<sup>1</sup>.

This present account contains specialist reports on mortar samples taken during the excavation (p. 204), on a coin from the 11th century ditch revealed during the excavation (p. 200), and on the glazed tiles (p. 202) and a 12th century stone carving (p. 200) uncovered during the redevelopment of the site. It also contains a description of features exposed during redevelopment, both within the sub-vault and in the area between the sub-vault and monastic kitchen to the east, and the late 14th century cellarer's range to the west (see Plan, Fig. 3).

## THE PATHWAY BETWEEN THE KITCHEN AND FRATER

In the report on the excavation in the sub-vault one of the unanswered problems concerned the pathway between the kitchen and frater<sup>2</sup>. There was no archaeological evidence for a roof over this pathway prior to the construction of the sub-vault. A passage in the Customary of Abbot Ware (1266) states that "up to the time of Prior Philip (1253-8) there was a hollow and a mural arch with a vault skilfully contrived between the refectory and the convent kitchen"<sup>3</sup>. In the excavation report this was interpreted as referring to an early version of the serving hatch in the frater wall through which the food was served<sup>4</sup>. If the "vault skilfully contrived" in fact referred to a roof over the pathway between the kitchen and frater, which had been built without using vertical supports, this might account for the lack of archaeological evidence.

This, however, would alter the date for the construction of the misericorde and its sub-vault from that of pre 1246 advanced in the excavation report<sup>5</sup> to between 1253-58. The initial dating of the sub-vault was largely based on the fact that the pier bases were of water-holder type, whereas those used in the rebuilding of the Abbey under Henry III which began in 1246 were largely of the succeeding triple roll type<sup>6</sup>.

Water-holder bases were used in this country from the late 12th century to c. 1260. The latest accurately dated examples were used in Lincoln Cathedral in the 1250s. There were a small number used in the post 1246 rebuild of Westminster Abbey, around the outer side of the ambulatory, and at the extremities of both transepts, but these, as the example X in Fig. 2 shows, were considerably more elaborate than the bases in the misericorde sub-vault.

It is virtually impossible to date water-holder bases with any accuracy. Most authorities tend to date the bases from other features of the building, or, failing that alternative, equate simplicity of moulding with earliness of date. It must be emphasised, however, that while there is a considerable amount of information available for the mouldings used in major structures, little is known of those used in minor works. It seems likely that while new techniques were being applied in major construction work, older ideas continued to prevail in the smaller structures.

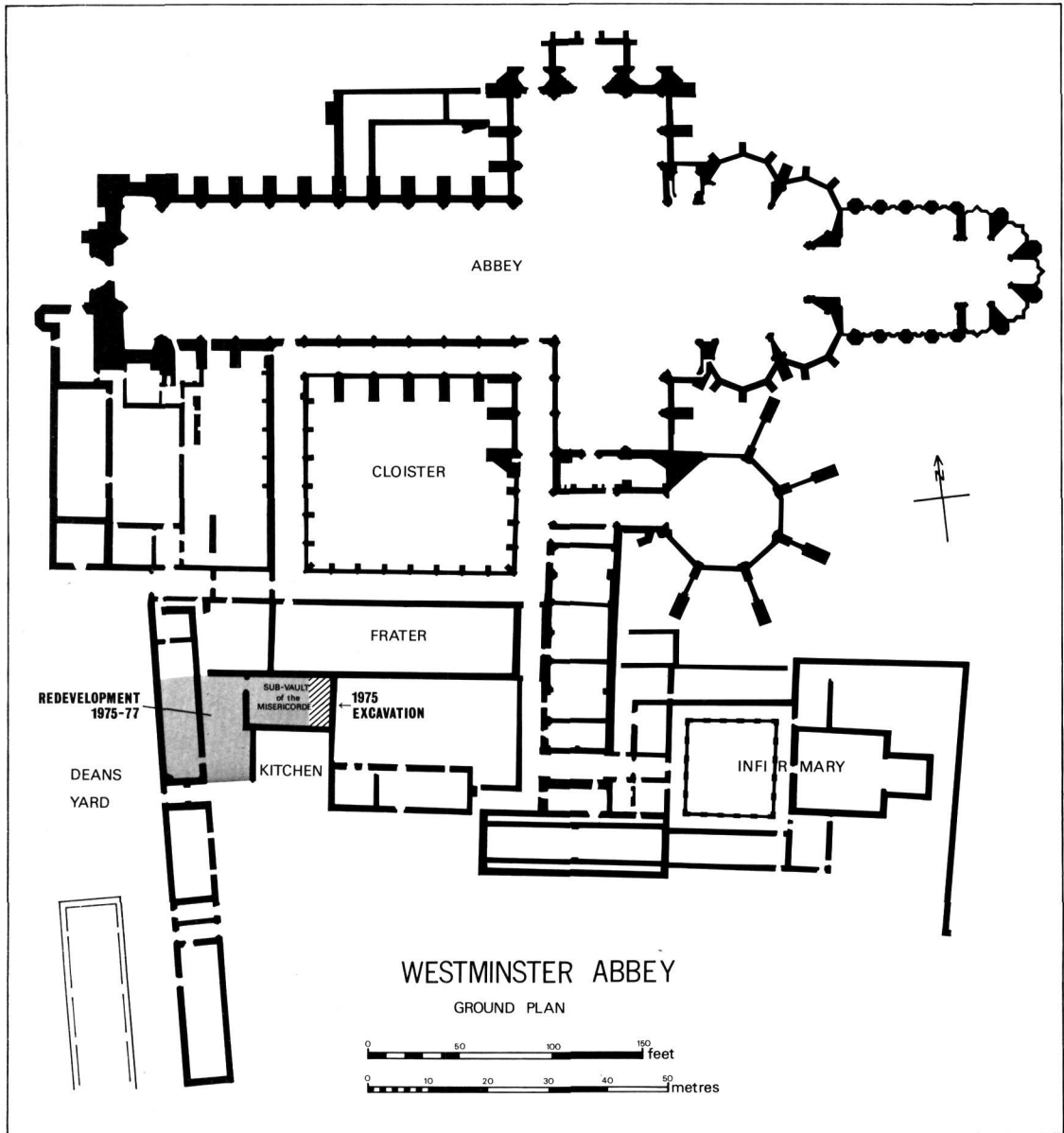


Fig. 1 Westminster Abbey ground plan. (After R.C.H.M. Westminster Abbey)

## Pier elevations

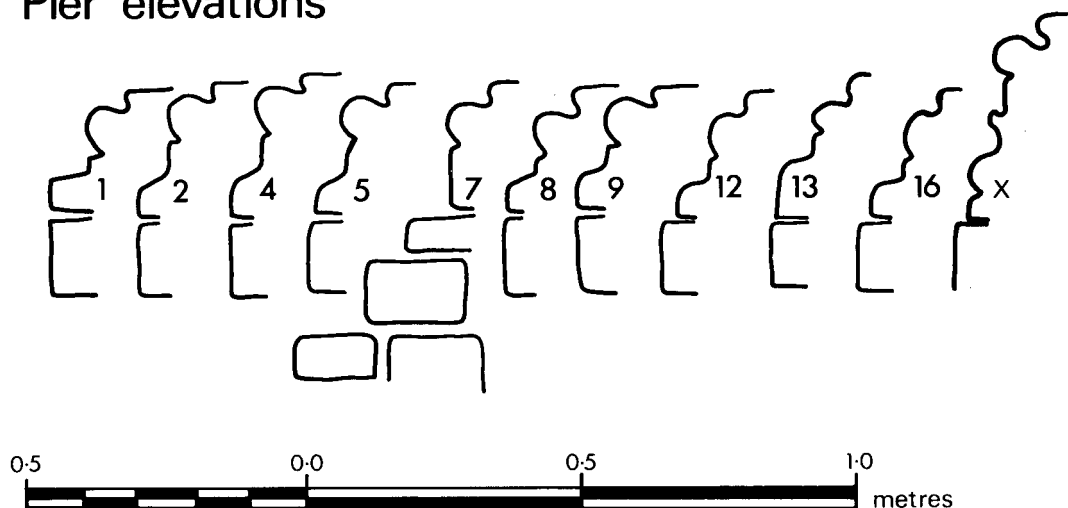


Fig. 2 Westminster Abbey. Redevelopment of 20 Dean's Yard 1975-77. Pier elevations. The numbers correspond to those in Fig. 3. Pier base X is a waterholder base from the west wall of the south transept of the abbey church

The pottery is not exceptionally helpful either. On the whole, the evidence from phases 3(d) and 4(a) of the excavation<sup>7</sup> would fit a pre 1246 date better. The only sherds which at present would seem better suited to a date in the 1250s are the Rouen copies, but there is a lack of information on when Rouen vessels were first imported into this country, and thus a pre 1245 date for copies is possible.

Thus, were it not for the documentary reference quoted above, the simplicity of the base mouldings and the evidence of the pottery would still point to a pre 1246 date for the building's construction. However, an alternative date between 1253-58 cannot be ruled out, and would solve the problem of the roofing of the pathway between the kitchen and frater.

### DEPOSITS DISTURBED DURING REDEVELOPMENT

Redevelopment began in September 1975. Within the sub-vault all deposits above the original 13th century floor level of the building were removed, and the west wall, west door, and remaining pier bases of the sub-vault were exposed. The wall and door had been recorded by Rev. H. F. Westlake in 1921<sup>8</sup>. West of the sub-vault, for a distance of 7.3m, deposits were removed down to the same level. A long drainage trench was dug from the sub-vault westward under the cellarer's range, cutting through its foundations, and one metre into Dean's Yard.

Within 20 Dean's Yard (see Plan, Fig. 3) a large trench was dug by the contractors. This trench was *c.* 5m north-south x 2.5m east-west x 1.25m deep. A shallow foundation trench was dug eastwards from this trench, and a small trench was excavated westwards from the NW corner of the large contractor's trench to the cellarer's building.

### STRATIGRAPHY WITHIN THE SUB-VAULT AND IMMEDIATELY WEST

Over the entire sub-vault a mortar floor survived in patches at the level of the original 13th century floor. In one area (see Plan, Fig. 3) a section of a decorated tile floor survived,

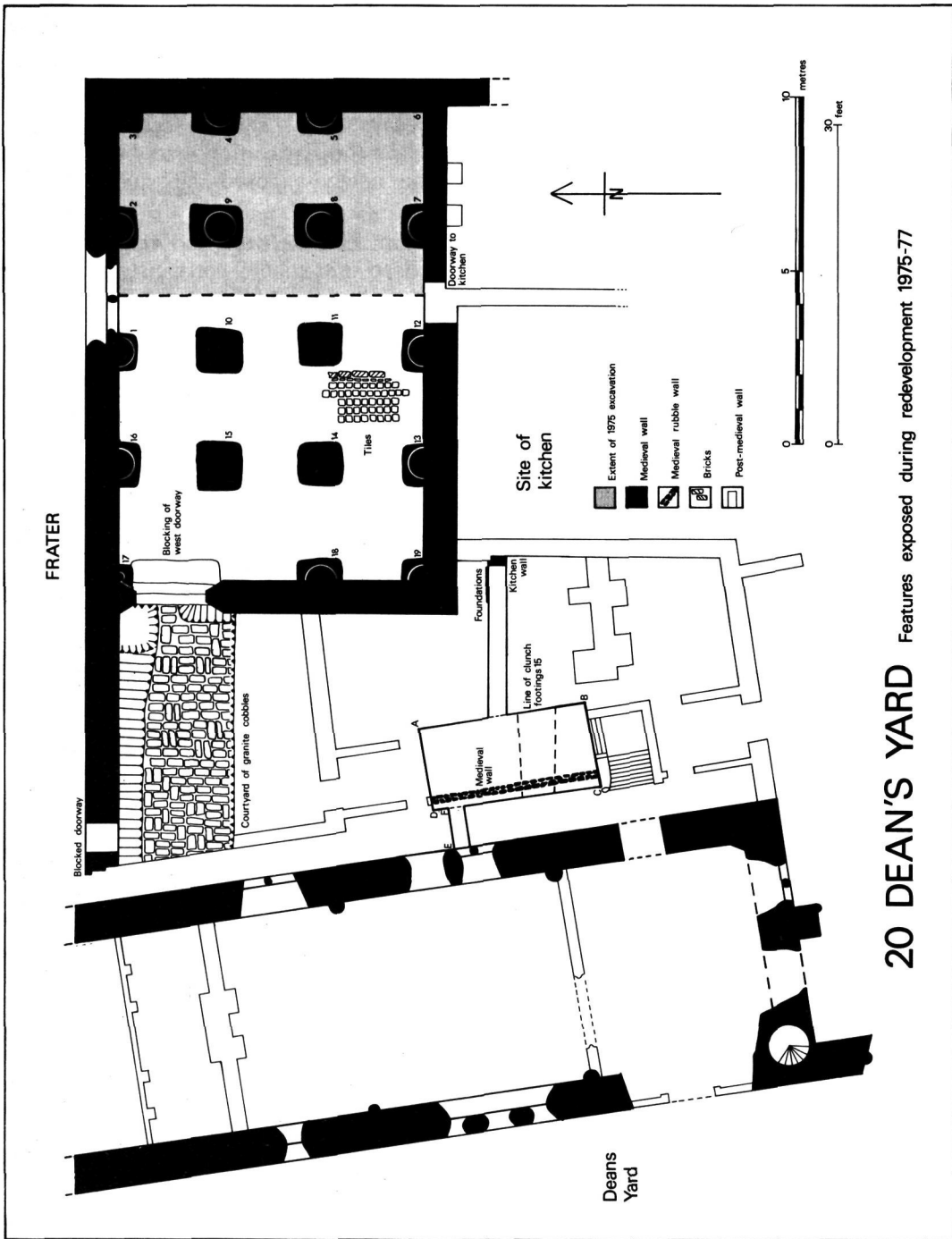


Fig. 3 Westminster Abbey. Redevelopment of 20 Dean's Yard 1975-77. Features exposed during redevelopment

consisting of re-used 13th and 14th century tiles bordered by bricks (see tile report p. 202). These tiles replaced the mortar floor at this point. Most of the deposits above this floor had been removed by 17th and 18th century pits. Even in the small area archaeologically excavated there had been a noticeable increase in post-medieval pitting towards the west. The main excavation section was in fact rendered useless because it only showed sections through post-medieval features. The area immediately west of the excavation had been totally destroyed, rendering it impossible to associate the newly exposed deposits with the stratigraphy recorded during the excavation.

Over most of the area, the post-medieval pits varied in depth between 0.05m and 0.25m above the level of the original floor. Below the pits, a deposit of rubble, consisting of Reigate stone, clunch, and mortar fragments lay directly on top of the original floor level. This rubble layer dated from the demolition of the misericorde and its sub-vault in the 1570s. This fact, and the presence of a section of a tiled floor consisting of re-used 13th and 14th century tiles, makes it likely that at some date prior to 1570 the deposits in the western part of the sub-vault were removed down to the original 13th century level. The 1975 excavation showed that the most easterly bay had been partitioned off from the rest of the sub-vault<sup>9</sup>, which probably explains why the deposits had not been removed in that bay.

The remains of the west wall of the sub-vault, surviving to a height of four courses, were revealed in the position recorded by Westlake<sup>10</sup>. The wall was rubble-faced, similar to the eastern wall, and 1.15m thick. The doorway in the north-west corner of the sub-vault was 2.14m wide. The splayed door jambs were faced with Reigate stone and the base of an internal moulded arch survived<sup>11</sup>. The doorway was blocked, and the blocking was sealed by demolition rubble. There was some evidence of burning on the internal face of the blocking and on the floor immediately adjacent to it.

The only pier bases which had survived within the sub-vault west of the excavated area were those which had been cut into the surrounding walls. The plinths of the internal piers survived but the pier bases themselves were probably removed when the sub-vault was demolished. Probing with a crow-bar failed to reveal the presence of any sleeper walls under the plinths similar to the one present in the excavated area. The original purpose of the sleeper wall discovered in the excavated area remains unknown<sup>12</sup>.

West of the sub-vault a surface of granite setts was exposed. This abutted the exterior face of the western wall and blocked doorway post-dating the blocking, and was 0.25m above the floor level of the sub-vault. The setts were laid on a deposit of clean sand, below which no deposits were removed by the contractor.

The demolition of an 18th century wall built against the south face of the frater revealed that the original facing of the frater wall had been partially removed at an earlier unknown date. The core of the frater wall was of clunch and mortar. A narrow drop-arched doorway leading into the frater was revealed in the north-west corner of the site. The date of its blocking is unknown.

The drainage trench dug westwards from the sub-vault through the cellarer's range to Dean's Yard revealed that the earliest floor in the excavated area (F90 — dated to the second half of the 11th century<sup>13</sup>) extended to the east wall of the cellarer's range where it was cut through by the late 14th century foundations. Within the cellarer's building all the deposits had been removed in the 19th century to allow the construction of a new floor at the original 14th century level (*c.* 1.25m below present ground level). Most of the deposits exposed in

Dean's Yard had been destroyed by Victorian drains, but there was evidence of clunch and mortar surfaces.

STRATIGRAPHY IN THE REAR OF 20 DEAN'S YARD (see Sections 1, 2 and 3; Fig. 4)

This area lay between the west wall of the monastic kitchen and the east wall of the cellarer's range. At no point within the contractor's trench was the underlying river silt or natural gravel exposed. Within the excavated area of the sub-vault *c.* 10m north-east of this trench, natural gravel occurred at 2.14m OD, and was overlain by a deposit of chocolate brown river silt, the top of which was at 2.54m OD<sup>14</sup>. The lowest point reached in the contractor's trench was 2.06m OD, revealing a slope in ground level.

Sections 1 and 2 ran parallel north-south. Section 2 was 2.5m west of Section 1. Section 3 ran westwards from Section 2 to the east wall of the cellarer's range.

It was not possible to closely observe deposits as they were being removed, therefore the remarks below on the stratigraphy of the site must be considered as tentative.

The east-west sections of the contractor's trench were damaged to such an extent by an 18th century wall at the northern end and work associated with the 1976 building operations at the southern end, that they could not be used to obtain a direct relationship between Sections 1 and 2.

A rubble wall 0.45m thick ran north-south along the entire length of the contractor's trench 0.30m east of Section 2, and had a partition wall of the 18th century building resting on it. Its top varied from 0.05m - 0.10m below the 18th century floor level. The surviving top two courses were faced (depth varied from 0.18m - 0.30m). Below these the foundations began with a single irregular step on the east side of the wall. It was not possible to associate the rubble wall with a particular phase in either Section 1 or 2, but it may have been connected with the construction of the cellarer's range, separating a pathway from the remainder of the yard.

SECTIONS 1, 2 and 3 — STRATIGRAPHY

Section 1 — nos 1-44; Section 2 — nos 1, 2, 15, 45-74, 80-82; Section 3 — nos 58-60, 62, 63, 71, 74-79, 83-85

*Phase 1*

Sections 1, 2 and 3

Floor 1 — consisted of packed Reigate stone flakes (1)

Floor 2 — a deposit of orange gravel (2)

Trampled deposits or dumping to raise the ground level — a deposit of mid brown soil (45).

The floors (1 and 2) extended across the contractor's trench, occurring in both sections, and may represent a general surface, possibly a part of either the Great Court of the monastery, or of the kitchen yard. There was no evidence for a trampled deposit on the surface of (1). This may mean that the surface was regularly swept clean, or that it was only make-up for a gravelled yard (2). The layer of mid-brown soil (45) may have been trampled on to the yard surface, or dumped to raise ground level.

*Phase 2*

Section 1

Wall of Reigate stone blocks (3) — faced on south side — block on north side probably removed by later cut (15) (see below Phase 3).

Floor 3 — mortar surface (4) on south side of the wall (3), and associated with it.

Trampled deposit of dark greyish brown soil (5) over the mortar floor (4).

Floor 4 — new mortar surface (6) laid south of the wall.

Floor 5 — north of the wall (3) the gravel (2) was sealed by a new mortar surface (7) — this surface did not extend along the remaining length of the trench.

Above this floor (7) was a deposit of light brown soil (8) which may have been trampled on to the

floor, or dumped there to raise the ground level.

Floor 6 — a new mortar surface was laid (9)

Above this floor was a trampled deposit of dark greyish brown soil (10).

Dumped deposits of mortar (11), dark greyish brown soil (12), rubble (13), and mid-brown soil (14).

The relationship between deposits north and south of the Reigate stone wall (3) was uncertain. It is probable that this wall was faced, and had associated floors, on both sides. Floor (7) may be the floor on the north side of the wall, laid after its construction, and therefore be of approximately the same date as floor (4). The relationship of floor (9) to floor (6) is unknown. Presumably the wall separated functions on its north side from those on its south side. The shallowness of the footings for the wall (3) are worthy of note. The reason for this may lie in the firm bed of Reigate stone flakes provided by the earlier floor (1). The deposits on the south side of the wall above floor (6) are discussed under Phase 3 below.

### Sections 2 and 3

Make-up for a floor — a deposit of Reigate stone flakes (46).

Floor 7 — deposits of orange gravel (47, 48) and brown gravel (49).

Dumping from the kitchen, or possible remains of a fire (50).

Floor 8 — a laid mortar resurfacing of floor 3 (51, 52).

Dumping of mortar (53, 54) rubble and dark greyish brown soil (55).

Floor 9, or make-up for a floor — a deposit of laid mortar (56).

Dumping of dark greyish brown soil containing fragments of clunch (57) or rubble (58).

Dumping from the kitchen or possible evidence of a fire (59).

Floor 10 — deposits of laid mortar (60) and Reigate stone flakes (61).

Dumping of Reigate stone flakes (62), sand (63) and dark soil (64).

Dumping of mid-brown soil with clunch fragments (65), deposits of Reigate stone flakes and mortar (66), orange gravel (67), and more Reigate stone flakes (68).

Shallow cut backfilled with burnt material (69).

There are two possible alternatives to the order of deposits enumerated above. Firstly (56) may originally have extended along the entire length of the trench, but had been cut through, and the cut backfilled by (57, 58, 59), and possibly (49) and (52).

The second alternative is that the deposits (61, 65, 66, 67, 68 and 69) represent the backfill of a cut.

There is also a possibility that layer (68) represents a Reigate stone flake floor associated with (15) — see Phase 3.

The contrast between Phase 2 deposits in Sections 1 and 2 is difficult to explain. Those in Section 1 are associated directly with the Reigate stone wall (3). The wall and deposits extended 0.15m into the trench before being cut through by an earlier exploratory trench dug by the developers. One possible explanation is that there may have been an earlier north-south partition on the site, associated with this wall.

### Phase 3

#### Sections 1, 2 and 3

Insertion of a foundation trench — filled with crushed clunch (15). The Reigate stone wall (3) was largely dismantled and the facing blocks were removed from its north side. Some earth fell in (16) during the digging of the trench.

South of the clunch foundations (15) material was dumped to raise the ground level — dark greyish brown soil (17), burnt material (18), more soil (19), mortar (20), more soil (21), sand (22), and some lighter soil (23).

Floor 11 — floor of laid mortar (70) running south from the wall (15) — may be the same as (24) in Section 3. Associated with the new wall.

The foundations (15) were the remnants of a wall which ran east-west across the area. The purpose of this wall is unknown, but must be associated with the floor surface (70/24) which extended south from it (see Phase 4 below, p. 197).

The deposits in Section 1 may be interpreted in different ways. It is not known, for example, whether the dumped deposits (17, 18, 19) were associated with the Reigate stone wall (3) or with the construction of the new wall (15). The mortar layer (20) looked remarkably like a floor surface, with a trampled deposit (21) above it. If so, presumably it represents a floor associated with the new footings (15) and immediately overlying the remains of the Reigate stone wall (3).

# WESTMINSTER ABBEY. 20 DEAN'S YARD REDEVELOPMENT 1975-77

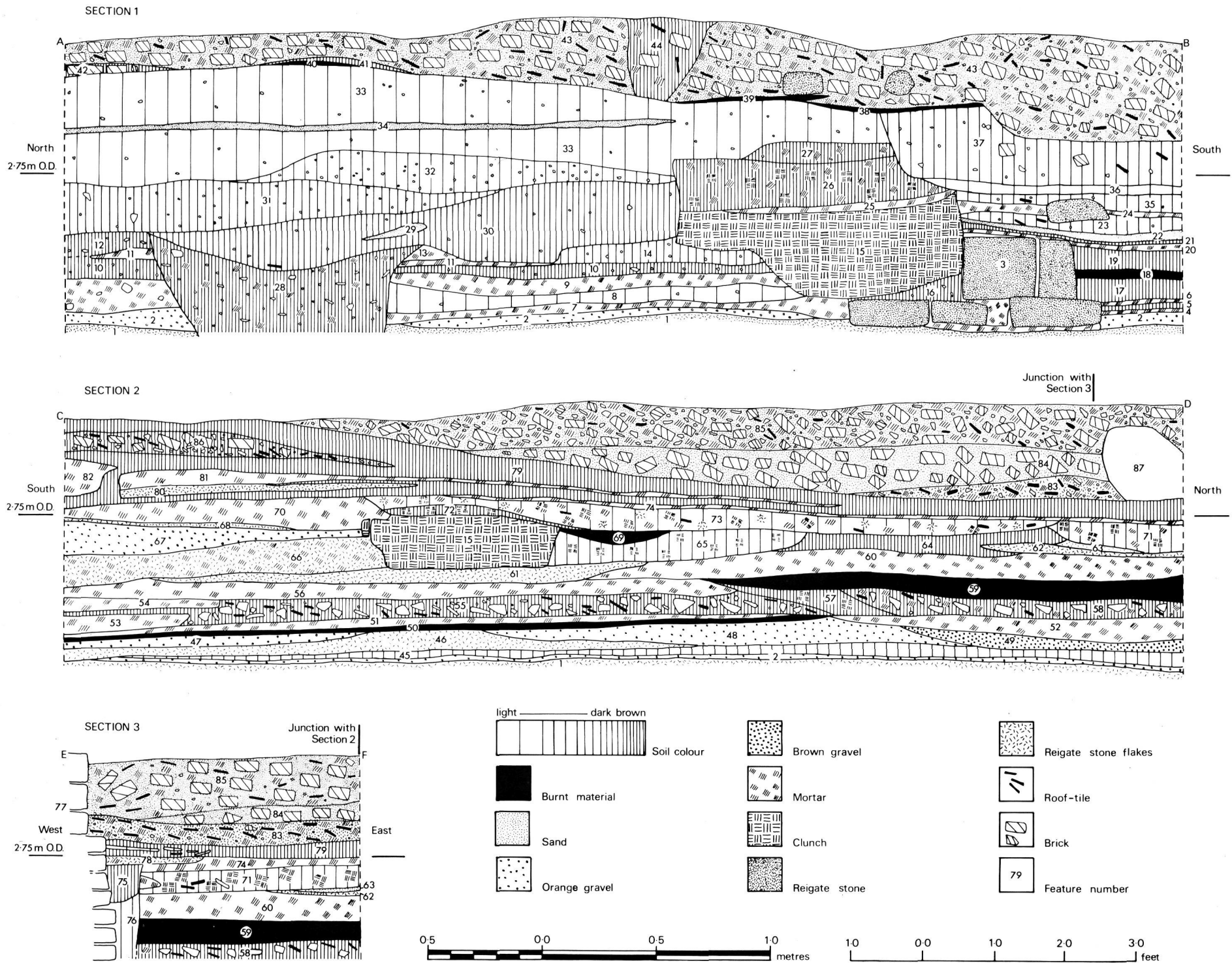


Fig. 4 Westminster Abbey. Redevelopment of 20 Dean's Yard 1975-77. Sections 1, 2 and 3



Whatever the reason for the separate Phase 2 functions revealed by Sections 1 and 2, it must have ended with the construction of a new wall which extended east-west across the entire area. As with the Reigate stone wall (3), it was not possible to determine its function, i.e. whether it was a partition wall or the wall of a hitherto unknown monastic building. In either case, the clunch foundations (15) may represent a rebuild of the earlier Reigate stone wall (see Phase 4 below).

#### *Phase 4*

##### *Section 1*

The wall above the clunch footings (15) went out of use and was robbed away completely. Remains of the robber trench survived (25, 26, 27), but the deposits it cut through had been totally removed by later features.

A large pit (28) was dug, and backfilled with dark greyish brown earth containing fragments of stone and mortar. (This pit may belong to an earlier phase).

Large shallow trenches were dug, and backfilled with soil, with patches of sand. In the northern three-quarters of the section the earlier trench was backfilled with deposits (29, 30, 31, 32, 33, 34). This was then cut through on its south side, where the feature was backfilled by deposits (35, 36, 37).

A number of interpretations are possible, particularly if the deposit of light brown soil (33) represents a gradual build-up rather than a sudden dump. The first possibility is that layers (15, 25, 26, 27) were all cut into existing deposits. Alternatively the robber trench represented by (25, 26, 27) may have been cut in from immediately below deposit (39) and that the sand layer (34) was actually cut through at its southern end. Associated with this, all the soil deposits from (30) upwards may represent a gradual accumulation after the insertion of the wall above (15).

##### *Sections 2 and 3*

A cut through the earlier dumped layers (62, 63, 64) — backfilled with mid-brown soil which contained fragments of clunch and mortar (71).

The removal of the wall for which (15) was the foundations, and its backfill with soil containing fragments of clunch and mortar (72, 73 — associate with 26, 27 in Section 1).

Floor 12 — resurfacing with laid mortar (74) above trenches (73) and (71) — acting as a partial resurfacing of floor 11 (70).

This resurfacing was then cut through by the foundation trench (75/76) for the cellarer's range (77), and that building constructed. The top of the foundation trench was then resurfaced with a mixture of Reigate stone flakes and mortar (78).

The formation of a trampled deposit of soil (79) above the floor (70/74/78).

Floor 13 — the possible construction of a new floor of laid mortar (81/82) resting partially on a deposit of Reigate stone flakes (80).

The wall above (15) was therefore removed and a new surface laid before construction work on the cellarer's range began. It is likely, however, that the demolition of the wall above (15) and the late 14th century construction of the cellarer's range were associated. The Blackstole Tower, which is part of the cellarer's range, lies 4.4m south of the contractor's trench. This tower is generally interpreted as the entrance to the kitchen yard of the monastery<sup>15</sup>. It is possible that the east-west walls in the contractor's trench ((15) in Sections 1 and 2; (3) in Section 1 — see Section 1 Phase 2 above p. 195) represent the northern extent of the original route to the kitchen from the Great Court, and this function ceased with the construction of the cellarer's range. Alternatively they may represent rebuilding phases of a hitherto unknown building within the monastery.

The contrast between Phase 4 deposits in Sections 1, 2 and 3 can be explained if the north-south rubble wall located during the redevelopment belongs to this phase (see above p. 195).

The deposits above the floor (70/74/78/?24) contrast sharply with those below it. Between this floor and the 18th century dumps of rubble were deposits of soil with, at most, one new floor level (34/81/82). This may mean that later medieval deposits were removed at some unknown date, or that there was a major change in the function of this area after the construction of the cellarer's range. There were three doors in the rear of the cellarer's range leading into this area, and a pathway may have existed from these doors, and possibly from the kitchen yard, to the sub-vault of the misericorde, and possibly to the small side door discovered in the frater wall during the redevelopment (see above p. 194).

*Phase 5*

## Sections 1, 2 and 3

The dumping of soil (79), burnt material (38, 39, 40) and demolition rubble (43, 83, 84, 85, 86).

A post-hole (44) was cut through these deposits.

These deposits represent the raising of the ground level in the 18th century to allow the construction of a new floor.

(87) was a hole dug by the contractor in 1976.

## DATING EVIDENCE FOR SECTIONS 1, 2 and 3

No datable finds were recovered from any of the sections in this trench. The most important factor is the relationship between the deposits in Section 3 and those in the foundation trench (75/76) for the cellarer's range (77). This latter was constructed in the late 14th century, probably with the major part of the building operations being carried out between 1388-92<sup>16</sup>. The foundation trench for the cellarer's range was sealed by a deposit of Reigate stone flakes and mortar (78) which was probably used to repair the floor (70/74) after the construction of the cellarer's range. The construction of the cellarer's range was within Phase 4 of the stratigraphy of the sections. The Reigate stone and mortar patching (78) of the floor (70/74) must therefore be dated *c.* 1390, and, although natural was not reached in the trench, there were eleven possible floor levels present which preceded this date.

## OTHER NOTES

A narrow foundation trench (*c.* 0.80m wide and *c.* 1.10m deep) was dug by the contractor from the main trench to the rear wall of 20 Dean's Yard. The trench revealed that this rear wall was built on top of the core of a medieval wall. Below the 18th century ground level this was faced with Reigate stone, but above this level the facing was removed. This wall was probably the west wall of the medieval kitchen.

Abutting the kitchen wall at this point, on the northern side of the contractor's trench, were massive rubble foundations 1.40m wide and 1.00m deep. These foundations were sealed by the 18th century floor and cut through the earlier deposits revealed in the contractor's trench. It was not possible to discover how far north these foundations ran.

## MASONRY EXPOSED IN THE ENTRANCE HALLWAY OF 20 DEAN'S YARD

The cellarer's building was a long range built along the east side of Dean's Yard in the late 14th century. It was originally of two storeys, with the Blackstole Tower incorporated in the centre of the range as the entrance to the kitchen yard. North of the Blackstole Tower the four bays of the ground floor were used as a storeroom, which was approximately 22.8m long<sup>17</sup>. The entrance hallway of 20 Dean's Yard almost fills the most southerly of the four bays.

The south wall of the hallway fronted onto the entranceway of the Blackstole Tower. The removal of an 18th century fireplace and its surrounds revealed a spiral staircase in the south-west corner, and a blocked doorway with a pointed arch opening into the Blackstole Tower. The position of this doorway was already known from the outer face of the wall<sup>18</sup>. The other features visible in the drawing are an 18th century window and the chimney from the 18th century fireplace (see Fig. 5).

The removal of plaster from the east wall exposed a late 14th century cinquefoil window, with its iron saddle bars still intact, and the damaged remains of a second similar window south of the 18th century doorway. It is likely that the doorway is on the site of a 14th century opening, and that it was raised in the 18th century because the ground level had risen 1.25m since the cellarer's range was constructed.

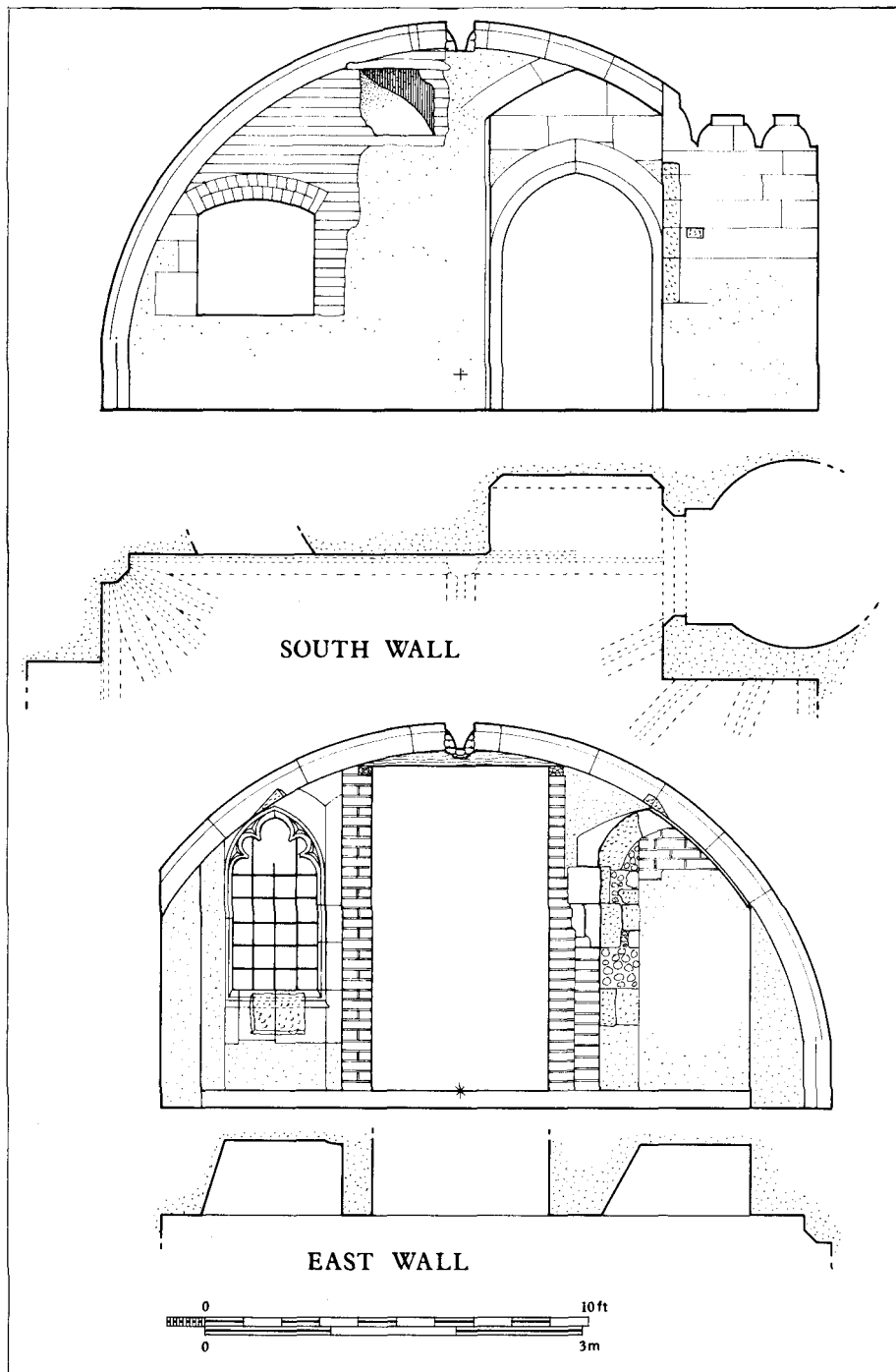


Fig. 5 Westminster Abbey. Redevelopment of 20 Dean's Yard 1975-77. Elevations of the south and east walls of the hallway

## NOTES

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| <p>1 Graham Black — "Excavations in the Sub-Vault of the Misericorde of Westminster Abbey" <i>Trans. London Middlesex Archaeol. Soc.</i> 27 (1976) 135-178.</p> <p>2 <i>ibid</i> 145, 156.</p> <p>3 Rev. H. F. Westlake <i>Westminster Abbey I</i> (London 1923) 30.</p> <p>4 <i>Black op cit</i> 139.</p> <p>5 <i>Black op cit</i> 154.</p> <p>6 <i>Black op cit</i> 154.</p> <p>7 <i>Black op cit</i> 161-168.</p> <p>8 Rev. H. F. Westlake "Notes on some recent excavations at Westminster Abbey" <i>Antiq. J.</i> 50 (1921) 232-3.</p> | <p>9 <i>Black op cit</i> 147, 155.</p> <p>10 Westlake <i>op cit</i> 232-3.</p> <p>11 <i>Black op cit</i> pl. 5.</p> <p>12 <i>Black op cit</i> 143, 145.</p> <p>13 <i>Black op cit</i> 143.</p> <p>14 <i>Black op cit</i> 141.</p> <p>15 Royal Commission on Historic Monuments <i>London (Westminster Abbey)</i> (1924) 89.</p> <p>16 Rev. H. F. Westlake <i>Westminster Abbey II</i> (London 1923) 373.</p> <p>17 Royal Commission on Historic Monuments <i>op cit</i> 89 Westlake <i>op cit</i> II 372-373.</p> <p>18 Royal Commission on Historic Monuments <i>op cit</i> 89.</p> |
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## COIN REPORT

IDENTIFICATION BY PETER BERGHAUS, UNIVERSITY OF MUNSTER.  
 COMMENTS BY MARION ARCHIBALD, DEPARTMENT OF COINS & MEDALS,  
 BRITISH MUSEUM

(Plate 2)

IDENTIFICATION — Barbarous imitation of Duisberg, Emperor Konrad II (1027-39), (Dannenberg 1876 311-313 [obverse]).

Not known in combination with the unusual cross reverse. Possibly minted in the Netherlands, certainly *not* Rhineland, Westphalia or Lower Saxony.

COMMENTS — The coin was hitherto unknown to German numismatists. German imperial coins and their copies are very unusual as site finds or in hoards in England. The London Walbrook hoard found in *c.* 1872 and containing some 7,000 coins, concealed in *c.* 1070, included one pfennig of Emperor Henry III (1039-56). A Henry IV pfennig of *c.* 1080-90 was also recently found in London — during the 1974 Seal House excavation in the City.

The date of deposition is difficult to determine. The evidence is very limited, but the context of the Walbrook hoard is Norman and not Saxon, and it is the Norman coins, not the Saxon, which exhibit borrowings from German imperial prototypes. Particularly because the coin is a copy of a Konrad II pfennig and not an original, it would be difficult to make the loss of pre-Conquest date.

EXCAVATOR'S COMMENTS — The ditch in which the coin was discovered was backfilled and a yard surface (F90) laid in a phase before construction of the frater began. The frater was completed in *c.* 1100, and it is likely that the ditch was of mid-11th century date (Black 1976, 141-2).

### SCULPTURED BLOCK FROM SUB-VAULT OF MISERICORDE, WESTMINSTER ABBEY

BY S. E. RIGOLD

(Fig. 6, Plate 1)

The stone was recovered from rubble from the demolition of the misericorde and its sub-vault in the 1570s.

This is a block of coarse Oolite, 0.38m long but broken off, 0.18m high and 0.23m thick. It has been re-worked on the rear-face to form a plinth-moulding, consisting of a cyma brought back to the face below by a relatively large hollow chamfer, all rather roughly tooled but consistent with the third quarter of the 14th century, when much of the refectory and the adjoining walk of the cloister were rebuilt. In view of the proximity of discovery and the material extracted from the south wall of the cloister under Gilbert Scott (Lethaby 1924, 33-37) it would seem likely that the stone derives from the refectory (possibly the main entrance or the lavatory) or the adjoining walk. The lower bedding-face seems original, the front is entirely covered with Romanesque carving, the upper bedding-face, which is now horizontal, seems to belong to the re-working, so that it may have been voussoir-shaped, and the left edge (as seen from the original front) is canted somewhat out of vertical.



Fig. 6 Westminster Abbey. Redevelopment of 20 Dean's Yard 1975-77. (a) The 12th century sculptured block — face (b) The 12th century sculptured block — profile of plinth-moulding on rear-face

The carving is deep but not particularly delicate — less fine than those in Canterbury cathedral crypt (Gardner 1951, 103-4, Stone 1972 pl 33-4, Zarnecki 1951 pl 49-56 (in a better-textured stone)), but about on a par with the cloister-capitals from Reading Abbey (Gardner 1951 fig. 115, Stone 1972 p 36-7, Zarnecki 1951 pl 59-63) some of which are also in Oolite, which, with a few fragments from Westminster itself (Lethaby 1924), are the most obvious technical analogues. The points in common are the tight interlace of three-banded strap-work, with beads or pellets along the central band; the enclosed, finger-like terminals of the foliage, forming three rolls of equal emphasis; and the bulging eye with no pupil marked. Each of these is widespread in English Romanesque; none is very subtle. But *their combination in very ornate works of high patronage makes a telling parallel with the other royal Abbey of Reading* (begun in 1121, fast-moving and probably nearly complete by the burial of Henry I in 1135).

The beaded strap on this piece forms an arc crossed by another strap, sharply recurved above the cross-over, and possibly by a third. It is gripped by an acanthus-like leaf and inhabited by a crouching female monster with short wings (sphinx?). The interlace is crossed by a geometrical frame represented by two straight, oblique rolls, not quite parallel, which might form part of a pedimental design. A composite tympanum is unlikely as late as this, but it might form the springer of a segmental arch-head, or a normal voussoir, but without enough selvage to allow for an outer order. Interlace is often confined (compare the spiral bands on the Gloucester candlestick or the west portal-shafts of St. Denis), and occasionally crossed by a geometrical frame.

This piece is another addition to the purely archaeological evidence for an elaborate campaign in the south and (?) west claustral ranges, under Henry I, possibly initiated (the evidence is the lost capital) in the repentant latter days of William II (Lethaby 1924).

## THE TILES

WITH COMMENTS FROM ELIZABETH S. EAMES

The majority of the tiles were recovered during the redevelopment work after the excavation, and although a number were found laid *in situ* they had, in fact, been relaid at least twice and in some cases three times. It is therefore to be expected that a high proportion of these re-used tiles would be the plain tiles used in borders and at the edges of rooms where they would receive less wear. Of the decorated examples, however, the largest number are from what must be a local source (Type I, Fig. 7, 1, 2, 4 to 9). They measure on average 134 mm square and the designs include the Griffin, the Clare Chevrons, the Lion, etc. They would appear to date from the late thirteenth and early fourteenth centuries.

There is one fragment of a tile (Type II, Fig. 7, 13) which appears in the Chapter House of the Abbey, and the last date for the manufacture of which is 1258, and one example of a tile (Type III, Fig. 7, 11) which occurs in the Muniment Room.

There are examples of Penn and Penn type tiles (Type IV) made in the middle of the 14th century (Fig. 7, 10 and 12) and one (Fig. 7, 3) which although similar to a Penn design, Hohler (1942, p65) is not a Penn tile, but may be a "Hertfordshire" type produced at the beginning of the 14th century.

The group also includes plain tiles imported from the Netherlands, with nail holes, and dating from the 14th and 15th centuries, with a preference for the later date.

The building material recovered included a number of fragments of glazed roof tiles and some broken pieces of brick which show secondary burning. The broken bricks occur in layers which may be associated with the bakers' ovens and could be associated with that phase of the sub-vault's use and occupation.

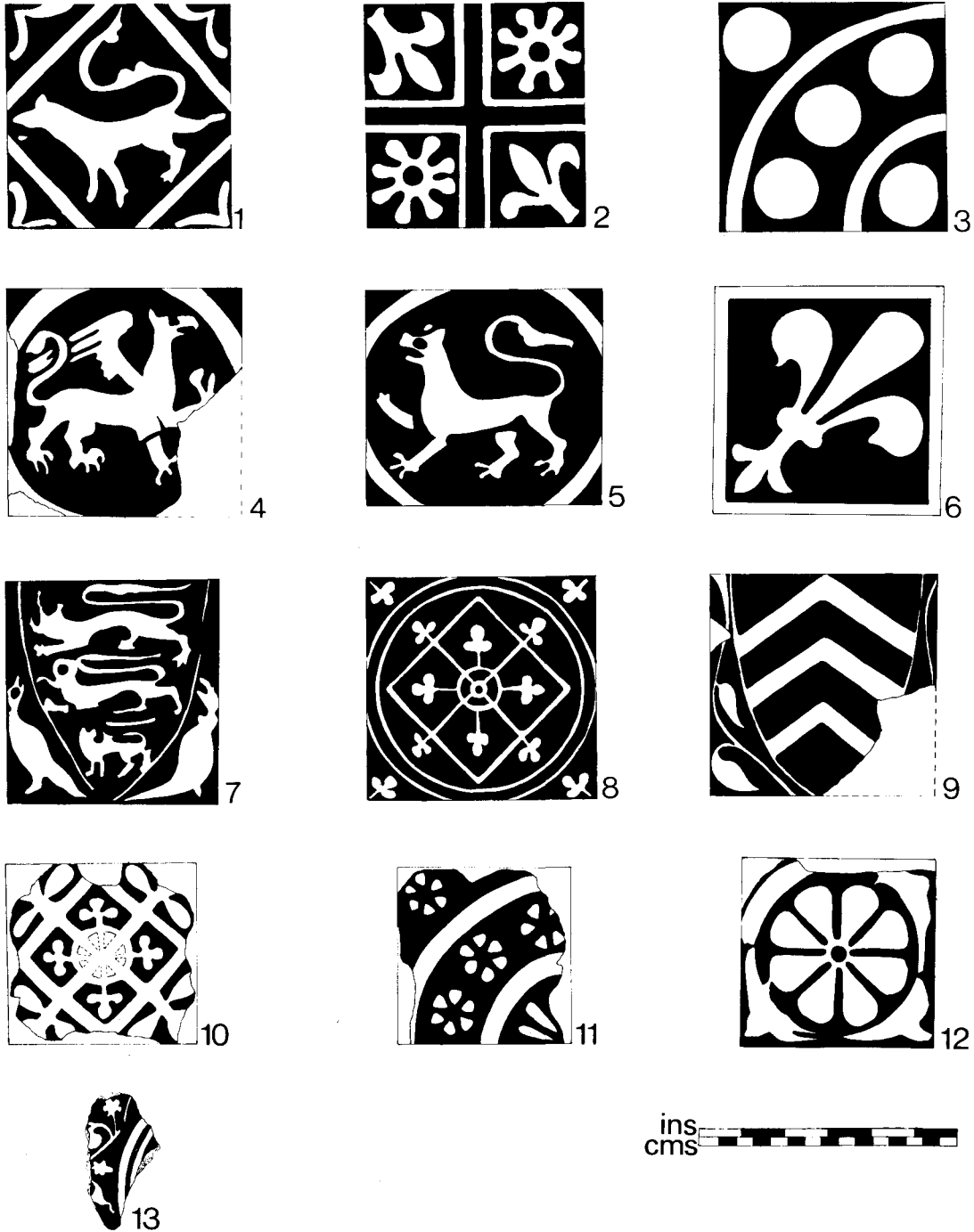


Fig. 7 Westminster Abbey. Redevelopment of 20 Dean's Yard 1975-77. The decorated tiles

## ANALYSIS OF MORTAR SAMPLES FROM THE SUB-VAULT

by JOHN EVANS, NORTHEAST LONDON POLYTECHNIC

### HISTORIC DEVELOPMENT OF CEMENT

Mortar is a term loosely applied to material used for bedding, jointing and rendering masonry. It consists of cementitious binding material, usually mixed with a fine aggregate such as sand. If the cementitious material is mixed with a coarse aggregate a concrete is produced. Concrete was used in historical times for foundations, floors and wall hearing.

It was not until the Roman occupation of Britain that building techniques employed mortar and concrete to any appreciable extent. Roman mortar and concrete are popularly supposed to be superior in quality to any that have been produced until modern times. This is partly due to the characteristic of well-made mortar that it tends to harden with the process of time and, partly, because Roman builders took care in the selection of their materials. The quality of Roman cements was sometimes further enhanced by the use of pozzolanic additives.

Pozzolanas are defined as materials which, though not cementitious in themselves, contain constituents which will combine with lime at ordinary temperatures in the presence of water to form stable insoluble compounds possessing cementing properties. Pozzolanas can be divided into two groups, natural and artificial. Natural pozzolanas are, for the most part, materials of volcanic origin, but include certain diatomaceous earths, (ie. earth containing the silicious deposit of diatom shells). The artificial systems are mainly obtained by the heat treatment of natural materials such as clays. In the Roman period natural pozzolanas were available for use in Italy but not in Britain. The Roman builders overcame this problem by producing an artificial material, namely crushed tiles and bricks.

The absence of pozzolanic materials in post-Roman building mortars gave rise to mortar (and concrete) mixtures that generally had relatively little strength and were slow setting. It was often necessary, therefore, to place spacers (such as oyster shells and wooden pegs) between the masonry blocks to prevent the mortar from being squeezed out of the bedding joints under load.

In the 16th and 17th centuries, Dutch pozzolanas were imported and used in mortar and concrete preparations. John Smeaton experimented with various limes and he deduced that a good cement could be produced by deliberately mixing and burning together limestone and clay. Towards the end of the 18th century James Parker found that he could produce a satisfactory cement by calcining nodules of argillaceous limestone washed out of the London clay cliffs on the foreshore of the Thames estuary. This cement was called 'Roman' cement.

At the beginning of the 19th century James Frost patented a cement produced by calcining a mixture of limestone and clay, which he ground together in a wet mill. Improvements on this method were made by Joseph Aspdin. The first reliable Portland cement was produced by Ian Johnson at Swanscombe in 1845 and, thus, gave birth to the modern cement industry.

### POTENTIAL EVIDENCE

#### MORTARS — CONCRETES

Scientific investigation of cementitious materials cannot give any absolute dating information; it can give, however, useful relative dating data within a given structure. In principle, it is assumed that when building operations were commenced, sufficient supplies of aggregate, lime, etc were available from a common source. Hence, when mortars and concretes are examined, if there is a high degree of similarity in their constitution it is reasonable to assume a common constructional period. One problem that occasionally arises, especially in material from the Roman period, is the use of sieved aggregate. In such situations, very similar results may be obtained for samples that are not contemporary. However, if a relatively large time period elapses between constructional features, there is usually a detectable change in the nature of the aggregate, as it appears that no large-scale quarry sources were available in Roman times. Thus it is possible, provided that sufficiently representative samples are used in conjunction with excavational evidence, to decide which modifications to the parent structure are contemporary and, hence, outline the principle periods of activity in the building.

Additional evidence is sometimes found in the nature of the aggregate itself. Although this is, mostly, gravel and sand (and crushed tile/brick in the Roman period) usually from a local source, it does occasionally contain oddities. The presence of daub, bones, charcoal, pot fragments and metal



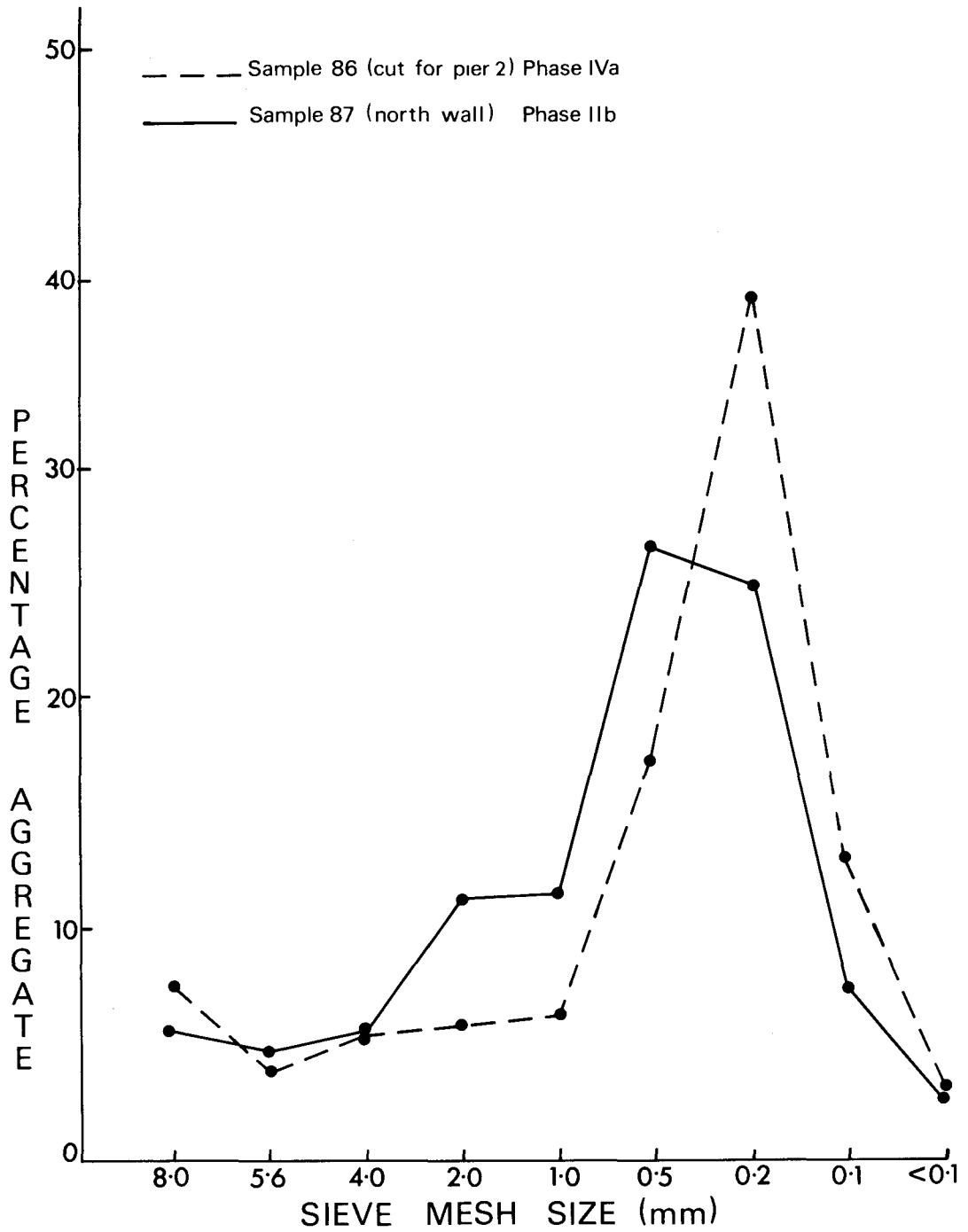


Fig. 8 Westminster Abbey. Redevelopment of 20 Dean's Yard 1975-77. Examples of aggregate distribution curves from the mortar analysis

fragments have all been detected and, as a consequence, some useful additional information may be obtained.

#### THE MORTAR SAMPLES FROM THE SUB-VAULT

55 mortar samples were taken during the excavation. The dates assigned to them on archaeological grounds ranged from the late Saxon period to the early 20th century. It was hoped that analysis of the samples would not only support the archaeological assignments but also give information about the development of mortar preparation techniques throughout this time period. Unfortunately, the samples, with the exception of No. 82 (early 20th century), were in a very friable state and most appeared to have lost calcium salts through leaching processes. It was not practicable, therefore, to draw any certain conclusions concerning the latter part of the investigation. The poor state of the samples, however, does seem to indicate that no pozzolanic materials had been used in any of the pre-20th century systems.

#### EXPERIMENTAL

Visual examination of the samples showed them to be in an extremely friable condition (excluding the early 20th century sample) and excessively leached. Several samples had in fact no coherent structure and consequently data concerning them can only be considered with circumspection. The aggregates appeared to be composed mostly of flints and sand with inclusions of chalk. In most cases the chalk inclusions accounted for no more than 5% of the observable aggregate. However, it was noted that in several samples the percentage was much higher, often approaching 50%. It was further noted that these chalk rich systems tended to be associated with Phases IV and V of the building, although not exclusively so. Several of the samples contained charcoal fragments particularly those samples concerned with the early building phases.

The colours of the samples ranged from a sandy brown to very pale cream, the colour variation appearing to depend on the percentage of chalk inclusion. Four samples, 11, 31, 51 and 82, had colours outside this range; 11 and 82 were pink in colour, and 31 and 51 dark grey. The former colour was produced by a preponderance of burnt clay fragments and the latter by inclusions of fine charcoal.

The samples were first dried at 110°C to constant weight. 200 g. of each sample was then treated with dilute hydrochloric acid to remove acid soluble material (mainly calcium salts) and thus reduce the sample to its aggregate. The aggregate was filtered, thoroughly washed and dried to a constant weight. It was then passed through a series of sieves and the various quantities retained noted. In order to enable comparison of the aggregate distributions to be made, the weights retained were converted into percentage of the total aggregate weight and plotted against sieve mesh size. The results of this exercise are shown in the following diagram (Fig. 8). All analyses were carried out in duplicate and the mean values plotted.

Geological examination of the insoluble aggregate indicated that the larger aggregate (that retained by a 2.00 mm mesh sieve) in all samples was composed mainly of flint fragments showing natural fractures and quartzite pebbles. 14 samples (4, 11, 21, 24, 31, 51, 67, 72, 73, 75, 76, 77, 81 and 82) contained burnt clay fragments, and 8 (33, 45, 50, 52, 56, 70, 74, 87) white/grey clay aggregations. The burnt clay fragments in 21 and 67 were identified as brown glazed tile fragments and a piece of daub (weight 17.5 g) respectively. Several of the flints in the samples had a reddish appearance reminiscent of having been fired, but the absence of sharp fractures suggested that this was a natural phenomenon. Samples 31 and 51 also contained several fish bones.

The finer aggregates were composed of small flints, sub-rounded quartz and fragments of oxidised pyrites. Both burnt and unburnt clay were also observed in the finer aggregates of those samples mentioned previously.

#### RESULTS

For convenience, the samples have been divided under three headings (based on archaeological considerations); floors, walls and samples from within features.

	Building Phase	Samples Assigned on Archaeological Evidence	Mortar Group	Samples assigned on Mortar Analysis
<b>Floor Samples</b>				
II	a	45(F90a) 46(F90b)	P1	45(F90a) 46(F90b) 51(F94d) 55(F94g)
	d	47(F94a) 48(F94b) 49(F94c) 50(F94e) 51(F94d) 55(F94g) 56(F94h)	P2	47(F94a) 48(F94b) 50(F94e)
			P3	49(F94c)
			P4	56(F94h)*
III	b	66(F92c) 67(F92d) 70(F106)	P5	34(F70b) 40(F76a) 52(F95) 66(F92c) 67(F92d) 70(F106)
	b/c	40(F76a) 52(F95)	P5	See above under III b
IV	a	34(F70b)	P5	See above under III b
	b	23(F64) 33(F59b)	P6	23(F64)
			P7	33(F59b)
	c	31(F56b)	P8	30(F51h) 31(F56b)
V	a	20(F51a) 21(F51b) 22(F62) 24(F51c) 28(F51d)	P9	20(F51a) 21(F51b) 22(F62) 24(F51c) 28(F51d)
		30(F51h)	P8	See above under IVc
		14(F51)	P11	See below under Vb
	b	10(F49a) 12(F49c) 13(F49b)	P10	10(F49a)
			P11	12(F49c) 13(F49b) 14(F51)
<b>Wall Mortars</b>				
II	b	83(N wall foundation) 85(S wall core) 87(N wall)	M1	83(N wall foundation) 87(N wall)
	c	73(F101) 74(F101c)	M2	73(F101)
			M3	74(F101c)
IV	a	75(pier 9) 76(plaster between piers 3 & 4) 77(pier 7)	M4	75(pier 9) 76(plaster between piers 3 & 4) 77(pier 7) 81(blocking of doorway in S wall)
		84(foundations E wall) 86(cut for pier 2) 88(cut for pier 3)	M5	84(foundations E wall) 85(S wall core) 86(cut for pier 2) 88(cut for pier 3)
VI	a	6(mortar from top of pier 4)	M6	6(mortar from top of pier 4)
	b	1(F1)	M7	1(F1)
Vb or VIb		81(blocking of doorway S wall)	M4	See above under IVa
C20th		82(early C20th sewer pipe)	M8	82(early C20th sewer pipe)
<b>Samples from within features</b>				
I	c	39(F84) 72(F108)	W1	39(F84) 72(F108)
IV	a	25(F68a) 26(F68b) 27(F68c) 35(F81a) 80(F86)	W2	26(F68b) 27(F68c) 35(F81a)*
			W3	25(F68a)*
			W4	80(F86)
V	a	8(F42a) 9(F42a) 11(F42b)	W5	8(F42a) 9(F42a) 11(F42b)
	b	16(F47b)	W6	16(F47b)
VI	b	4(F28)	W7	4(F28)*

\* Indicates degenerate sample

## DISCUSSION

It can be seen from the table that there is quite a high degree of correlation between the groups produced by the archaeological evidence and those produced by the aggregate analysis. Each of the subdivisions will now be considered in detail.

## A. FLOOR SAMPLES

A consideration of the two sets of groups shows that the aggregate analysis has tended to re-distribute the features concerned with the earlier building phases. As the aggregate distribution curves for groups P1 and P2 are quite characteristic it seems reasonable to assume that features F90 a/b and F94 d/g are contemporary, as are features F94 a/b/e. The marked differences between the curves for either of these groups and the curves for P3 and P4 clearly suggests that features F94c and F94h are not contemporary, either with the previously mentioned features or with each other. (It may be, of course, that the samples are not representative, as is likely with the degenerate sample 56.)

The six samples assigned to group P5 appear to spread across building phases III and IV. Aggregate analysis indicates a contemporary origin for the four features F76a, F92 c/d, F95 and F106. The presence of a sample from F70b in this group suggests that some phase IIIb structure, possibly a floor, was broken up and used as rubble hardcore for the phase IVa floor. The splitting-up of the IVb sample into two groups P6 and P7 gives support for the idea that the floor F57/64/67 was new.

The assignment to a single period of features F51h and F56b (group P8) is not unexpected as the samples were removed from floor features that were described as patchy. It is quite possible, therefore, that the samples were, in fact, removed from contemporary deposits. Although both were described as sandy deposits by the excavator, the high soluble percentages (29% for 30 and 25% for 31) argue strongly for them to be degenerate mortars as opposed to natural sands.

Four of the five mortars making up group P9 are samples of the mortar used for laying the tiled floor F51d. As their aggregate make-up is very similar to that used in feature F62 it is reasonable to assume that this feature is contemporary with the construction of the tiled floor.

The occurrence in P11 of a sample from the brick partition, F51, with two samples from the suspected rubble in feature F49 c/b suggests that the partition was partially demolished and used for hardcore for the phase Vb development.

## B. WALL MORTARS

At first sight, aggregate analysis appears to have produced quite a marked difference in the sample groupings. However, on closer examination the redistribution is not unexpected. Possibly the most serious deviation from the archaeological groupings are the re-arrangement of the samples assigned to building phase IVa and the samples assigned to group M5.

The M1 group is in keeping with the archaeological evidence, as the foundation of the north wall of the kitchen was a phase IIb activity. One would thus expect a sample from its foundation to correspond to other phase IIb samples.

One curious anomaly (apparently) thrown up by the aggregate curves is the assigning of the sample from the south wall blocking to M4. The other members of this group are all concerned with the piers and consequently would be expected to be similar. It seems most unlikely (on archaeological grounds) that the blocking of the south wall could be contemporary with the activities concerning the piers and so the presence of F81 in this group must be considered to be coincidental. A possible cause of this could be the poor state of the sample.

Although group M5 contains only four samples it is probably the most controversial group in the whole analysis. The occurrence of the two samples from piers 2 and 3 with that from the east wall foundation, F86a, is, of course, quite acceptable, but the additional presence of the sample removed from the south wall core is totally unexpected. Indeed, the archaeological evidence is completely against this latter sample having an origin contemporary with the samples from the piers and the east wall. As the aggregate distribution characteristics of this group are quite distinctive it seems highly unlikely that the presence of the wall sample is a coincidence.

## C. WITHIN FEATURE SAMPLES

It can be seen that there is a high degree of correlation between the two sets of groups in this subdivision. Such differences that do occur can all be accounted for in such a way as not to contradict the excavational evidence.

The grouping together of the samples from the trench feature, F108, and the post-hole F84, in W1,



Plate 1 Westminster Abbey. Redevelopment of 20 Dean's Yard 1975-77. 12th century sculptured black (scale cms) (see p. 200)



Plate 2 Westminster Abbey. Redevelopment of 20 Dean's Yard 1975-77. Barbarous imitation of Duisberg, Emperor Konrad II pfennig. Obverse (*above*); Reverse (*below*). (Diameter 19.5mm)

is particularly significant as it lends support to a contemporary origin of these two features. As feature F68 was stratigraphically later than feature F86, and feature F81 was isolated from the other features by pits, it is not surprising that the five samples from phase IVa did not fall into a single group. Furthermore, the samples from F68a and F86 were in a very poor state, consequently they could well give erratic results.

The assignment of the two samples from the mid-late 15th century oven (feature F42) is, at first sight, not surprising. However, one sample was removed from the external surface and one from deep within the wall structure of the oven. The fact that they are practically the same indicates that the oven structure was never re-pointed.

#### EXCAVATOR'S COMMENTS

The results of the analysis of mortar samples from the excavation have been important for a number of reasons. Firstly the high degree of correlation between samples assigned on the evidence of mortar analysis and the features phased on archaeological evidence provides further welcome support for the interpretation of the site.

As a corollary to this, the phasing of the features, where archaeological and mortar evidence seemed to disagree, was re-assessed. In particular this involved the phasing of features F51 and F94, the blocking of the door in the south wall, and the south wall core.

Feature 94 (Black 1976, 143) (Phase IIb; mortar groups P1, 2, 3 and 4) consisted of a series of repairs to the pathway between the kitchen and frater, west of the sleeper wall. It was not possible to separate these repairs into different phases because of the lack of finds from them, and because of the disturbance caused by modern features. Mortar analysis separated these repairs into four groups. Archaeologically this is perfectly acceptable, and helps to show that the repairs occurred periodically over a long time.

Feature F51 (Black 1976, 150) (Phase Va; mortar groups P8, 9, 11) was an area partitioned off in the north-east corner of the sub-vault, within which was a plain glazed tile floor, which was later replaced by a new floor also of tiles. F51(h) was a deposit of loose mid-brown soil containing some mortar, sealed by make-up for the earliest tile floor, and initially interpreted as part of that make-up. However it was an isolated deposit, sealed by the cut for that tile floor. There were also no datable finds from it. Therefore it may in fact have been associated with F56(b) which was make-up for a phase 4(c) floor (F57/64/67).

It is more difficult to account for the presence of sample 81 (from the blocking of the doorway in the south wall) in mortar group M4. This group also contained samples from piers 7 and 9, and from a plaster facing between piers 3 and 4. One possibility is that the walls were plastered and the piers re-pointed when the doorway in the south wall was blocked.

There is no obvious archaeological explanation for the presence of sample 85 (from the Norman south wall core) in mortar group M5. The rest of the group were samples from the 13th century insertion of the sub-vault. The only possibility seems to be that the sample came not from the original Norman core of the wall, but from the backfill of a later cut. The sample was taken from a badly disturbed section of the wall beside the 15th century baker's oven (F42).

Finally, analysis of two of the samples, 30(F51h) and 31(F56b) revealed them to be degenerate mortars rather than sandy soils, which is how they were described in the site report. This shows the importance of analysing deposits where their constituents are not totally certain.

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