I

Excavations on Hadrian's Wall at Denton, Newcastle upon Tyne, 1986–89

P. T. Bidwell and M. Watson with contributions by C. Batey, R. Brickstock, A. Croom, G. Morgan and R. Payton

INTRODUCTION

THE excavations (at NZ 201655 see figs 1, 2, 7) were carried out in advance of the construction of the Newcastle Western Bypass, which links the Great North Road (A1) north of Gosforth with a new crossing of the River Tyne to the west of Scotswood Bridge. At the intersection of the West Road (A69) and the bypass, a large roundabout was constructed above a deep cutting which accommodated the bypass. The cutting, which was 20·00 m deep, together with slip roads leading to the roundabout, destroyed a stretch of Hadrian's Wall 130·00 m in length and some 50·00 m of the Vallum. It is doubtful whether destruction of the Wall on such a scale would have been contemplated had plans for the bypass been first drawn up in the 1980s. But the scheme originated in the 1930s, and the only reason it could be built through the western suburbs, which are mostly of post-war date, was that a corridor had been kept free of buildings along its proposed line. Neither a bridge nor a tunnel was feasible at Denton and thus the destruction of the Wall could not be avoided.

In 1986 a resistivity survey detected strong disturbances on the line of the Vallum but found only a very weak anomaly on the site of the Wall (Ancient Monuments Laboratory Report G 22/86). The original project design for archaeological work on the line of the bypass (Archaeological Unit for North-East England, unpublished) proposed the excavation of a 150·00 m length of the Wall and a 60·00 m length of the Vallum. Trial excavations in March 1987, consisting of five trenches 2·00 m in width cut across the line of the Wall, showed that it had been extensively robbed, and the scope of the larger programme of work was reduced to the investigation of a 20·00 m length of the Wall and a 5·00 m length of the Vallum (fig. 8). Excavations began in early September 1987. Within a few weeks area excavation revealed what had not been apparent in the trial trenches: the survival at the rear of the Wall of pre-Roman and Roman deposits of considerable importance. The excavations were enlarged and continued until mid-February 1988. In August 1988 limited excavation was carried out on the site of the bus turning-circle (Area II), and at the end of the year Areas III and IV, on the east side of the junction of Southway and the West Road, were examined. In March 1989 contractors working to erroneous plans laid a gas-pipe along the length of the Wall core for a distance of 70·00 m extending to the west from Area I, Trench F. This trench was dug in May 1989 when it became apparent that landscaping would affect the archaeological deposits. A watching brief on the roadworks was also carried out during 1988 and 1989.

The project was organized by the Archaeological Unit for North-East England and funded by English Heritage, Tyne and Wear Museums Service, the Manpower Services Commission and Kenton Utilities Ltd. The trial excavations were directed by Mr. C. O'Brien who, with Professor P. J. Fowler, was responsible for negotiating funding and access for the larger programme of excavations. Mr. D. Sherlock, English Heritage Inspector for Hadrian's Wall, provided much assistance and advice. The main excavations were directed by P. T. Bidwell and supervised

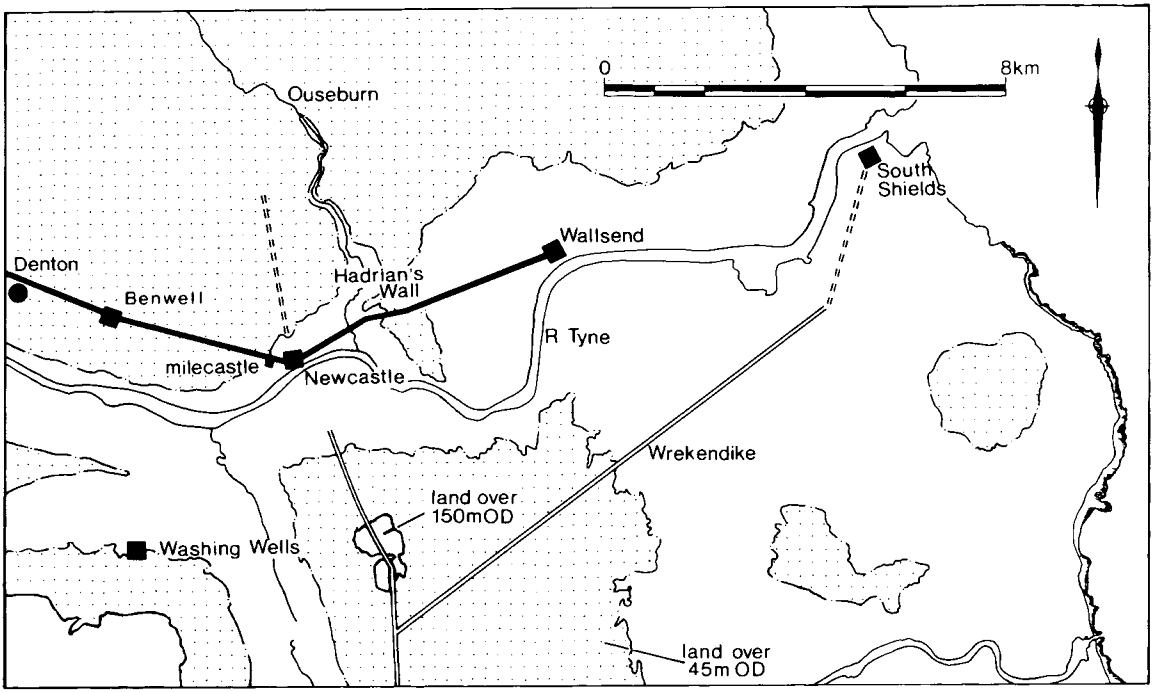


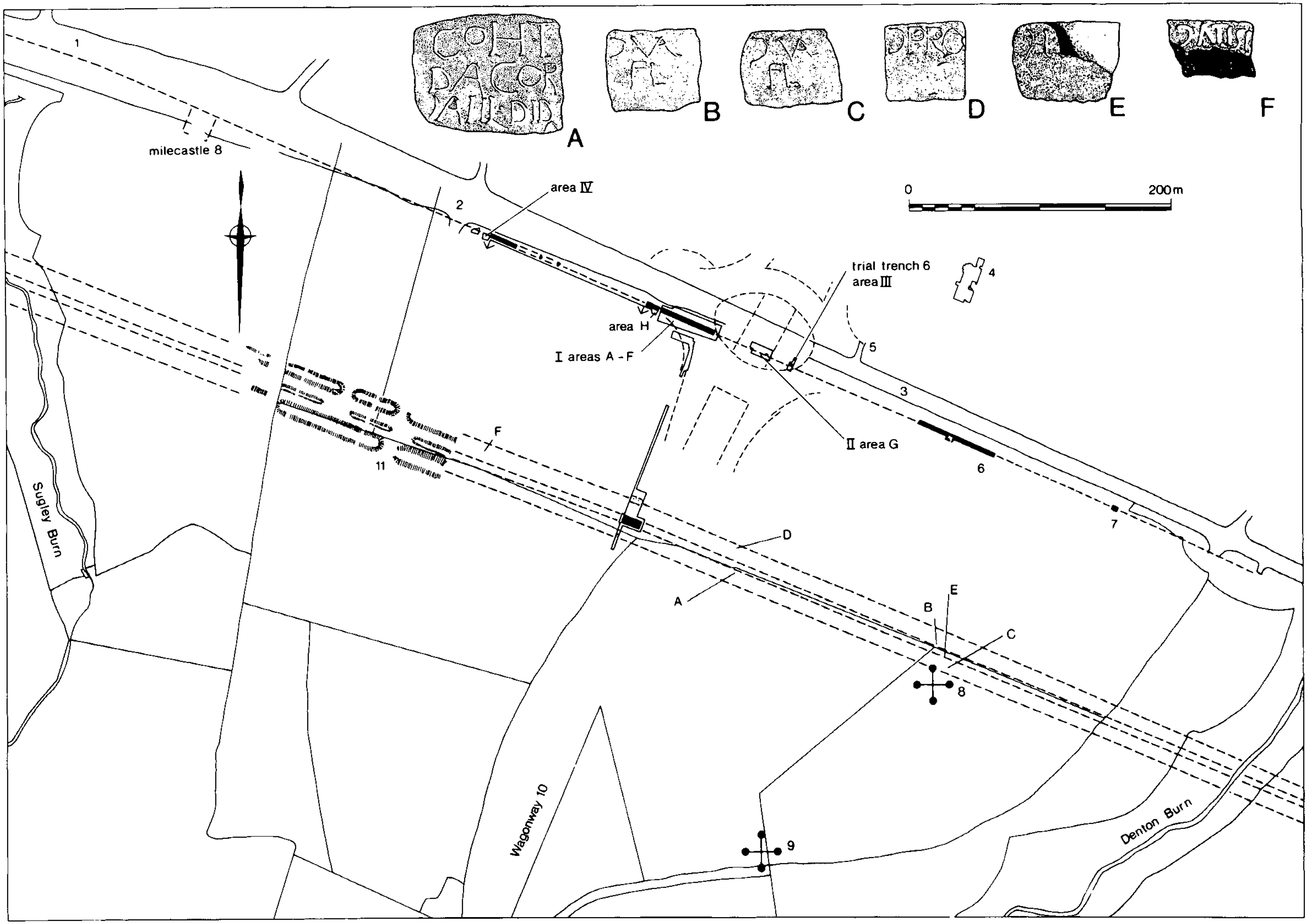
Fig. 1 The lower Tyne Valley showing the line of Hadrian's Wall and its forts. The fort at Washing Wells is probably of exclusively pre-Hadrianic date. Scale 1 : 150,000.

by Ms. (now Captain) M. Watson; the excavations in 1988–89 were supervised by Mr. G. Foley. We are especially grateful to Dr. R. Payton (Soil Survey and Land Research Centre, University of Newcastle upon Tyne) for his reports on the paleosols, presented here in summary; we are also grateful to the other specialist contributors, Dr. C. Batey (Glasgow Museums and Art Galleries), Dr. R. Brickstock (University of Durham), Ms. A. Croom (Tyne and Wear Museums) and Mr. G. Morgan (University of Leicester).

This report was written by P. Bidwell using the archive reports compiled under his supervision by M. Watson and G. Foley (these will be lodged together with the finds in the Museum of Antiquities, University of Newcastle upon Tyne). The drawings are by R. Oram. I am grateful for information from and discussion with Mr. J. Crow, Mr. C. M. Daniels, Professor P. J. Fowler, Dr. C. Hart,

*Fig. 2 Plan of archaeological and other features in the Denton area. Scale 1 : 5000. Key to plan: 1) Location of geological deposits seen when the A69 carriageways were renewed in 1989 (the culvert over the Sugley Burn would have been near this point; 2) Wall ditch seen at this point in 1989; 3) Wall ditch seen in 1989 in relaying of services under south side of West Road immediately north of boundary between nos 739 and 741; 4) East Denton Hall (formerly Denton Hall), built in 1622; 5) site of chapel apparently in existence before 1194 (*NCH, xiii, *132; 6) turret 7b; 7) Wall seen at 717 West Road; 8) Bronze Age cist found in 1936; 9) Bronze Age cist found in 1813; 10) wagonway built in 1818 from Fawdon to Bell's Close, Scotswood, which seems to have been out of use by the time its course was recorded on the Tithe Map of 1844; 11) Vallum mounds and ditch surviving as earthworks at Southway. The field boundaries south of the Vallum are those shown on the Tithe Map of 1844.*

Key to building stones from the Vallum mounds: A) RIB *1365; B)* RIB *1362; C)* RIB *1363; D)* RIB *1364; E)* RIB *1361; F)* RIB *1367.*


A
B
C
D
E
F
0
200m
1
milecastle 8
2
area IV
trial trench 6
area III
4
area H
I areas A - F
5
3
II area G
6
7
F
11
D
A
B
E
C
8
9
Sugley Burn
Wagonway 10
Denton Burn

Dr. N. Hodgson, Mr. S. Speak, Mr. P. Topping and Mr. A. Welfare, and for comments on a draft of the report from Dr. N. Hodgson and Mr. D. Sherlock.

TOPOGRAPHICAL SETTING

The line of the Wall in the area excavated lies *c.* 1·5 km north of the Tyne at an elevation of 75 m OD. To the north the land continues to rise, forming a gently undulating landscape up to a height of 140 m OD. The line which the Wall follows rises very gradually towards the west; to the east the ground falls away towards Denton Burn and then mounts rapidly towards the summit of Benwell Hill (130 m OD), the site of the fort of *Condercum*.

ARCHAEOLOGICAL REMAINS AT DENTON (FIGS 2–6)

South of the Vallum, two stone-lined cists of Bronze Age date were discovered in 1813 and 1936 (figs 2, 8–9); a perforated stone axe-hammer was found in 1822 near Denton Hall (Miket 1984, 15–16).

Hadrian's Wall follows the top of the slope which runs down to the River Tyne 1·5 km to the south. Its course continues in a straight line from the fort at Benwell to the site of milecastle 8 and then changes alignment slightly towards the west. At a point just beyond milecastle 10 it again changes alignment to run almost due east-west. The Vallum, however, runs in a straight line from Benwell to the second change in the alignment of the Wall at the point just beyond milecastle 10, so that due south of Area I its centre line lies 160 m distant from the Wall. Elsewhere, between the top of Westgate Hill and turret 33b, where it diverges to the lower ground while the Wall begins its ascent of the Whin Sill, the centre line of the Vallum usually lies no more than 70–80 m south of the Wall.

Between the estimated position of milecastle 7 and the site of milecastle 8, indicated only by "characteristic occupation earth and pottery" (*NCH*, 13, 531), several lengths of the Wall have been investigated. Starting from the east, the Wall was seen in the garden of the Methodist Chapel at the bottom of Benwell Hill (fig. 3, 3) in 1953 (Daniels 1978, 71) and again in 1990 (*Britannia* 22, (1991), 234). Denton Burn would have passed under the Wall by means of a culvert, the likely form of which is evident from the remains of that which accommodated the Sugley Burn just west of milecastle 12 (fig. 4). A tiny fragment of the Wall, preserved in the forecourt of the garage on the west side of the junction of West Road and Denton Road, was revealed in the early 1980s (fig. 3, 2). The adjacent length to the west (fig. 3, 1), once picturesquely crowned with an apple tree and thus frequently illustrated, was first described by Brand (1789, 607) and was investigated by Parker Brewis in 1927 (Brewis 1927, 109–12). The foundation of the Broad Wall was seen on the west side of 717,

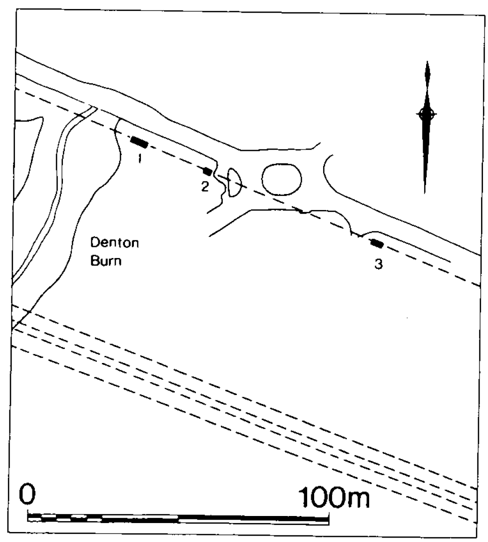


Fig. 3 Continuation eastwards of Fig. 2. Scale 1 : 5000. Key: 1) length of Wall visible since the eighteenth century and formerly crowned by an apple tree; 2) fragment of Wall in garage forecourt at the junction of West Road and Denton Road; 3) fragment of Wall surviving beneath the garden of the Methodist Chapel at the bottom of Benwell Hill.

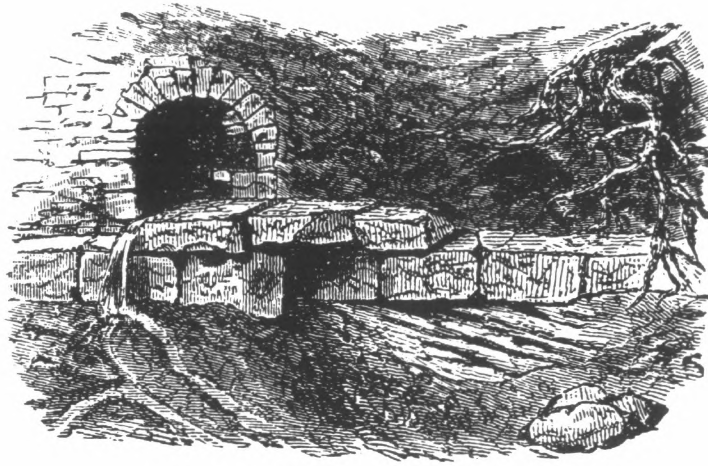


Fig. 4 Engraving of watercolour of culvert taking the Sugley Burn through the base of the Wall just to the west of the probable site of milecastle 8 (Bruce 1863, 55).
Watercolour bound into Bruce's interleaved copy of his third edition of The Roman Wall; *J. C. Bruce Collection, South Shields Museum.*

West Road in 1981 (fig. 2, 7; *Britannia* 12 (1981), 322; CEU Archive, Site Code 196).

Horsley (1733, 138) described the lines of the Wall and Vallum from Denton to Chapel House (milecastle 9) as "visible and distinct all the way". A watercolour of 1848 by H. B. Richardson (*NCH* 13, Plate 7) shows the remains of turret 7b (fig. 2, 6) as a small mound interrupting another lower mound representing the line of the Wall; in the foreground the north mound of the Vallum and its ditch are preserved in a state similar to that of the stretch still surviving west of Southway (see below). On an aerial photograph of 1930 these earthworks can still be seen (fig. 5). In 1929 the turret and a short length of the Wall on either side had been excavated by E. Birley (1930, 145–52); as the aerial photograph shows, the excavations were subsequently filled in. The site was taken into guardianship by the Office of Works in November 1934. There were further excavations in 1936 and 1938 when much more of the Wall was revealed than in 1929; the remains were consolidated for permanent display by early 1939 (Office of Works File 10351/01; Spain 1939, 3). The only notable discovery recorded from these later excavations was made when the blocking of the turret door was removed. "Splayed stones" (perhaps voussoirs from window arches) were found; although the file minute records that "they were to be sent to Corstopitum Camp and labelled accordingly", they do not seem to have survived (kindly confirmed by Miss Georgina Plowright, Curator of the English Heritage Hadrian's Wall Museums).

According to Hodgson (1840, 281), "in 1804, a little to the west of Denton-hall, the eastern portion of a long picturesque line of [the murus] was dismantled of its antient garb of thorns and hazels, and levelled for the plough. Here the two centurial stones inscribed [*c(enturia) Iuli* | *Rufi* (*RIB* 1356–7)] were found". Elsewhere (ibid., 282), Hodgson states that the two stones "were found, in 1804, in clearing away the ruins of the murus for the plough in the field next south-west of the gate leading to Denton-hall, where I copied them in 1808"; the gate to Denton Hall (fig. 2, 4) lay opposite Denton Square, and the field in question is that which contained Areas I–III and the intervening length of Wall. This provides a better provenance for the two stones than that

Fig. 5 Vertical aerial photograph of the Denton area taken by the RAF on 22 October 1930. The Military Road (A69) crosses the top of the photo horizontally; the line of the Wall is represented by a lighter line south of the road, interrupted due south of Denton Hall by a lighter patch where the excavation trench for turret 7b, dug in 1929, has been backfilled. The buildings at the bottom of the photograph on the left are Dentonwood House (thus labelled on the 1897 OS map), where RIB *1360, a building stone of* cohors viii, legio II Augusta, *was built into the garden wall (Bruce 1875, no 37). It is now lost. The entry in* RIB *equates the site of Dentonwood House with that of the later Howlett Hall, a public house at the junction of Denton Road and Whickham View; but this identification is wrong, for Howlett Hall stands on the site of Denton Woodside House, an isolated group of buildings visible on the photo on the right-hand side of Denton Road which is the major road running south from the Military Road. Reproduced by courtesy of the Aitchison Collection, Museum of Antiquities, University of Newcastle upon Tyne.*

Fig. 6 Consolidated section of Wall between Areas I and IV, view from south-west, taken 23 September 1954. Photo: English Heritage (A3389/4).

given in *RIB*, which merely states that they were found "probably near Denton Hall" and does not cite Hodgson. On the watercolour of 1848 cited above, the mound is still visible almost as far east as a building which formed part of Denton Square.

Nothing has been published concerning the excavation of the visible portions of the Wall between Areas I and IV, and they are first mentioned in the eleventh edition of the *Handbook* (Richmond 1957, 57). However, a file minute of the Office of Works by J. Charlton dated 20 July 1947 describes their discovery: "At the time of my recent visit to the Wall area, some Council workmen, engaged in preliminary road-works near Denton, encountered some traces of Wall, where it has been thought to have disappeared. These traces, at the instance in the first place of Mr. F. Gerald Simpson, were followed up, and eventually some 50 to 100 yards of Wall were revealed in varying conditions. Over much of the length there is little more than footings, but in places there are two or even three courses and as the latter are 14 in[ches] [0·36 m] deep we get at one point a height of some four feet [1·22 m] of fine masonry". The line of the carriageway was altered so that the Wall could be saved, and it was subsequently consolidated and taken into guardianship by the then Office of Works (fig. 6). Nothing more of the Wall has been recorded between this point and the site of milecastle 8; roadworks carried out in the last forty years have probably removed all traces of it. In 1969, a Romano-Celtic head was found near the site of milecastle 8 (Harrison 1970; *CSIR* I, 1, no. 315). A second head was discovered in 1980 lying at the foot of a tree "about 400 yards" (366 m) south of milecastle 8, in the garden of a house backing onto the Sugley Burn (Smith 1984). The occurrence of two stone heads in proximity suggests that there might have been a shrine near milecastle 8.

Little is known of activities in this area in the medieval and early post-medieval period. In May 1751 an Act was passed for the construction of the Military Road between Newcastle and Carlisle, and work began on it in the same year (Lawson 1966). It follows the line of the present A69. There was probably an earlier road or track on the same line, for a plan of the Manor of Benwell in 1637 shows a bridge crossing Denton Burn just north of the Wall (*NCH*, 13, between pp. 231–2); it perhaps ran past the chapel at Denton (fig. 2, 5), in existence in the twelfth century, towards Walbottle. The tender document for the Military Road specified "best quarry rubbish or other proper material" (ibid., 205). There is no evidence that the Wall was robbed at this time; permission would have been required from the various owners of the land in which it stood, and stone was perhaps more easily won from quarries along Denton Dene Burn, one of which is shown on a woodcut of *c.* 1840 (Birley 1958, 309). Clearance of the Wall in 1804, noted above, was followed in 1818 by the building of a wagonway from Fawdon to staithes at Bell's Close, Scotswood (Lee 1951, 172); part of its course is shown on a Tithe Map of 1844 (fig. 2, 10). Denton Square, consisting of two small terraces of houses and a smithy, occupied Areas II and III; the buildings appear on the Tithe Map and thus were built before 1844.

The remains of the Vallum divided a series of fields running west from Denton Burn, the fence line following the centre of the ditch or the southern berm. Until the 1930s its preservation was such that "for a half mile west of Denton Burn village ... several gaps can be seen in the mounds and opposite them faint traces of the causeways across the ditch" (*NCH* 13, 538). In 1936 a stretch of the Vallum over 300 m in length was levelled when the South Denton housing estate was built; the discovery of five building stones (fig. 2, A–E; *RIB* 1361–5) is recorded by Richmond and Birley (1937); Wake (1935–6, 226–7), in his description of the Bronze Age cist found at the same time, reproduces a drawing of a section through the south mound of the Vallum. A sixth stone (*RIB* 1367; fig. 2F) was found 390 yards (356·6 m) west of turret 7b at Southway, when a further 110 m of the Vallum was obliterated in 1953. The only length of the Vallum which now survives in this area lies immediately west of Southway (fig. 2, 11).

PRE-ROMAN ACTIVITIES

Introduction

Although two Bronze Age cists are known to the south of the Vallum, no evidence for activities of this early period was found within the excavated areas. By contrast, exceptionally well-preserved remains of Iron Age cultivation were found under the Wall and its associated deposits. Soil conditions under the Vallum were quite different, and no signs of cultivation were observed there.

Area I (figs 8–11, 21)

The natural boulder clay in Area I was covered by a layer of soil (fig. 21, Sects 1 and 2, 289; described in detail below) which was in turn sealed beneath the Wall and construction deposits to the south and north. Along the southern edge of the excavation, beyond the area sealed beneath the deposits associated with the Wall, the soil altered its character, becoming more humic. This was the result of medieval ploughing and root action, which had destroyed the pre-Wall soil. In the trial trench between Trenches A and B, four oval pits with near-vertical sides were sealed by the pre-Wall soil (297, 0·03 m deep; 298, 0·27 m deep; 300, 0·19 m deep; 303 0·16 m deep; 299 was a small post-hole cut in from some point above the

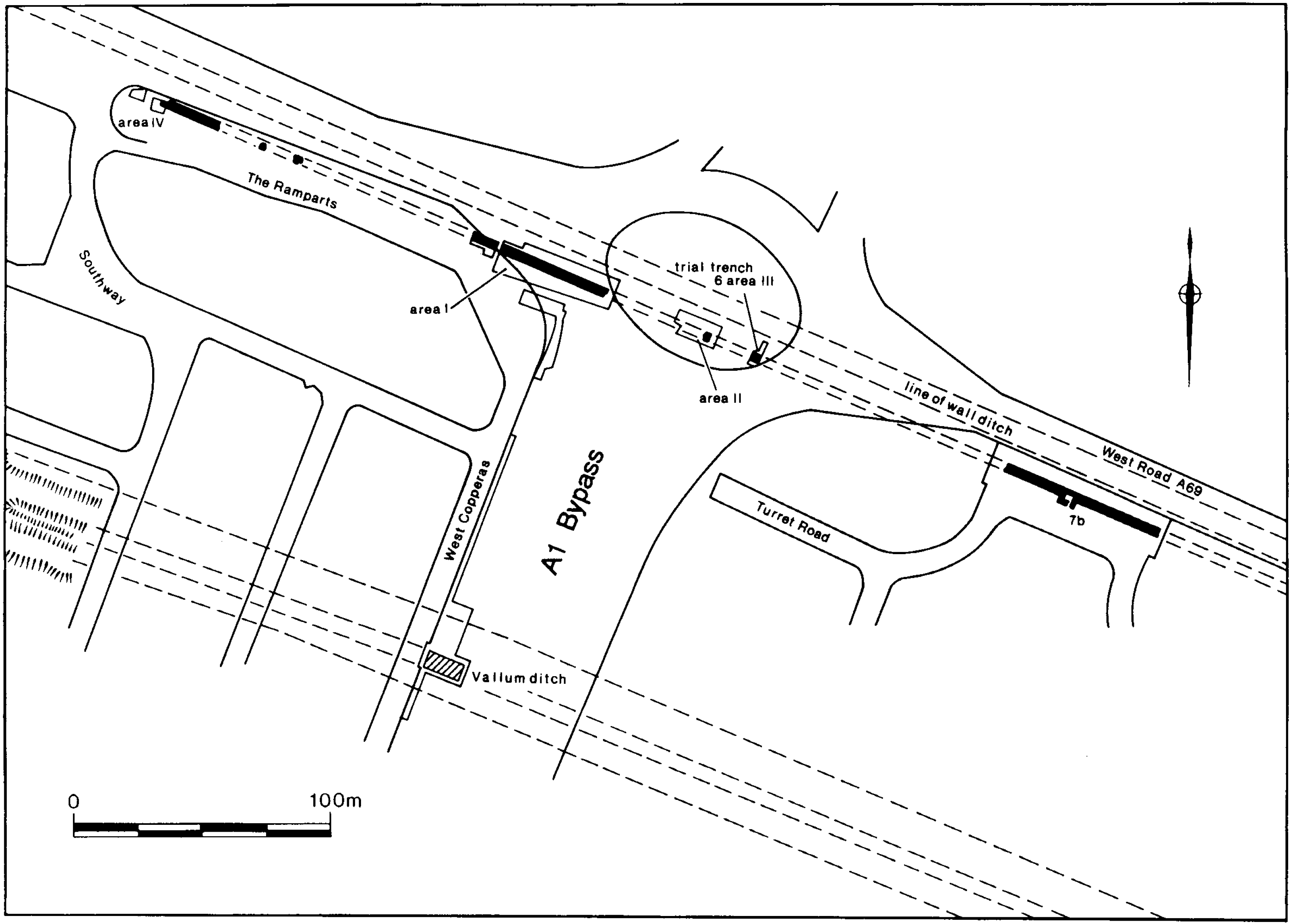


Fig. 7 Location of excavations. Scale 1 : 2500.

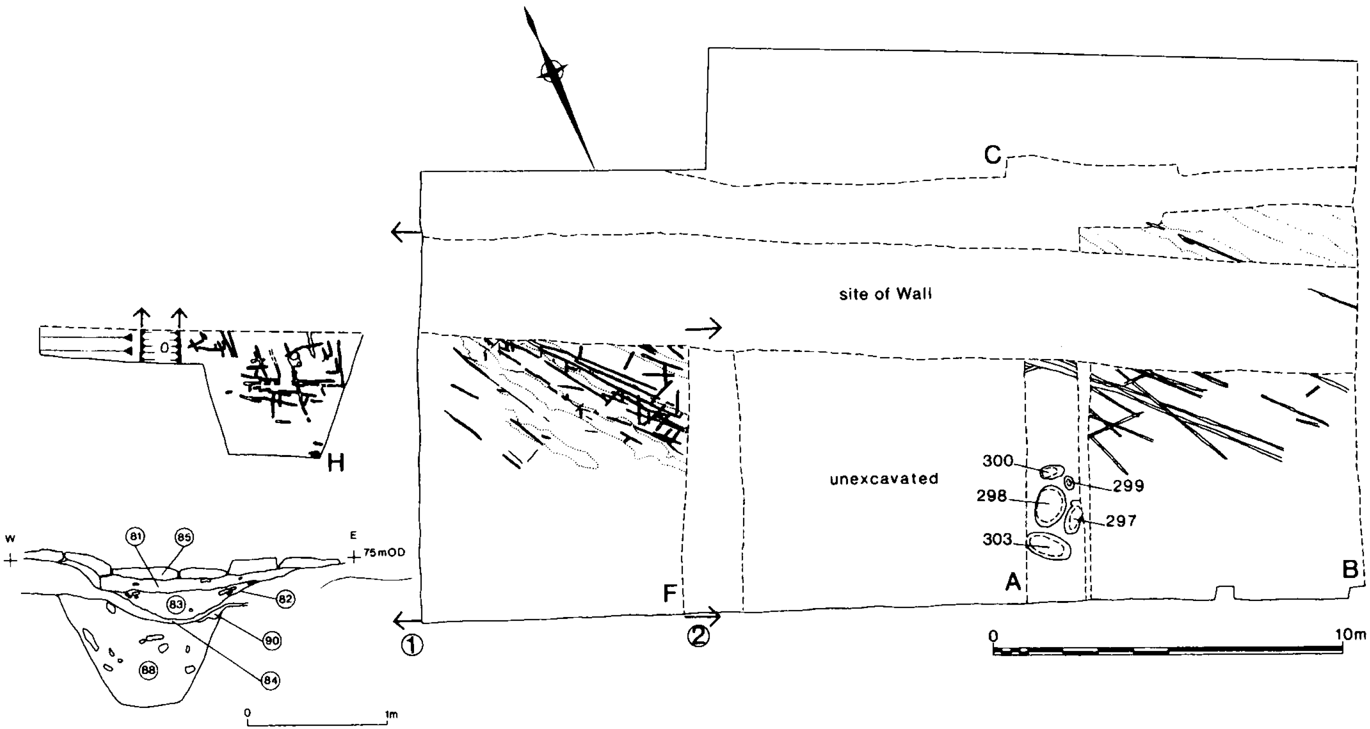


Fig. 8 Area I: ard marks and other features earlier than the construction of the Wall; dotted lines show furrows cut through surface of soil sealing plough marks in Trenches C and F. Scale 1 : 200. Inset: section of ditch (89) in Trench H, north-facing. Scale 1 : 50.

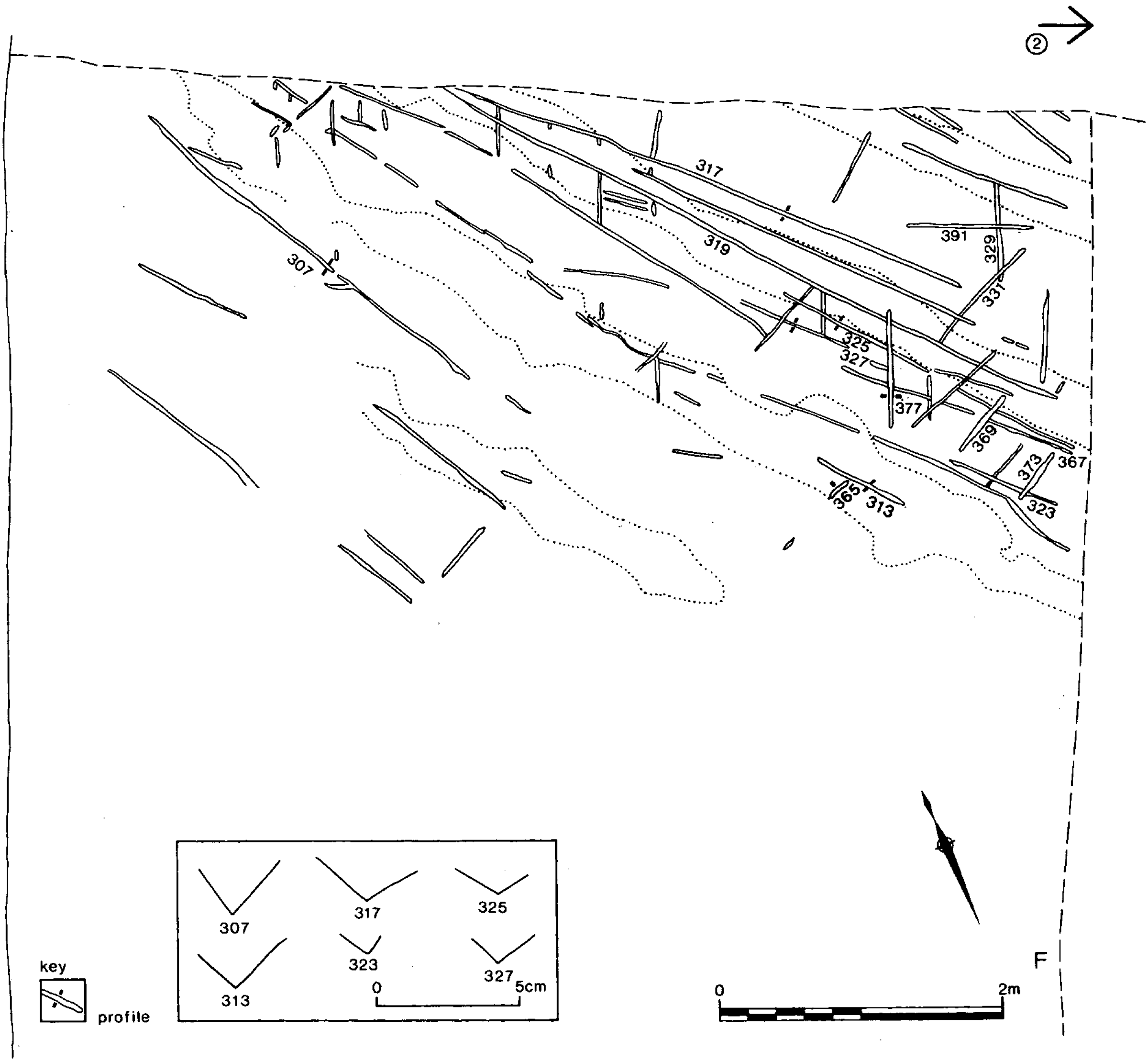


Fig. 9 Detailed plan of ard marks in Trench F. Scale 1 : 50; profiles 1 : 2.5.

pre-Wall soil). Their fills were similar, consisting of clay silt and small sandstone fragments. They perhaps represent holes dug to remove the roots of bushes or small trees, preparatory to the episodes of cultivation described below.

A short length of ditch (fig. 8, inset, 89) on the west side of Trench H ran at right angles to the line of the Wall and formed the limit to a complex of ard marks to the east. The ditch was 1·20 m in width and 0·90 m in depth with a flat base. Immediately to the west, there was a bank of clay loam 0·45 m in height which extended about 2·00 m to the west, gradually diminishing in height. At South Shields, beneath the remains of the Roman fort, a ditch with a similar profile and with a bank of simi-

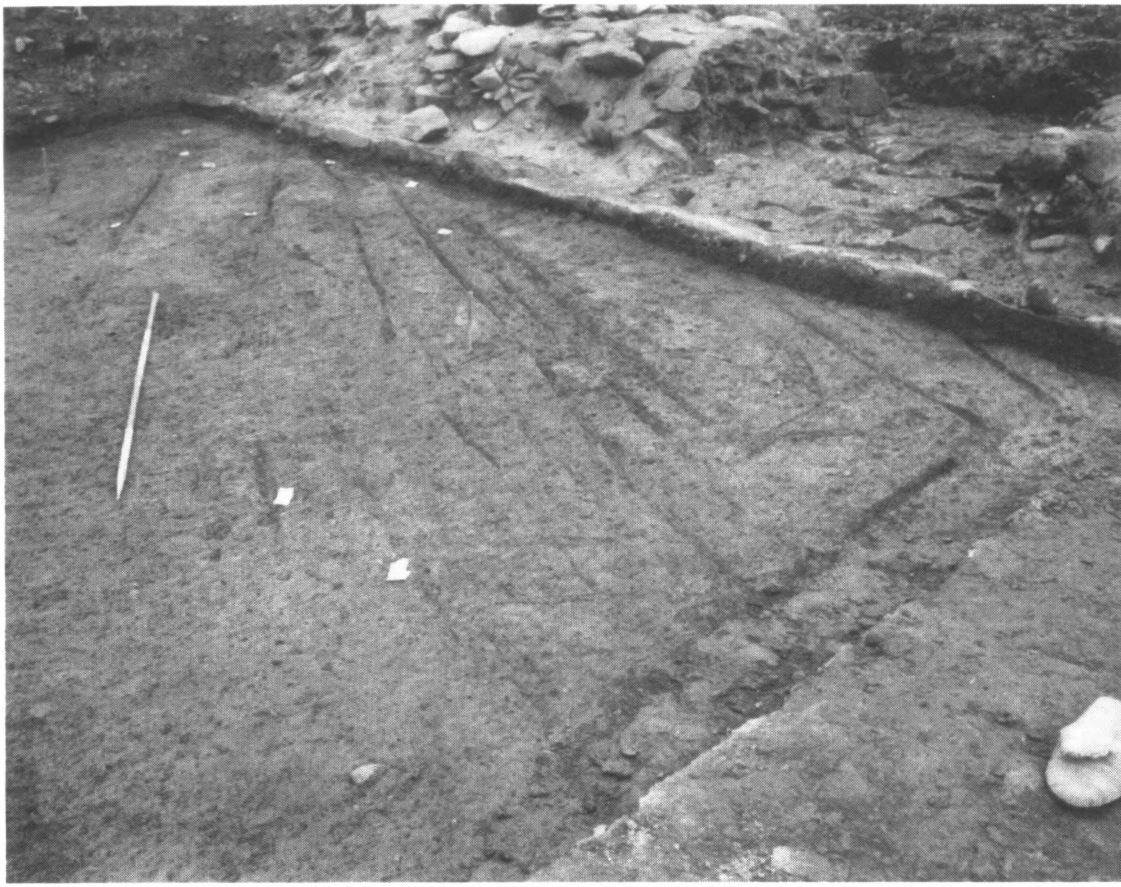


Fig. 10 Ard marks in Trench F, looking north-west with Wall in background. 1 m scale.

lar dimensions was associated with an area of cultivation and a round house dating to the mid-third century BC. A much larger ditch, 2·40 m in width and 1·10 m in depth with a bank standing to a height of 0·50 m, was found under Hadrian's Wall at Tarraby Lane, a little to the east of Stanwix; despite its large size it seems to have formed part of a field system, for a smaller ditch, likewise cut by Hadrian's Wall, was found running parallel to it at a distance of *c.* 90·00 m (Smith 1978, 21–3, figs 4–6).

To the east, the pre-Wall soil sealed several series of V-shaped grooves up to 60 mm in width and 40 mm in depth cut through the surface of the natural boulder clay. Their lengths varied from a few centimetres to a maximum of 7·00 m. Their fills differed little from the overlying soil, but slight changes in colour and texture sometimes allowed the relationships between intersecting marks to be established. These marks are the results of cultivation with an ard or share (because of the difficulties in distinguishing between the use of these two types of implement from marks left in the subsoil surface, "ploughing" is used as a general term to describe cultivation in what follows). Variations in the orientations of the marks suggested that they represented a number of ploughings, and the relationships established

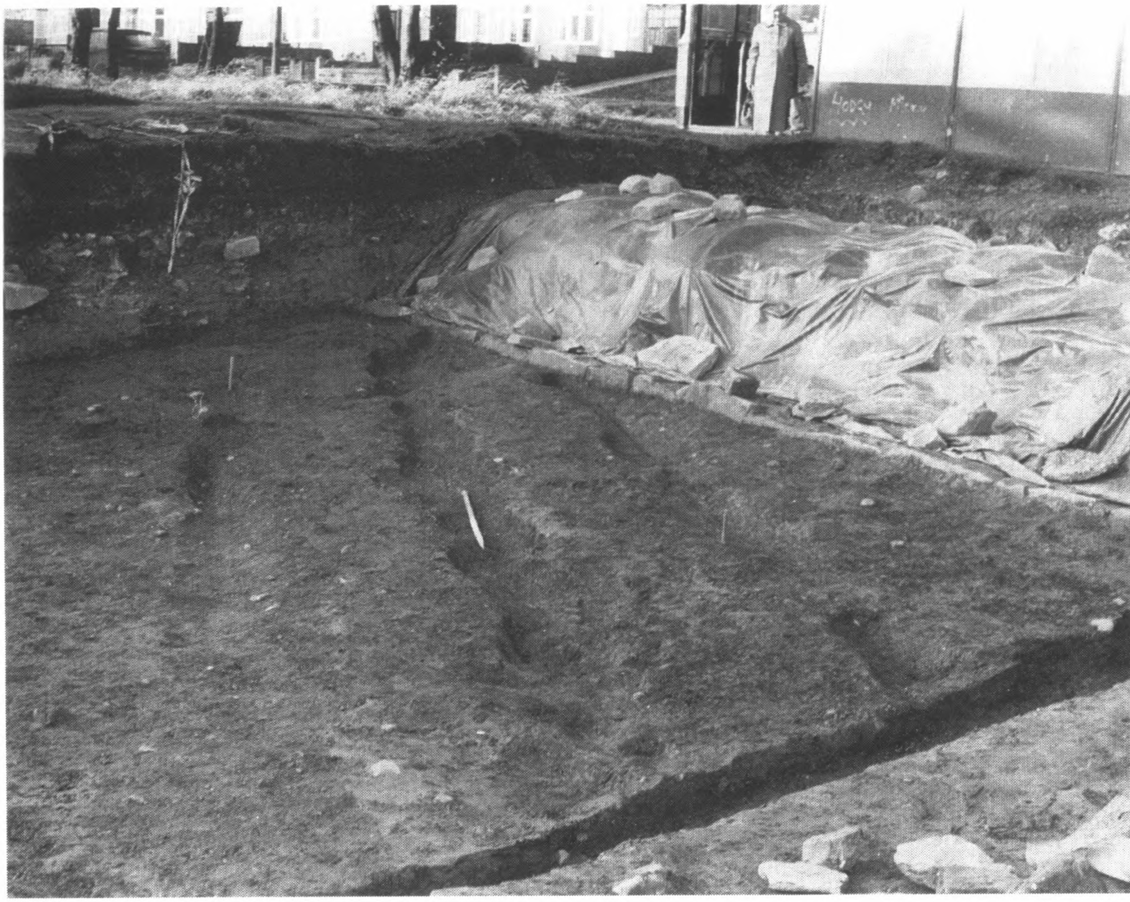


Fig. 11 Furrows in surface of soil pre-dating Wall, looking north-west. 1 m scale.

between the marks allowed them to be divided into five groups.

Group 1: there were seventeen of these marks running parallel to the line of the ditch; they occurred only in Trench F. Their lengths varied from 0·5 m to 0·85 m and their spacing from 0·1 m to 0·52 m.

Group 2: these marks ran at right angles to the ditch. There was only one in Trench F (391), but Trench H contained a number of fragmentary lengths on this alignment. The eight surviving marks varied in length from 0·32 m to 0·76 m and were spaced up to 1·16 m apart.

Group 3: these marks, fifteen in all, were found in Trenches F and B, and in the latter they occurred on both sides of the Wall and one was preserved under its foundations. They ran at an angle of about 63° to the line of the ditch; their lengths varied between 0·08 m to 1·72 m, and the distance between them was from between 0·20 m to 1·16 m. One mark (307) had a cut 0·2 m in length diverging from it at an angle of 30°.

Group 4: these marks ran at an angle of about 45° to the line of the ditch. Their lengths varied between 0·12 m and 2·93 m.

Group 5: Trench H contained a series of short marks running at an angle of about 20° to the line of the ditch.

The relationships between these marks make it clear that each group does not represent a single episode of cultivation: different marks within each group either cut or were cut by marks of other groups. For example, a mark of Group 1 (329) was cut by marks of Groups 2 (391) and 3 (331), but another mark of Group 1 (377) cut three marks of Group 3 (319, 325 and 367). Similarly, some marks of Group 3 (323, 325 and 367) were cut by marks of Group 4 (365, 369 and 373); a mark of Group 4 was cut by one mark of Group 3 (325) but cut by another of the same group (327). It is evident from these relationships that some of the marks running parallel or at right angles to the ditch were earlier than those running at other angles, and that others were later. Furthermore, the relationships between the marks of Groups 3 and 4 show that they represent more than two episodes of cultivation.

The alignment of the marks of Group 5, which only occur in Trench H, may be accounted for by the presence of the ditch, and the need to turn the ard to run more or less parallel to the ditch in order to cultivate the ground immediately adjacent to it. Some marks of Group 2 extend almost as far west as the ditch and presumably precede it, but the absence of marks under the bank to the west suggests that there is some earlier form of field boundary on this line. The ditch had been filled with clay-silt with a few cobbles and small sandstone fragments (88); it was sealed by soil identical to that covering the ard marks, so presumably had gone out of use before the final phase of cultivation, described next.

The ard marks were sealed beneath soil from 0·17 m to 0·20 m in depth. Detailed examination by R. Payton (see p. 42 below) showed that ard marks were visible in section within this layer of soil but it proved impossible to trace them by area excavation. The surface of the soil had been burnt and in places was bright red or black and sometimes baked hard. The burnt surface was cut by a series of furrows running on the same alignment as the marks of group 3 and spaced *c.* 1·10 m apart from centre to centre (figs 8–9 and 21, Sect 2, 270, 276, 282). The furrows were *c.* 0·40 m in width and 0·15–0·20 m in depth, with rounded profiles. They were filled with soil similar in character to that through which they were cut; the main means of distinguishing the two soils was the inclusion of much burnt material in the filling of the furrows and its loose composition.

Area II

Ard marks were found in Trial Trench 2, 18·00 m each of Trench B. The four marks (not illustrated) shared the same alignment as those of Group 3 in Area I.

Area III

The bedrock in this area was not covered by boulder clay and only a thin layer of dark brown sandy soil separated the bedrock from the footings of the Wall.

Area IV (fig. 23)

In the surface of the natural clay were two groups of ard marks (fig. 22, 1). They were sealed by soil similar in character to that over the ard marks in Area I. Two furrows *c.* 1·00 m apart were cut through the surface of the soil, the northern furrow continuing beneath the footings of the Wall. They shared the same alignment as the furrows in Area I which lay 135·00 m to the east.

PRE-ROMAN ACTIVITIES: DISCUSSION

It has to be concluded that the type of implement which formed the marks in the subsoil was an ard. There is no evidence that the plough, in the sense of an implement with a coulter (which cuts the soil vertically) and a mouldboard (which turns over the soil), was in use in the later Iron Age. At Rudchester it was claimed that the cord rig underlying the fort was associated with the use of a plough (Gillam et al. 1973, 84–5), but this assertion has been subsequently rejected, explicitly or by implication (Rees 1979, 86; Jones 1989, 131). All that can be said of the Denton marks is that their crisp, V-shaped profile suggests that they were made by an iron share (Rees 1979, 48–59, figs 49–68), rather than by one of wood or stone.

The relationships recorded between the ard marks preserved in the surface of the subsoil suggest a long sequence of cultivation. This is entirely in accordance with R. Payton's conclusion that the soil sealing the marks was characteristic of arable and grassland rotation. It has been suggested that marks of this type were the result of deep ploughing of new land, deliberately ripping into the subsoil, in order to prepare it for cultivation (Fowler 1983, 168–9). This possibility has been discounted by Higham (1991, 97): the regular spacing of the marks and the number of episodes of cultivation which they represented were judged to be "symptomatic of an intensification of land-use in a controlled and carefully managed landscape, characterized by frequent re-use of a designated cultivation area". R. Payton (below p. 42) was able to distinguish the V-shaped profile of an ard mark in the soil immediately above natural; it seems likely that the shorter marks at Denton result from the ard share or point cutting down into the subsoil in areas where the soil cover was thinner than elsewhere.

The ard marks and cord rig at Denton are further evidence for widespread cultivation along the line of Hadrian's Wall to the east of the Whin Sill ridge. Where the subsoil surface has been carefully examined, ard marks have been observed on the majority of sites. They have been listed most recently by Topping (1989, Appendix 1) and Higham (1991, 96); in addition, marks have been observed at the unnumbered Westgate Road milecastle (Harbottle et al. 1988), 717 West Road (fig. 2, 7; excavations in 1981 when ard marks were sealed by a pre-Wall buried soil, *Central Excavation Unit Archive* Site 196) and at South Shields (Bidwell and Speak 1994, 13). Some sites have nevertheless failed to produce any signs of cultivation preceding the Wall. The most notable is perhaps at Buddle Street, Wallsend, where extensive areas to the north and south of the Wall were opened up; a pre-Roman soil surface was observed, but no marks were seen in the surface of the underlying boulder clay. Under the fort 50 m to the east, traces of cultivation were seen in various areas (Daniels 1976, 306–8, ard marks and cord rig, the latter originally interpreted as trenches for timber granaries earlier than the known fort).

The three examples of cord rig from the area east of the Whin Sill ridge immediately preceded Roman construction work: at Rudchester (Gillam et al. 1973, fig. 5) and Wallsend (information from C. Daniels) the furrows contained masons' chippings, which showed that they were filled only when construction work had begun on the sites; at Denton the episode of burning took place not long before the building of the Wall, and the remains of the burning were cut by the furrows of the cord rig. At Rudchester the distance between the furrows from centre to centre was *c.* 1·50 m, as opposed to *c.* 1·10 m at Denton. The average width of cord rig surviving in Northumberland and the Borders is 1·40 m (Topping 1989, 161). The purpose of cord rig was to increase the temperature of the soil and drain the ground; generally, wetter soil is associated with narrower rigs (ibid., 163–4), and the tendency of the soil under the Wall at Denton to become waterlogged, noted above by R. Payton, explains why the cord rig was narrower than average. At Denton some of the ard marks of Group 3 coincided with the centres of furrows, and this raises the possibility that the ard was used to form furrows. It would have been used to break up the ground along the line of the furrows, the loosened soil being dug out with spades and spread between the furrows so formed to make rigs. The absence of spade marks in the subsoil is accounted for by the shallow depth of the furrows, which are wholly contained within the overlying soil; at Rudchester, likewise, the furrows did not penetrate to the subsoil (Gillam et al. 1973, fig. 5). It is quite possible that some ard marks in the other groups were associated with the formation of earlier sets of furrows on different axes (C. F. Topping 1989, 167).

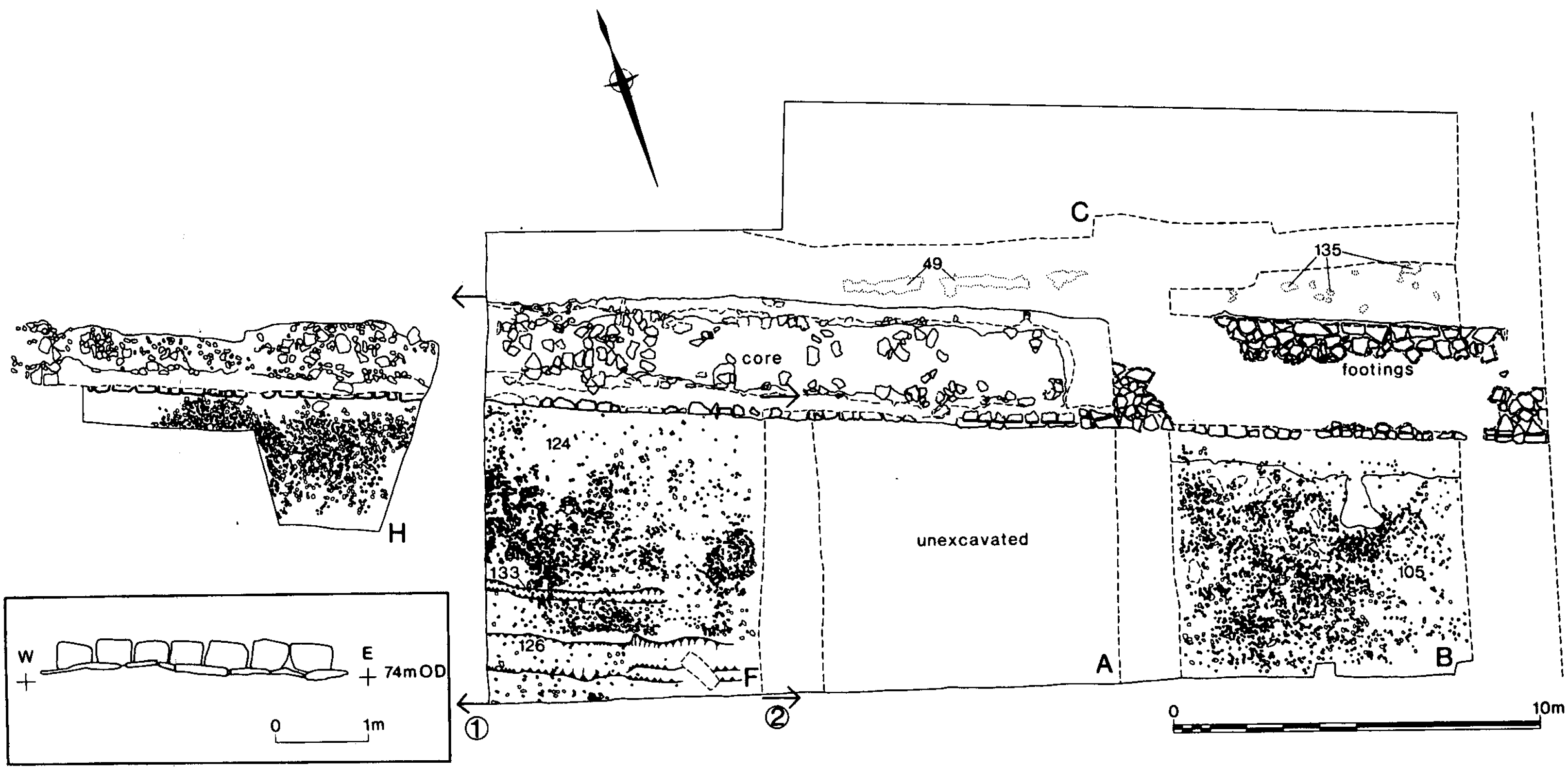


Fig. 12 Hadrian's Wall with primary metalling and wheel ruts to the south. Scale 1 : 200. Inset: elevation of footing slabs and foundation course in Trench A. Scale 1 : 80.

No traces of burning similar to those at Denton were noted at Rudchester and Wallsend, but they are known elsewhere along the line of the Wall. "A burnt area [0·46 m] in diameter and [0·02 m] deep" was seen under the south mound of the Vallum at Lemington Middle School (Tait 1962, 137). In 1865, immediately to the east of milecastle 10, there was seen beneath the Wall "soil [0·10–0·11 m thick], which was blackened by the vegetation of the pre-Romanic period, and which no doubt [represents] the surface as the builders of the Wall found it" (Bruce 1865, 222). Under turret 10a there was a charcoal streak, and the pre-Roman soil, which sealed ard marks, also contained charcoal (Bennett 1983, 53, fig. 19); at Heddon-on-the-Wall, between turret 11b and milecastle 12, "four to six inches [0·10–0·15 m] of soft black humus had been left under the foundations" (Brewis and Simpson 1927, 119); at Wallhouses "fragments of charcoal were distributed throughout" the soil beneath the Vallum mounds (Bennett and Turner 1983, 66). Finally, Bruce (1858, 233) describes burnt material beneath the mounds of the Vallum, seen when the North Tyne Railway was cut across its course just to the east of the Roman bridge at Chesters: "one, and in places two layers of burnt matter, were noticed at the base of [the Vallum mounds] ... the ashes, seemingly, of wood, had in some instances begun to assume the appearance of fossil coal, having formed themselves into trapezoidal masses".

Some of these instances of burning might have resulted from clearing scrub or light woodland in preparation for the construction of the Wall or, some years later, the Vallum. Where such evidence has been recovered on sites which had been cultivated, as a turret 10a and Wallhouses, it might equally represent the clearance of fallow land for cultivation which is evident at Denton. R. Payton's study of the pre-Wall soils at Denton suggests that the furrows represent a single episode of cultivation after the land had been under grass for a long period, perhaps with some invasion of scrub. The evidence is consistent with limited ploughing "probably in the year before the construction of the Wall". If this was autumn ploughing followed by seeding, then the farmer would never have had the opportunity to harvest the crop: at the beginning of the building season, when the line of the Wall was laid out in the spring of the following year, the farmer would have been expelled from the land by the Roman army.

HADRIAN'S WALL

Introduction

Hadrian's Wall was examined over a length of 240 m at various points where it was to be destroyed by the construction of the A1 underpass and its associated roadworks. Its fabric had been extensively robbed and in some stretches even the footings had been removed. Nevertheless, a great deal of useful information about the construction and later history of the Wall was recovered.

Area I: the Wall (figs 12–15)

The Wall was traced for a distance of 61·00 m across Area I; detailed examination was confined to a stretch 38·00 m in length in the western part of the area, the remainder having been almost entirely robbed out. Its footings were of a uniform width, *c.* 3·05 m (10·34 Rft) with variations of only a few centimetres. They were constructed of a single layer of slabs of yellow laminated sandstone up to 0·15 m thick packed around with yellow clay; a single slab of whinstone was noted in the footings in Trench H. Large slabs had been laid to form the edges of the footings and the space between had been filled with smaller slabs and sandstone fragments. The surface on which the footings had been built sloped southwards at an angle of about 3·5 degrees to the horizontal. Attempts had been made to compensate for this by terracing the north side of the footings into the underlying soil to a maximum depth of 0·08 m. The south side, however, was built directly on the pre-existing surface. The terracing was not deep enough to make the footings

Fig. 13 Section through Wall core, looking west. 0.5 m scale.

lie horizontally from north to south; and this, combined with the greater depth of soil along the southern side of the footings, meant that the weight of the superstructure was not distributed evenly. The results could be seen along the south edge of the footings where the slabs had snapped through along a straight line, some 0·2 m from the edge of the footings, which corresponded to the south face of the foundation course of the Wall (fig. 14). The only stretch of the footings where this had not occurred was in Trench H, above the pre-Roman ditch (89), where the footing slabs had been pushed down into the soft fill. In some places the foundation course had canted forward, pushing the fractured footings slabs beneath it downwards and tilting the projecting fragments upwards. Eventually the footing subsided so much that, sometime after the early third century, the south face of the wall collapsed (see below).

Seven facing stones remained on the south side of the Wall in Trench A (fig. 12, inset). They had formed part of the foundation course, above which the Wall would have been offset by *c.* 0·05–10 m, as in the surviving fragments between Areas I and IV (Standard A: Birley et al. 1932, 255, Pl XLIII). Subsidence

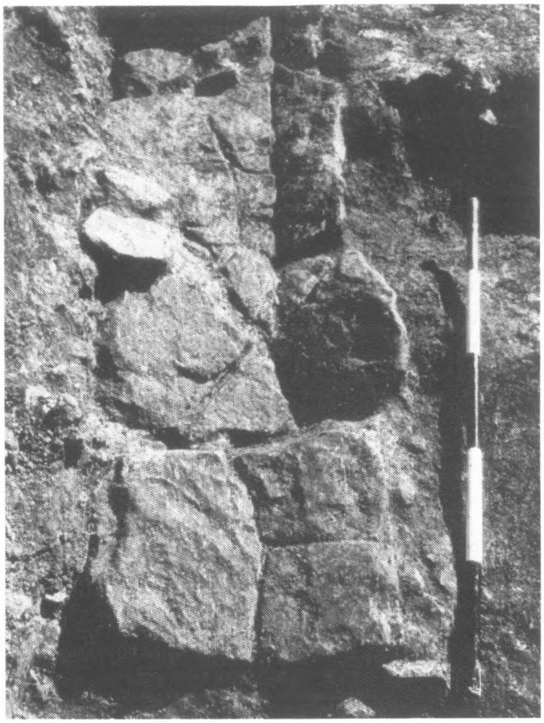


Fig. 14 Broken footing slabs on south side of Wall in Trench B. 1 m scale on south side.

of the footings had displaced the stones, so that their faces were at angles of between 9·5 and 19 degrees from the vertical. Four of the stones were roughly cubical, the remainder having "tails" (i.e. in plan the sides tapered away from the face) to bond with the core. They were of a large size, their heights ranging from 0·26 to 0·34 m. Their faces had been worked flat with a point or punch, but the other surfaces were split faced. On the backs of three stones there were very shallow rectangular marks *c.* 70 mm in width; these were almost certainly made by wedges of iron or wood, employed to split the blocks from their beds (fig. 15). Mortar which was grey in colour with inclusions of charcoal and burnt clay had been applied sparingly to bind the stones together: much of it was decomposed and very soft, but some still adhering to the stones was very hard indeed. The appearance of this mortar was similar to that of a modern cement mix of coarse quality and contrasted strongly with the lime-rich mix of the plaster rendering. Two facing stones were also seen at the western edge of Trench H; they were 0·26 m in height, with traces of grey mortar on their tops and sides.

On the north side of the footing, the foundation course, its position indicated by the north side of the robbing trench, was offset by 0·25–0·30 m from the northern edges of the footings. The overall width of the foundation immediately above the footings had thus been *c.* 2·9 m (9·83 Rft). The width of the Wall surviving between Areas I and IV was *c.* 2·8 m (9·49 Rft) above the foundation offsets.

The core of the Wall survived for a length of 26·80 m, continuing westwards beyond the limits of the excavation; to the east it had been entirely robbed. It was preserved to a maximum height of 0·96 m above the footings. A section cut through the core in Trench F (fig. 13) showed it was constructed of clay and rubble, roughly in proportions of 2:1. The rubble consisted of large angular sandstone fragments, up to 30 kg in weight, and a few whinstone boulders of about the same size. The rubble had not been pitched into the core at random but was laid horizontally; however, no consistent coursing was observed. It has been said (e.g. Daniels 1978, 16) that the clay in the core of the Broad Wall was puddled; to "puddle", according to the *Oxford English Dictionary*, means "to knead and temper a mixture of wet clay and sand so as to form a plastic mass impervious to water". This is certainly not a correct description of the core at Denton, where the yellow clay, although compact, was mixed with distinct pockets of brown silt, which would have been blended with the clay had it been properly puddled.

The core of the Broad Wall at Denton can thus be described neither as a clay core nor as a rubble core set in clay. It is a clay and rubble core with the clay, compacted perhaps by treading but not puddled, providing the body of the core; the rubble, probably derived from digging the Wall ditch, was inserted as a filler.

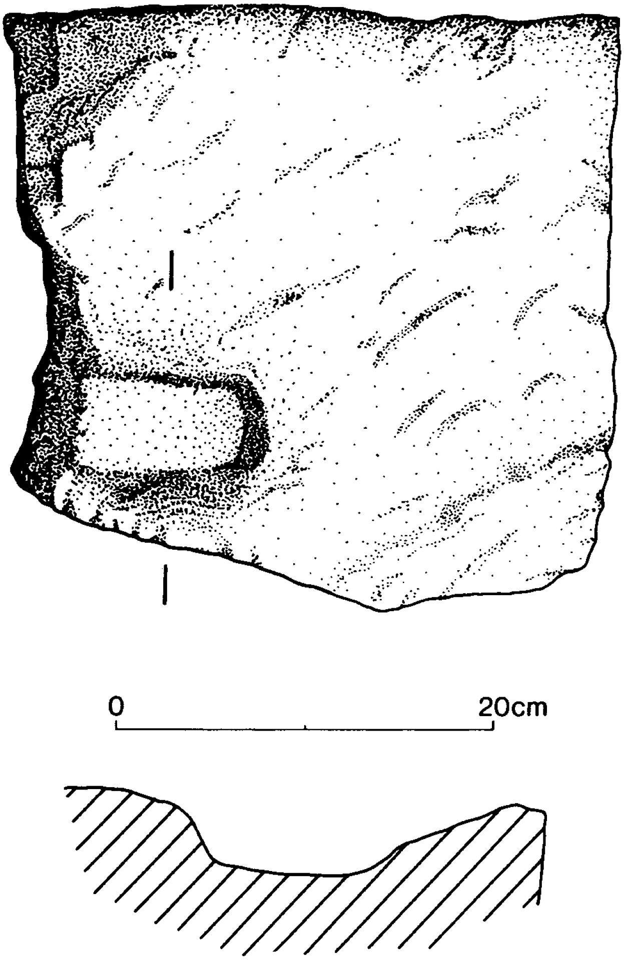


Fig. 15 Wedge slot in surface of facing stone on south side of Wall in Trench F. Scale 1 : 4; section 1 : 1.

Area I: construction deposits south of the Wall (fig. 16)

Immediately above the burnt surface of the soil and the in-filled furrows in Area I was a thin spread of yellow clay and sandstone chippings with a maximum thickness of 0·10 m. Its depth and extent varied considerably: in Trench B it extended beyond the southern limit of the excavation (122); in Trench F it petered out before reaching the southern limit of the trench (fig. 16, Sects 1 and 2, 136); and in Trench H two separate dumps of clay and sandstone chippings were distinguished, with a maximum overall depth of 0·20 m (81, 83). The deposit abutted the south side of the Wall footings, which had been laid on the old ground surface. The layer also filled a pit 0·3 m in depth which extended beyond the western limit of Trench F (not illustrated in plan; fig. 16, Sect 1). Similar clay spreads, abutting the Wall immediately above the pre-Roman ground surface, have been noted to the east of turret 10b (Bennett 1983, 30–1) and at 717 West Road, east of turret 7b (excavations in 1981, *Central Excavation Unit Archive Site* 196).

The clay can be interpreted as a construction deposit and is probably associated with the building of the Wall-core in clay and rubble. The absence of other signs of constructional activity requires explanation. As already noted, mortar was used very sparingly and the absence of mortar-mixing areas need occasion no surprise: the mortar was presumably prepared in bulk at points a convenient distance away from the building activities on the Wall and brought up as required. If the stone for the Wall came from the Wall-ditch (as it argued later), it would have saved much labour if the facing stones were prepared on the berm, north of the Wall.

Area I: metalling south of the Wall (figs 12 and 16)

The surface of the clay spread was sealed beneath a thin layer of sandstone chippings and gravel no more than 0·05 m in depth (105,

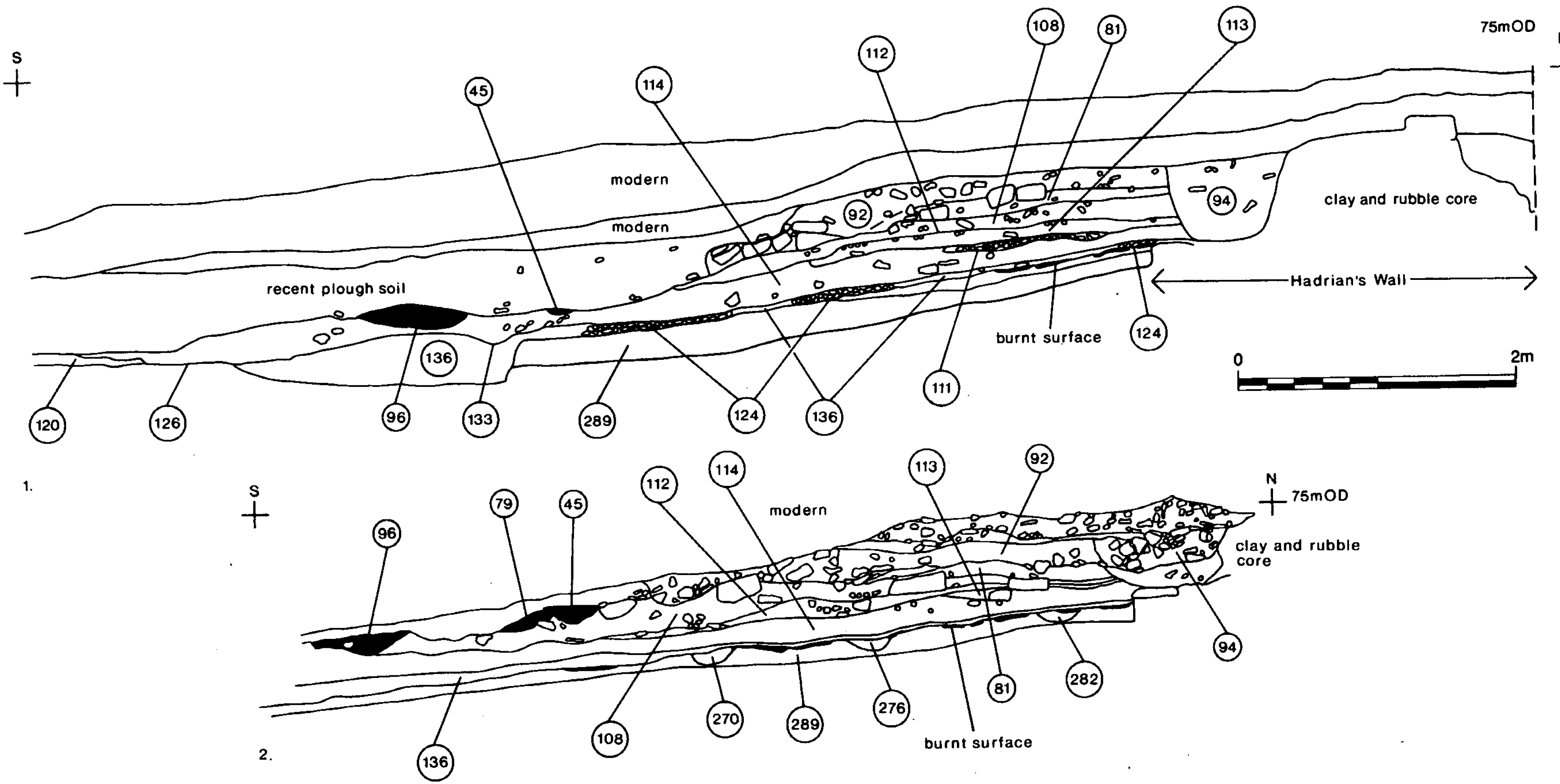


Fig. 16 Section 1: Trench F, west side, east facing. Section 2: Trench F, east side, east facing. Scale 1 : 50.

124). In Trench F the layer (fig. 16, Sect 1, 124) sealed the Wall footings, but in Trench H the equivalent layer (79) did not extend as far as the Wall, petering out 1·00 m to the south. In Trench B (105), the metalling also petered out *c.* 0·06–1·0 m south of the Wall. In all three trenches it extended as far as the southern limits of the excavation, giving it a maximum width of 8·4 m, where it became thinner and patchier, as if its southern limit lay just outside the excavations. The surface of the chippings and gravel was compacted and displayed obvious signs of wear. Moreover, in Trench F there were two depressions worn through the surface which appeared to have been wheel-ruts (figs 12 and 16, Sect 1, 133 and 126). The chippings and gravel can thus be justifiably described as metalling. They are unlikely to represent a road or track provided for the use of the builders, because in Trenches B and F the metalled surface was covered not by building debris such as clay, mortar or sandstone chippings, but by a discontinuous layer of brown silt. The silt was very thin to the north but had accumulated to a depth of 0·2 m along the southern edge of the area (102, 107, 109). It contained some worn sandstone chippings but no other building debris and might well have represented mud accumulating over the metalled surface. The layer of silt was sealed beneath a dump of clay which contained a few pockets of brown silt, charcoal, fragments of grey mortar, similar to that bonding the facing stones of the Wall, and two facing stones, none of the surfaces of which had mortar adhering to them. In Trench B, the dump (89) was up to 0·22 m in depth and extended for a maximum distance of 4·44 m from the south face of the Wall, which it abutted. In Trench F, the clay dump (fig. 16, Sects 1 and 2, 114) was of a similar depth but extended further to the south, merging with a layer of silt (fig. 16, Sect 1, 120), the original character of which had probably been altered by root-action and medieval cultivation. In Trench H, the deposit (79, 80) was up to 0·30 m in depth.

In Trench F, a narrow strip of metalling (not illustrated in plan; fig. 16, Sect 1, 111) was found above the clay dump (114); it had a maximum width of 1·39 m and its northern edge lay parallel to and 0·40 m distant from the south face of the Wall. The metalling was also traced in Trench H (76) where it was 1·50 m in width and lay 0·50 m south of the Wall; at this point to consisted almost entirely of gravel and small, water-worn cobbles. No traces of this metalling were seen to the east, and it seems to represent a path laid down when the primary metalling to the east in Trench B was still in use as a surface.

The primary and secondary layers of metalling were all sealed beneath a dump which was covered by yet another layer of metalling. In Trench F the secondary metalling was sealed beneath a dump of mixed yellow clays (fig. 16, Sects 1 and 2, 113); in turn, it was sealed by metalling (figs 12 and 16, Sects 1 and 2, 112) with a maximum depth of 0·05 m which consisted of sandstone chippings mixed with pebbles and set in a matrix of orange sand. The surface of the metalling was compacted and displayed evident signs of wear. In Trench H the dump (75) included small fragments of grey mortar and white plaster; the overlying metalling (74) was very worn and compacted. An identical layer of metalling (fig. 17A, 57) was laid down over the clay dump in Trench B. It extended for a distance of 5·6 m from the south face of the Wall; its southern edge was partly eroded by an irregular but very shallow gully with a maximum depth of 0·10 m and an average width of 0·60 m (fig. 17A, 87) which presumably marked the southern edge of the metalled surface. From its filling of loose stone and cobbles was recovered a stone bar mould (fig. 27, no. 7). Above the clay dump in Trench A, only a very small area of metalling survived (91); the surface of the clay dump in the vicinity of the surviving metalling was not compacted and showed no signs of wear, and this suggests that it had been protected by a more extensive area of metalling, much of which might have been removed for reuse.

Collapse of the south face of the Wall and the fallen plaster (figs 17B and 18)

The uppermost metalled surface was covered by a thin layer of silt, probably representing an accumulation of mud (Trench B: 51, containing a copper alloy ring, fig. 27, 3); Trench A: 88; Trench F: fig. 16, Sects 1 and 2, 108; Trench H: 70). The silt contained frequent small fragments of plaster.

Above the silt (51) which covered the uppermost metalled surface in Trench B were deposits of mortar and plaster (50). The fallen plaster preserved in its upper surface (that is, the surface adhering to the Wall face) the impressions of the joints between the facing stones. The latter had been removed, probably to repair the Wall, but the impact of the fall had loosened much of the plaster from the collapsed Wall face, so that it lay where it had fallen, except where it had been disturbed by the removal of the stones. The plaster extended for a distance of 2·25 m south of the line of the Wall face; further to the south it would have been destroyed by post-Roman activities.

The plaster was recorded at a scale of 1:5. The best preserved fragment (fig. 19A, H) was lifted by freezing the deposit on which it lay into a block with liquid carbon dioxide. The work was carried out by the University of Durham Archaeological Conservation Laboratory, where the block was stored in a freezer until it was conserved. Other smaller fragments were lifted without being conserved, but many were friable and disintegrated while being removed.

The plaster is cream-coloured. It is of a light weight when compared to ordinary mortar because of the small size and sparseness of its aggregate (for analysis, see below). Its character is quite different from that of wall plaster used for internal decoration, which usually has a dense aggregate of fine sand with a thin layer of lime wash on top to receive painted decoration. The surface of the plaster is extremely weathered in places, being pitted with numerous small holes; occasionally whorls are visible, presumably the result of a blending of different mixes which have weathered to varying degrees. The surfaces of some fragments are less weathered and preserve the grooves of false ashlar jointing. These usually have a curved profile and are between 20 mm and 35 mm in width and 3 mm to 5 mm in depth, although some examples have a sharper profile. Where not weathered, the surfaces of the grooves are very smooth, as if they had been impressed into the wet plaster with a round-edged implement.

The rear surfaces of the plaster fragments bear the impressions of the joints between the facing stones. The depth to which the plaster penetrated the joints varies between 20–30 mm, and the widths of the joints are generally *c.* 25 mm, diminishing to a width of 10–15 mm. Grey mortar identical to that bonding the foundation course in Trench F is found adhering to the ends of some of the joint impressions. On the sides of some of the fragments there are projecting flanges where the plaster was carried across the face of the Wall; the thicknesses of these flanges usually varies between 10–14 mm, although some are only 3–4 mm thick. Fragment 1 (H: fig. 20) shows plaster extending 100 mm across the surface of a facing stone; the broken edge of the plaster displays a thickness of 6–7 mm.

The plaster represents either an overall render or flush pointing. The latter is an application of mortar or plaster liberal enough to cover entirely the joints of the stone work, also extending some distance over the surface of the wall face (Bidwell 1996). False jointing is usually picked out with the point of a trowel, although sometimes, as in the amphitheatre at Caerleon (Wheeler and Wheeler 1928, 121–1. Pls XXIV, 1–2)), there are more carefully executed examples with red paint filling the scored lines. Generally, the overall effect is of an untidy patchwork of stone and mortar or plaster, but it is probable that the original appearance was improved by whitewashing the wall face once the flush pointing had been applied, thus giving the impression that the entire wall face had been rendered

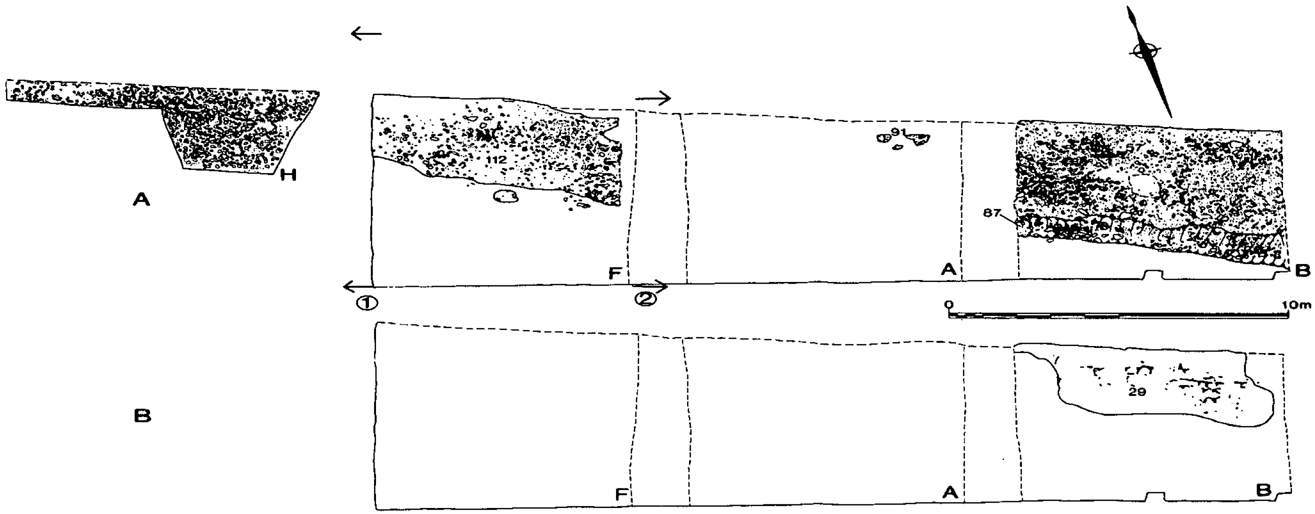


Fig. 17. *A. Final layer of metalling south of Wall. Scale 1 : 200.*
B. Position of fallen plaster in Trench B. Scale 1 : 200.

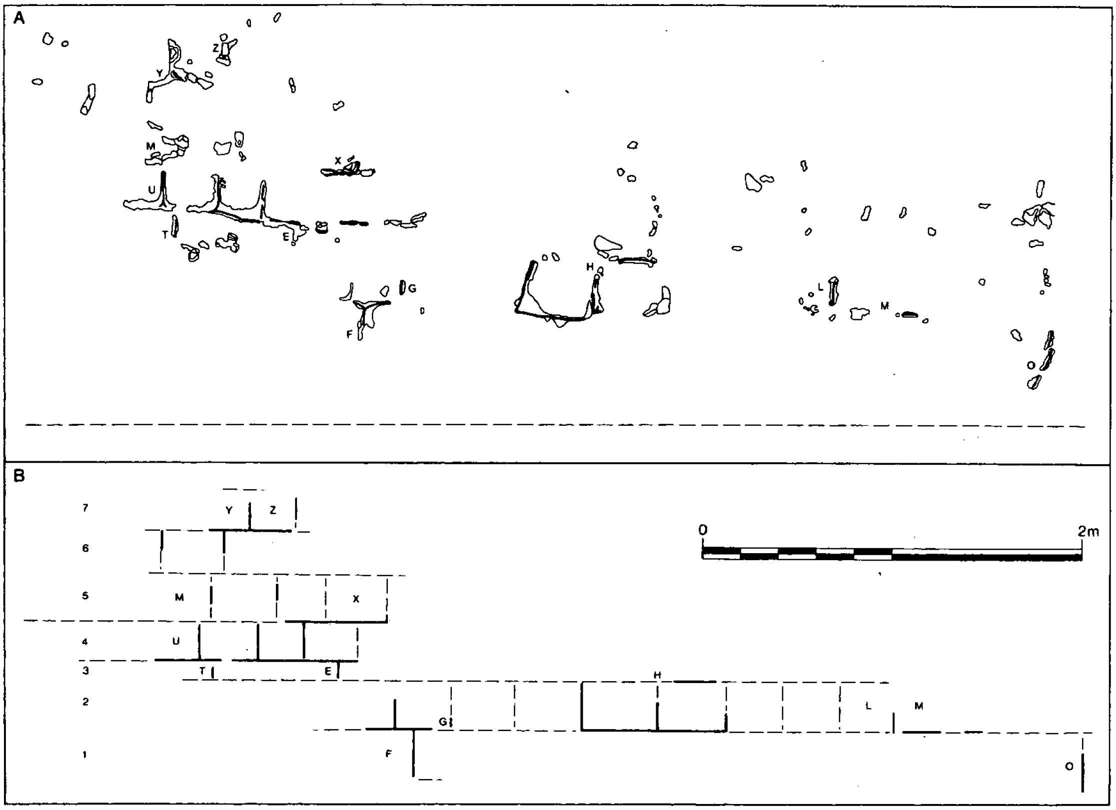


Fig. 18 A. Detailed plan of fallen plaster in Trench B. The broken line at the bottom of the plan shows the estimated position of the vertical south face of the Wall above the foundation course. Scale 1 : 40.
B. Reconstruction of fallen Wall face in Trench B. Scale 1 : 40.

Unfortunately, clear evidence of this practice has yet to be discovered.

If the Wall at Denton had been given an overall render, the plaster layer would have been quite thin: on fragment H, for example, a thickness of 6–7 mm was recorded at a distance of 100 mm from the jointing. On the stones of the foundation course surviving in Trench A, the external faces are somewhat uneven, commonly with variations of up to 5 mm in the depth of the dressing and at one point with a variation of 10 mm. It must also be noted that the fallen plaster, with the exception of fragment B, all came from the jointing of the Wall. This does not necessarily mean that there was no overall render: the plaster surface was perhaps so weathered when the Wall collapsed that it survived for the most part only where it was firmly fixed in the jointing of the stonework; equally, if rendering had actually survived until the collapse, it might have adhered to the face of the fallen stones which were removed for reuse.

It is, thus, impossible to be certain whether the plaster represents flush pointing or an overall render. The difference is perhaps of marginal importance if it is accepted that the flush pointing was whitewashed. In either case, the Wall would have appeared as a gleaming white line cutting across the landscape, like the defensive walls at the limits of empire which according to Aelius Aristides, writing in the second

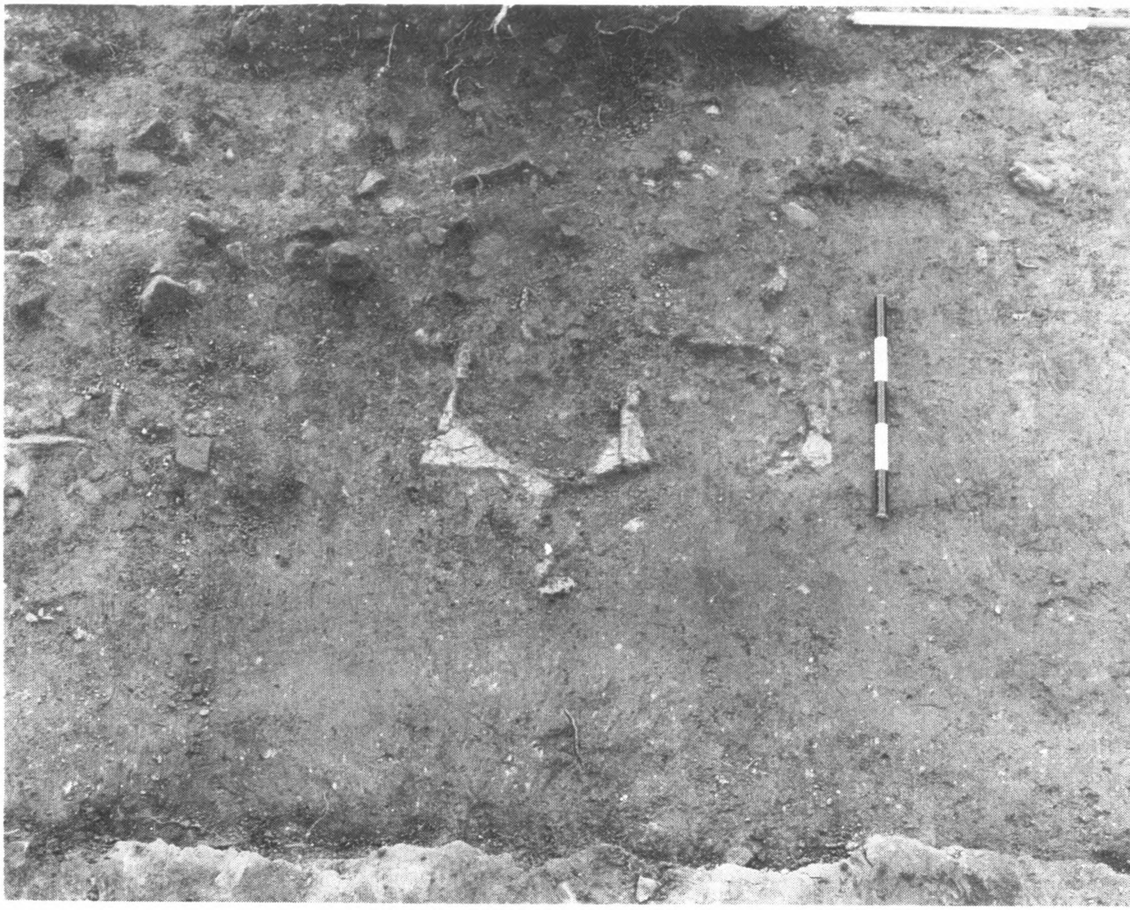


Fig. 19 Fallen plaster in Trench B (fragments F, G and H, cf fig. 18A), looking south. 0.50 m scale.

century A.D., "gleam with more brilliance than bronze" (*Orations*, XXVI, 83: Behr 1981, 90–1).

At Heddon-on-the-Wall, hard white mortar is still preserved on some of the facing stones at one point on the south face of the Wall. A chamfered slab "with a distinct whitened outside [which] provides evidence for the use of whitewash" was found at Peel Gap near the supernumerary turret between turrets 39a and 39b (Crow 1991, 59, fig. 3). The external decoration of structures with ornamental pointing or some form of overall rendering was a routine matter in the Roman world (ibid., 59). For large masses of masonry, especially defensive walls, plaster with grooves in imitation of ashlar jointing was especially favoured, although it was also used on domestic buildings (Bidwell forthcoming).

The only evidence in the layers below the collapse to indicate the time by which the rendering had been applied to the Wall was from the dump (75) below the uppermost layer of metalling in Trench H. Small fragments of plaster in the dump seemed to have come from weathering of the rendered Wall surface.

Reconstruction of Wall elevation (figs 19A and B)

In addition to providing evidence for the decorative finish of the Wall, the fallen plaster also allows the Wall elevation to be partly recon-

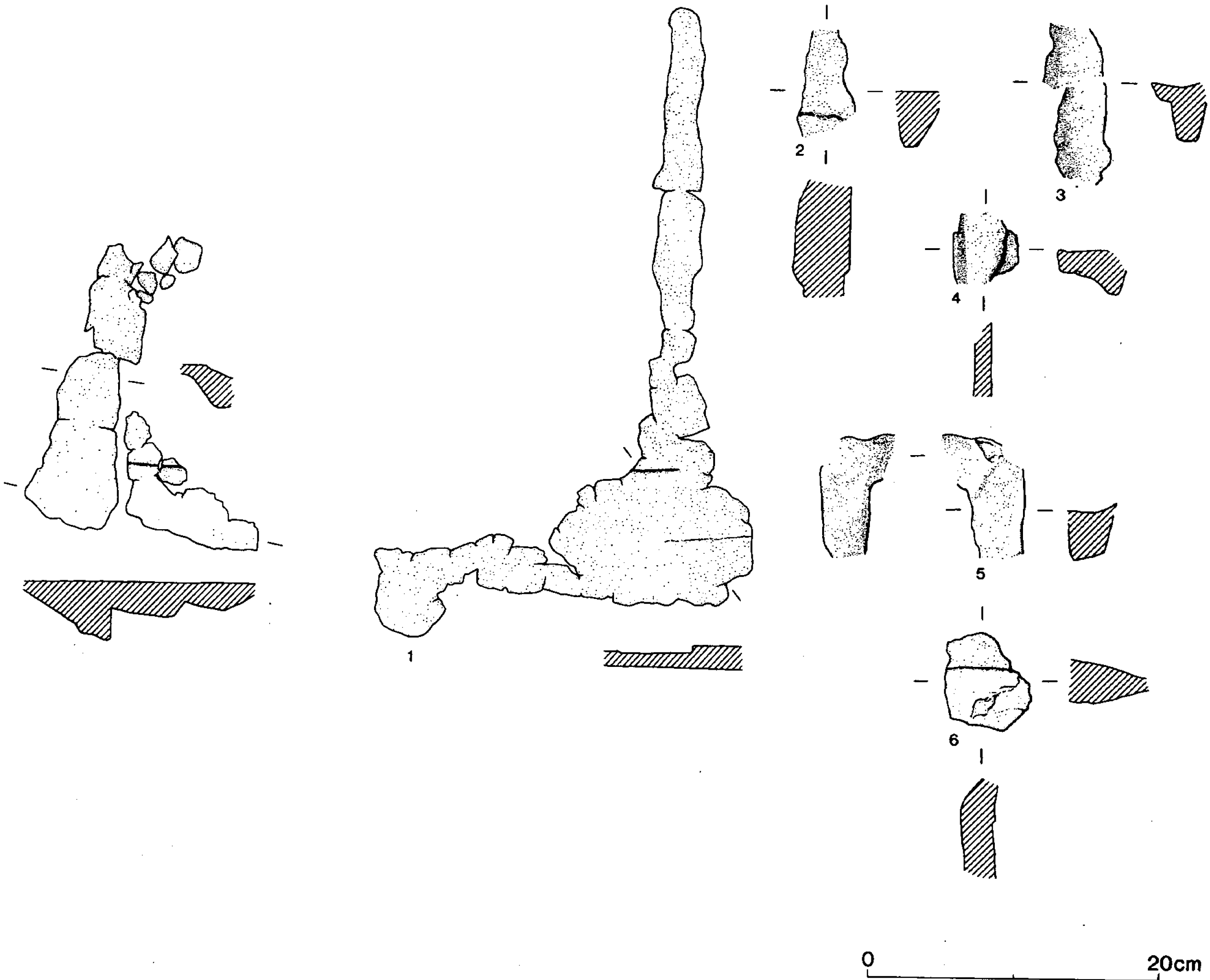


Fig. 20 Plaster fragments. Scale 1 : 5. For catalogue, see p. 47.

structed. Fragments of seven courses of facing stones extending over a length of 4·88 m are represented by impressions in the rear of the plaster. The horizontal jointing did not lie exactly parallel to the Wall: that between the first and second courses was at an angle of about 4 degrees to the south-east and that between the third and fourth courses was aligned a further 2 degrees to the south-east. It seems as if the Wall face had skewed slightly in the process of collapse. The second course was *c.* 0·28 m in height, and the outlines of facing stones 0·38 m and 0·42 m in length were preserved (fragments T and H). The dimensions are similar to those of the foundation course in Trench A (fig. 12, inset). The distance of the horizontal jointing between the first and second courses at fragment F and that of the third and fourth courses at fragment U was *c.* 0·40 m. The space which represents the third course is thus *c.* 0·12 m, less than half of the height of the courses below. This might be the result of the

Wall face buckling as it fell, although the skewing noted above suggests a slight fanning out of the face during collapse. A likelier explanation is that the third course consisted of thin slabs functioning as a bonding or levelling course. Such courses can be seen on the south face of the Wall at milecastle 37 (Crow 1989, 32–3), where they are spaced about 4 Rft (1·18 m) apart, and on the south face of the Wall immediately west of the fort at Housesteads.

Above the probable bonding or levelling course the jointing from four courses was preserved (4–7). Their heights vary between 0·21 m and 0·24 m, rather less than the height of the lower courses.

The only evidence for the position of these fallen courses in the Wall face is provided by the probable bonding or levelling course, which, assuming that the height of the Wall was 15 ft (4·57 m), would have been either 5 ft (1·52 m) or 10 ft (3·05 m) above ground level. The jointing between the third and fourth courses lay 1·25–1·35 m south of the line of the Wall face; if the bonding or levelling course apparently represented by the third course was the one at a height of 5 ft, it would seem that the Wall had collapsed immediately above the foundation course. This certainly seems to have been the case in Trench A where the surviving foundation stones were tilted at angles of between 9·5 and 19 degrees. They cannot represent the angle which the entire Wall face had reached when it collapsed; if so, the top of the Wall would have oversailed its foundations by 0·80 m to 1·60 m. Presumably the forces involved in the collapse pushed the stones of the foundation course further from the perpendicular. However, from the maximum angle of tilt in the foundation course, which was 19 degrees, it can be calculated that the second course at its top would have oversailed the base of the Wall by *c.* 0·25 m and thus would surely have fallen.

Reason for the collapse of the Wall

The structural reason for the collapse of the Wall is clear: the pre-Roman soil was compacted by the superincumbent mass of the Wall, but unevenly, so that the structure tilted backwards leading to the eventual fall of the south face. Similar defects are known elsewhere. At Drumburgh, the stone replacement of the Turf Wall had a foundation of thin flagstones; these had broken along the line of both Wall faces, the projecting portions being tilted upwards (Simpson and Richmond 1953, 12–13, Pl I, 1). In this instance, the Wall had perhaps settled evenly and thus had not collapsed. Broken flagstone foundations were also noted at milecastle 79 and at "many other points on the Intermediate Wall" (Richmond and Gillam 1953, 19, Pl IV, 1). Between Stott's Road and Finchley Crescent, Walker 0·70 km west of the fort at Wallsend, a stretch of the Wall built to Broad gauge had collapsed and had been rebuilt to Narrow gauge 2·50 m to the south; both had foundations of clay and cobbles which had proved inadequate for the soft ground on which they were laid (*Britannia* 10 (1979), 279). Evidence for the refacing of the Wall at Wallsend and to the west of Housesteads is discussed in the next section.

Evidence for repairs to south face of Wall (fig. 21)

It seems probable that at Denton repairs were effected soon after the south face of the Wall collapsed, which would account for the removal of the fallen facing stones. Unfortunately, in Trench B no evidence for such a repair survived. However, in the adjacent Trench A and in the eastern part of Trench F, the robber trench for the removal of the south face of the Wall abruptly increased in width over a length of 10·35 m (fig. 21). In the west section of Trench F (fig. 16, Sect 1, 94) it can be seen that the robber trench is no wider than was required to remove the facing stones of the foundation course; in the east section (fig. 16, Sect 2, 94) the base of the robber trench continues to the southern edge of the flagged footings, *c.* 0·30 m beyond the line of the Wall face. This probably resulted from the removal of a repair to the original face effected by constructing a new face a little to the south. A repair of this type has been seen at Wallsend and similar refacings might account for the insets and outsets visible in the south face of the Wall west of

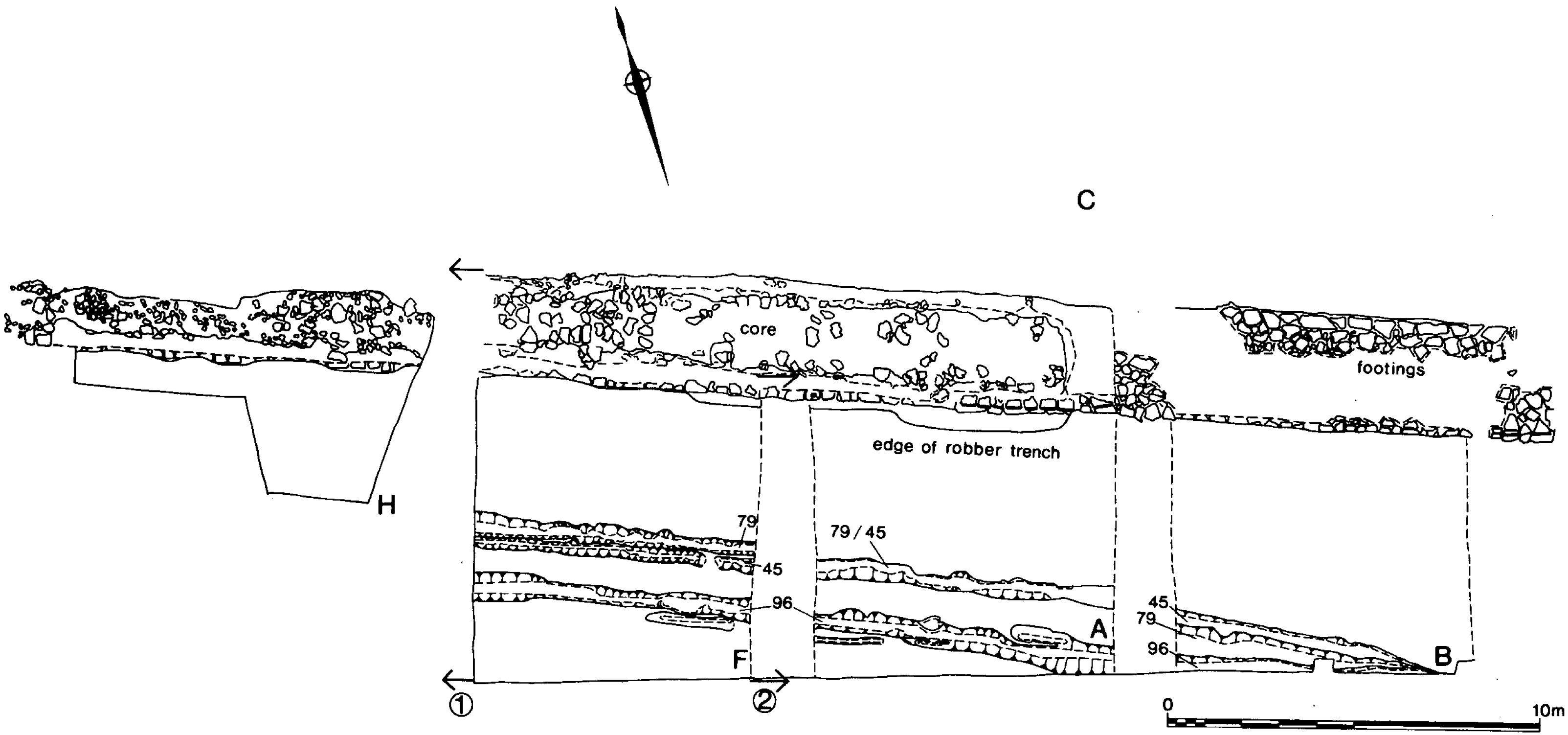


Fig. 21 Post-Roman features south of Wall in Area I: wheel ruts and robbing of Wall faces. Scale 1 : 200.

Housesteads. At Buddle Street, Wallsend, at a point 70·00 m west of the fort, the rear face of the Wall had collapsed; it was repaired, apparently in the third or fourth century, by constructing a new face 0·30 m south of the original rear face. No attempt was made to mask the junction of the two faces, and the resulting abrupt change in the Wall width resembles the insets and outsets visible in the Wall west of Housesteads. These were first noted by Hodgson (1840, 276, 288). His explanation, that different work details had built their allocated lengths to slightly varying widths, is still current (e.g. Daniels 1978, 164).

The sequence of possible repairs at Denton is uncertain. It is worth noting that the dumps separating the layers of metalling south of the Wall each contained some building debris and might have been associated with repairs to the Wall pre-dating the collapse represented by the fallen plaster.

Deposits north of the Wall in Trench C (fig. 12)

Only a very limited area was examined, which lay to the south of a trench for an electricity cable. Deposits associated with the construction of the Wall consisted of a thin layer of yellow clay (151) sealing the footings of the Wall and abutting its offset north face; it was similar in character to the clay spread above the pre-Roman soil south of the Wall. Above the clay were sandstone chippings (fig. 12, 49, 135); at one point they were covered by a small patch of grey mortar resembling that which was used to bond the facing stones.

These deposits associated with the construction of the Wall were sealed by a layer of silt up to 0·05 m in depth (134), above which was a layer of yellow clay, sandstone and some mortar fragments (130). The latter was similar in character to the layer of clay and rubble overlying the earlier metalled surface south of the Wall and was probably associated with repairs to the Wall. Above this layer was an accumulation of silt (129), sealed in turn by deposits associated with the decay and demolition of the Wall.

Decay and robbing of the Wall (figs 21 and 16)

In Trench F the upper metalled surface (112) and the silt (108) above were sealed by two layers of grey-brown soil and sandstone rubble (fig. 16, Sects 1 and 2, 81, 92) including a few facing stones; these deposits also included small fragments of plaster and grey mortar. The maximum surviving depth of these deposits was 0·35 m, but they were truncated by recent activities and cut away along their southern edge by medieval and later cultivation; in a deposit associated with this cultivation was found a fragment of a silver hand pin of late sixth- to seventh-century date (figs 28–30). In Trench B the upper metalled surface (57) and collapsed plaster above the silt (51) were sealed by a further layer of silt (85) containing some grey mortar; by the south Wall face it was 0·12 m deep, but it rapidly diminished to a depth of 0·02–0·03 m some 2·00 m south of the Wall. It was sealed by a layer of brown silt and sandstone rubble up to 0·5 m in depth (28), equivalent to deposits (81, 92) in Trench F. Similar deposits were seen in section in Trench A but were not excavated. The material seems to have been sorted through, for there were very few complete facing stones, and the rubble lay at various angles.

For a distance of 15·6 m across Trenches A and F, the north and south faces of the Wall had been robbed, leaving only the clay core of the Wall and a few stones of the southern foundation course; the south face had also been robbed in Trench H. The robber trenches cut the debris from the decay or demolition of the Wall described above and were filled with small pieces of rubble and brown soil; they were sealed by plough soil. To the east of Trench A, the entire fabric of the Wall had been robbed, leaving only some of the sandstone footings in position. The fill of the robbing trench consisted of mixed clays, which suggests that after the facing stones and rubble of the core had been removed, the clay from the core was thrown back into the robber trench. No finds were recovered from the fill, which was largely removed by a machine, but it is possible that the extensive robbing occurred "in clearing away the ruins of the murus for the plough" in 1804 (Hodgson 1840, 281; discussed above).

It proved impossible to establish a relationship between the robbing of the Wall faces and of the entire fabric of the Wall to the east; however, along the southern edge of the robbing fill in the latter area an admixture of brown soil and rubble might have represented the filling of an earlier trench dug to remove the facing stones which had collapsed when the Wall core was robbed and became mixed with the later robbing debris.

Along the southern edges of Trenches B, A, F and H, there were two parallel sets of features consisting of continuous and discontinuous slots, varying from 0·25 m to 0·50 m in width and 0·10 m to 0·20 m in depth (figs 21 and 16, Sects 1 and 2, 45, 72, 79, 96); the distance between the slots, from centre to centre, was c. 1·40 m. The profile of the slots and their spacing indicates that they were wheel ruts, and this is supported by the discovery of a horseshoe (fig. 27, no. 6) at the base of the plough soil between the ruts. The bases of the ruts were covered by thin layers of sand and silt mixed with small sandstone fragments. The remainder of their filling consisted entirely of small fragments of coal and coal dust; no traces of any form of metalling were found. The wheel ruts probably mark the line of an unmetalled track, and the coal filling the ruts suggests that the track lead to a coal pit. An exposure of coal was seen 150 m to the east (see below).

The wheel ruts lay some 4·5 m south of the wall and the track which they represented was probably skirting the mound of debris produced by the decay or demolition of the Wall, which is described above. A tiny rim fragment from a cooking pot in Oxidized Gritty Ware provided a terminus post quem of the later twelfth or earlier thirteenth century for the filling of the southern rut (96), The ruts were sealed by brown soil mixed with rubble, probably representing agricultural soil mixed with material which had fallen from the mound of debris. Post-medieval finds, including pipe stems and bottle glass, were recovered from this deposit.

Areas II and III

The remains of the Wall in these areas were poorly preserved. The flagged footings survived in part and, in Area II on the north side of the Wall, there were two adjacent facing stones of the foundation course which were 0·30 m in height. A little of the clay and rubble core remained in Area III. No deposits associated with construction or later activities survived south of the Wall; to the north was a layer of clay sealing the edge of the footings with traces of brown silt above.

Area IV (fig. 22)

Immediately to the north of this area the Wall, surviving to a height of one course, had been consolidated. The sandstone flagstones forming the footings were set in clay and were shattered along the line of the south Wall face, as elsewhere. A patchy surface of sandstone footings (46) sealed the pre-Roman soils. It was covered with a clay dump (41), above which was a worn metalled surface of river gravel and small cobbles (fig. 22, 3, 34). Later deposits would have been removed by modern landscaping.

The Wall west of Southway

To the west of Southway the line of the A69 diverges a little to the south so that it runs across the line of the Wall. In 1989 the south carriageway was entirely reconstructed and the excavations were monitored for any sign of the Wall. All traces of it had been removed. The filling of Sugley Dene Burn, consisting of mixed clayey soils and stone, was evident. The eastern side of the dene was of solid sandstone; just to the east of its lip was a seam of coal *c.* 11·00 m in width.

The Wall ditch (fig. 2)

The Wall ditch lay under the southern carriageway of the A69 which obviously prevented its excavation. In 1988 and 1989, however, the entire substructure of the carriageway was grubbed out and relaid; service mains were also re-routed or replaced. During a series of watching briefs the filling of the Wall ditch was seen in two places.

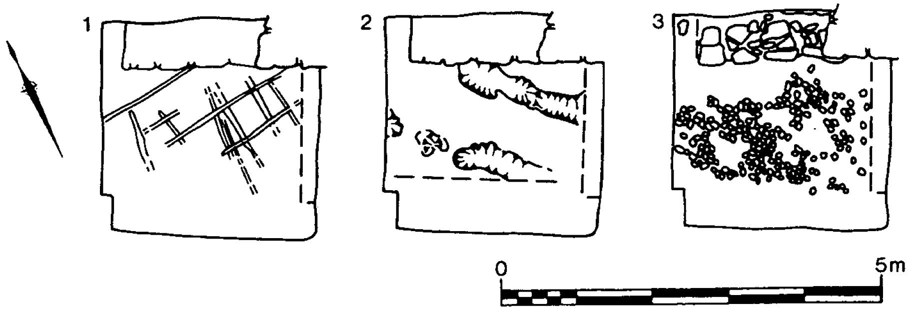


Fig. 22 Area IV (for location see fig. 8). 1. Plough marks beneath soil sealed by Wall. 2. Furrows in surface of soil sealed by Wall; the northern furrow runs under the Wall. 3. Metalling overlying construction deposits of Wall. Scale 1 : 100.

In February 1989, a layer of brown clayey silt with small stones was seen 13·00 m north of the Wall just to the west of the consolidated length which incorporates turret 7b (fig. 2, 3). The brown soil was 1·00 m to 1·30 m in depth, its top sealed beneath the substructure of the modern road which was *c.* 0·60 m thick. Assuming that the berm in front of the Wall was *c.* 6·00 m in width and the Wall ditch *c.* 9·00 m in width, the brown soil should have represented filling over the northern slope of the ditch.

In the same month, natural clay was seen just to the north of Area IV at a level of 79·24 m OD (fig. 2, 2). Brown soil was seen 9·00 m to the north at 78·84 m OD; the soil presumably represents the top of the surviving filling of the ditch.

HADRIAN'S WALL: DISCUSSION

The Broad Wall

A "new structural fact" concerning the construction of Hadrian's Wall emerged in 1948 when it was found that the core of the west wing-wall of turret 26b, built to Broad gauge, "was composed entirely of broken freestone bound with stiff and still resilient puddled clay" (Richmond 1950, 43). Attention was later drawn by E. Birley (1960, 52–60) to several undoubted instances where the Broad Wall had a concrete core. Birley concluded that "clay was normally used in effect as a damp-course, but only exceptionally was it substituted for mortar in the superstructure" (ibid., 56); these exceptions were to be associated with building work by recruits untrained in the use of mortar. During the last thirty years, further instances of Broad Wall with clay and rubble core have come to light. Equally importantly, on a number of occasions sections of the Narrow Wall with a core of unmortared rubble have been recorded. These discoveries suggest that mortar was used very sparingly in Hadrian's Wall as it was originally designed, and following the modifications made to that design (for a detailed examination of the evidence, see Bidwell forthcoming). Stretches of Broad and Narrow Wall with mortared cores appear to be exceptional rather than regular occurrences.

The excavations at Denton are important because the Broad Wall core of clay and rubble was preserved to a height of 0·96 m. Only at turret 26b does this type of core survive to a greater height (1·5 m); at Willowford the unmortared rubble core of the Broad Wall survived to a height of 1·6 m (Bidwell and Holbrook 1989, 56, fig. 41, 1). It is, of course, possible that at these sites the Wall from a level above the existing fabric had a mortared core, but there seems no need for a damp-proofing course up to 1·5 m thick. Indeed, no other instances of horizontal damp-proofing are known in Roman building technology (for vertical damp proofing see Vitruvius VII, 4, 1–2 advising the use of spacer tiles (*hamatae tegulae*) to form a cavity wall to protect wall paintings, as in the Garden Room of Livia's House at Prima Porta (Gabriel 1955, 3–5 and figs 4–7), or a double or cavity wall, an example of which is visible in the cryptoporticus at Bavai). At Denton, it was noted that the rubble from the decay and collapse of the Wall contained very little mortar.

An explanation for the construction of the Broad Wall with a clay and rubble core is furnished at Denton by the surface geology. Hard sandstone of the type used for the facing stones of the Wall lay at a shallow depth: in the Vallum ditch the rock head was at a depth of 1·50 m, beneath a layer of loose, laminated sandstone 1·20 m thick; immediately north of the Wall hard sandstone occurred at a depth of 1·50 m beneath boulder clay (Archive Soil Profile Description No. 1); in Area III hard sandstone was just below the surface. The ready availability of sandstone meant that there was no need to open quarries: the Wall ditch could have provided almost all the necessary building materials, as the following calculations show.

1. The volume of material in the Wall is less than that removed in forming the Wall ditch, as a comparison of their cross sections demonstrates:
   Wall. The width of the Wall above its offsets is 2·82 m (9·25 ft); assuming a height of 4·57 m (15·00 ft), the cross section to the level of the Wall walk has an area of 12·89 sq m. To this must be added the cross section of the parapet, assumed to be 0·45 m in width and 0·90 m in height giving an area of 0·40 sq m. If the merlons are assumed to be the same height as the parapet and one third the width of the embrasures, then a figure of 0·40 sq m divided by 4 must be allowed for their cross section. This gives a total cross section with an area of 13·39 sq m. If the Wall was twelve feet in height, the area of its cross section would have been 10·81 sq m.
   Wall ditch. Its dimensions at Denton are unknown, but if a width of 30 ft (9·14 m) and a depth of 10 ft (3·05 m) are assumed (cf. Daniels 1978, 20–1), the area of its cross section would have been 13·94 sq m.
2. Thus at Denton the ditch would have supplied a volume of material in excess of what was required for the construction of the Wall. Moreover, the materials were present in the necessary proportions. For example, assuming a width for the facing stones of 0·30 m, the cross section of the Wall faces would have had an area of 2·74 sq m, to which must be added 0·50 sq m for the parapet and merlons. If the ditch was cut through hard sandstone to a depth of 1·50 m above its base, the sandstone would have had a cross section 3·30 sq m in area; a further depth of 0·30 m would produce a cross section 4·77 sq m in area. This accords with the recorded depths of the rock head as set out above. The materials at a higher level in the ditch would have provided the clay for the core and laminated sandstone for the flagstones for the footings.

The thesis proposed here is that the Broad Wall at Denton represents nothing more than the re-assembled contents of the Wall ditch. The only material required from elsewhere was the mortar for the pointing of the facing stones, and that, as we have seen, was used very sparingly. Lime was not obtainable at the east end of the Wall; the nearest source of suitable limestone is at Harlow Hill, 12 km to the west of Denton along the line of the Wall (Tate 1867, 355). The geology along much of the line of the Wall between Newcastle and the North Tyne is similar to that at Denton; the implications of this ready availability of the necessary building materials, excepting lime, will be discussed elsewhere (Bidwell forthcoming).

The track behind the Wall

The three layers of metalling behind the Wall represent a track which was laid down when the Wall was built, or shortly afterwards, and which remained in use until at least the early third century, as an unworn coin of A.D. 202–10 demonstrates (the coin was recorded from the uppermost metalling (57) in Trench B, but could have been pressed into the layer by traffic passing over its surface). The metalling contained much gravel, probably from the beds of the nearby Denton and Sugley Burns. Rubble foundations typical of Roman roads were not provided (cf. the nearest recorded stretch of the Military Way at Lemington Middle School which was built of "fairly large stones set in the boulder clay": Tait 1962, 142). Instead, the light metallings of the track resemble the paths leading from the turrets to the Military Way, as at turret 29b where metalling 0·15 m thick and 3·35 m in width was found (Newbold 1913, 63–4) and at turret 34a ("a path of small stone and amphora fragments": Charlesworth 1973, 100). Nevertheless, the probable wheel ruts in the earliest surface suggest that the track was used on occasion by wheeled traffic.

This track is not a newly-discovered feature in the anatomy of the Wall. At Tarraby Lane, a little to the east of the fort at Stanwix, an unmetalled hollow way was found 10·00 m south of the Turf Wall; it was deeply rutted and sealed by debris from the demolition of the Turf Wall (Smith 1978, 23–4, fig. 7). The apparent absence of the track elsewhere might be accounted for by the fact that few modern area excavations of the Wall have been undertaken. At Steel Rigg, where the most extensive excavations of recent times have been undertaken, the topography would have made a track for the use of wheeled vehicles impractical. At Buddle Street, Wallsend, the area south of a stretch of the Wall 33·00 m in length revealed no traces of metalling. However, the Wall in that sector was built at the same time as the fort at Wallsend, and there would have been a road running out of the western *porta quintana* 41·00 m south of the Wall. As originally designed and built, of course, the Wall had no forts on its line, those on the Stanegate being retained in use. Arrangements in the eastern sector have always been unclear, for between Corbridge and Wallsend no pre-Hadrianic forts are known north of the Tyne. It is probable that a service road was built, perhaps branching off Dere Street south of the Portgate (Bidwell and Holbrook 1989, 153); evidence for its existence is supplied by the bridge at Newcastle (assuming that it is of Hadrianic date, cf. Haverfield 1904, 143, n 4) and by the Vallum crossing at Benwell.

That the metalled track at Denton represents this service road is scarcely credible: it can be confidently expected that such an important route would have been properly engineered, of adequate width and with a foundation raft. Moreover, the position of the Vallum crossing at Benwell indicates that at that point the road would have lain at least 200·00 m south of the Wall. It might be argued that access to the rear of the Wall would have been needed for maintenance, especially in this sector where the ill-conceived design of the Broad Wall was eventually to lead to its collapse, and for the occasional clearance of vegetation from the vicinity of the Wall. For the purposes of supply and the movement of soldiers, milecastles and turrets could have been connected with the service road by branch tracks, as in the case of the later Military Way. Communications of this sort would have been radically altered by the building of the Vallum, which could be crossed from the south, where the service road ran, only at the forts. The need for a track communicating between milecastle and turrets is far more obvious at this stage than when the Wall was first built. There were indeed gaps in the north mound of the Vallum opposite the milecastles, but metalling on the berm of the Vallum has only been found in a few places (Breeze and Dobson 1987, 56–7); elsewhere, as at Denton, there are no signs that the north berm was used for traffic.

The track at Denton, therefore, and for that matter the hollow way at Tarraby Lane, might have been established when the Vallum was built. When the hollow way at Tarraby Lane was covered by debris from the demolition of the Turf Wall, it had almost certainly been superseded by the Military Way, for it is probable that the construction of the new road and the rebuilding of the Turf Wall in stone both took place when Hadrian's Wall was reoccupied in the 160s. Likewise, the Military

Way at Denton, running north of the remains of the Vallum, would have made the track behind the Wall redundant. It is surprising to find that the track has three layers of metalling, which were probably laid down in the period of about fifteen years that elapsed between the construction of the Vallum and the advance from Hadrian's Wall into Scotland under Antoninus Pius. The unworn *denarius* of Severus from the uppermost metalling must also be accounted for; although it is argued above that the coin could have been pushed into the metalling by traffic, this would still mean that the track was in use in the early third century. Perhaps, despite the nearby Military Way, use was still made of it for maintenance purposes.

THE MILITARY WAY

No remains of the Military Way were seen in the trench excavated between the Wall and Vallum. An area extending from 32·00 m to 47·00 m south of the Wall had to be left unexcavated because of the presence of a right of way and other obstructions, and the Military Way probably ran through this area. At milecastle 9, Chapel House, the road lay 30·50 m south of the Wall (Birley 1930, 155), and at Lemington Middle School it lay a further 3·00 m to the south (Tait 1962, 136, 141–2); east of Denton it would have approached the western *porta quintana* of Benwell fort 45·00 m south of the Wall (Simpson and Richmond 1941, plan facing p. 42).

THE VALLUM

Introduction

The remains of the Vallum were first examined in a trial trench 1·80 m in width which was dug for a distance of 190 m south from the Wall. Once the remains were located, the area in which they were encountered was enlarged to a width of 10 m, stretching from just beyond the southern lip of the Vallum ditch to a point just beyond the north mound; the area containing the ditch was subsequently enlarged to a width of 15 m. An attempt was made to clean down to the remains of the north mound using a machine, lack of time and resources preventing its excavation by hand. This proved less than successful: although the northern revetment of clay blocks was easily located and cleared, the core material and poorly preserved southern revetment were impossible to distinguish from the overlying deposits using this crude method and were only seen in section. The ditch was also emptied by machine.

The buried soils under the Vallum were sandy loams and preserved no evidence of cultivation in the form of ard marks. However, the soil characteristics as described below by R. Payton are consistent with intermittent periods of cultivation.

The remains of the Vallum were buried beneath modern deposits up to 1·2 m in depth. The lower levels contained late nineteenth- or early twentieth-century material, and the upper levels some very recent debris.

The Vallum ditch (figs 23–26)

The fill of the Vallum ditch was removed by machine for a length of 15·0 m. At its base the maximum width was 2·85 m, and at the top 5·70 m; its maximum depth from the surviving north lip of the ditch was 2·44 m. The ditch was rock-cut, penetrating through a layer of loose, laminated yellow sandstone *c.* 1·2 m in depth, below which was a solid layer of yellow sandstone *c.* 0·9 m in depth. The laminated sandstone had weathered and formed the lowest fill (fig. 24, 251), which had accumulated at a steep angle against the sides of the ditch. The profile of the ditch below the laminated sandstone showed no signs of collapse, and at this level the sides were at angles of *c.* 75–80 degrees to the horizontal. If the sides are projected at these angles to the level of the berms, an original width of *c.* 3·8 m is indicated for the top of the ditch. The surface of the rock was examined carefully for tool-marks but none was evident. The amount of weathering detectable was so limited that deep pick marks should have been preserved. This suggests that wedges were probably used to extract the stone; they would have left slighter traces

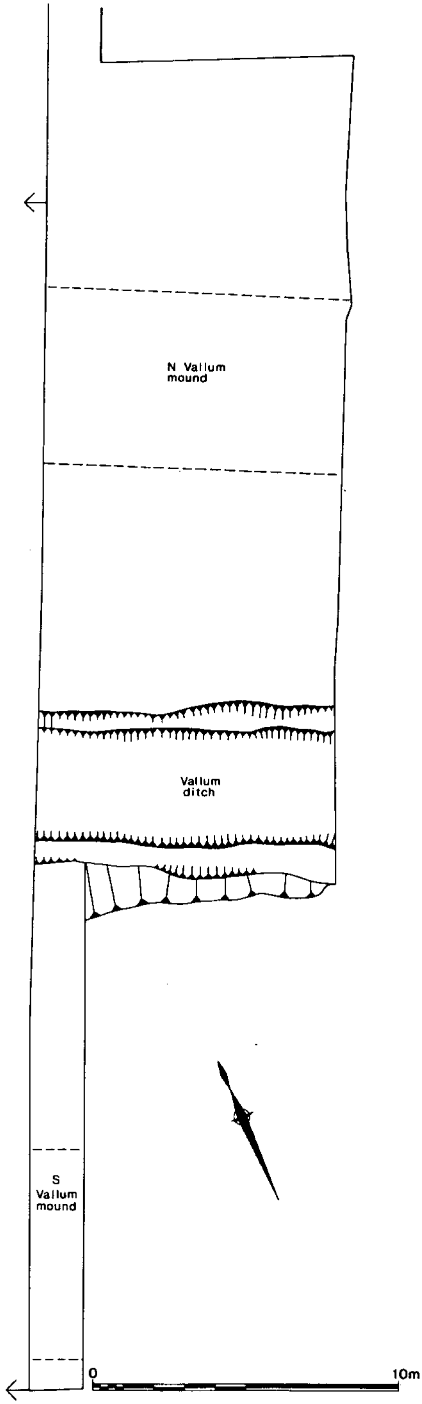


Fig. 23 Plan of Vallum (for trench location, see fig. 8). Scale 1 : 250.

which even a small amount of weathering would have removed (see fig. 15 for an example of a wedge-mark on a facing-stone of the Wall).

The primary silting (fig. 24, 251) resulting from the collapse of the laminated sandstone was sealed beneath a number of layers of compacted clays and silts mixed with sandstone fragments. Layers 249, 250 and 252 (fig. 24) were predominantly of clay; layer 249 had been stained black by standing water at some period. Layer 248 (fig. 24), which consisted of clay and sandstone, contained much iron pan. The interfaces of these deposits displayed cylindrical intrusions, probably root holes which had been filled with material from the overlying deposits. The upper fills (fig. 24, 246 and 253) contained rather more sand than the lower fills. The sequence of fills exposed in the east-facing section was similar. There were only two significant differences: at about the same level as layer 248 in the west-facing section, there were thin, laminated layers of sand and fine gravel *c.* 0·15 m in depth; secondly, the upper levels were much sandier.

The standing sections were examined by R. Payton who concluded that the lower layers of filling above the primary silting had accumulated in water-logged conditions when the ditch formed a "marshy depression". The sandier upper layers were derived from exposure of the loamy soils adjacent to the ditch. Sampling recovered no traces of organic remains in the various layers of the filling.

The north mound (fig. 24)

The north mound of the Vallum, which was situated 8·15 m north of the ditch, survived to a width of 5·95 m and to a height of 0·75 m. It was constructed of clay and sandstone rubble retained between two banks formed of clay blocks. When first seen in section in the sides of the trial trench, its remains were extremely difficult to distinguish from the overlying deposits, and only the north revetment bank (fig. 24, 207) could be identified. Following enlargement of the excavated area, the south revetment bank was seen in section 10 m to

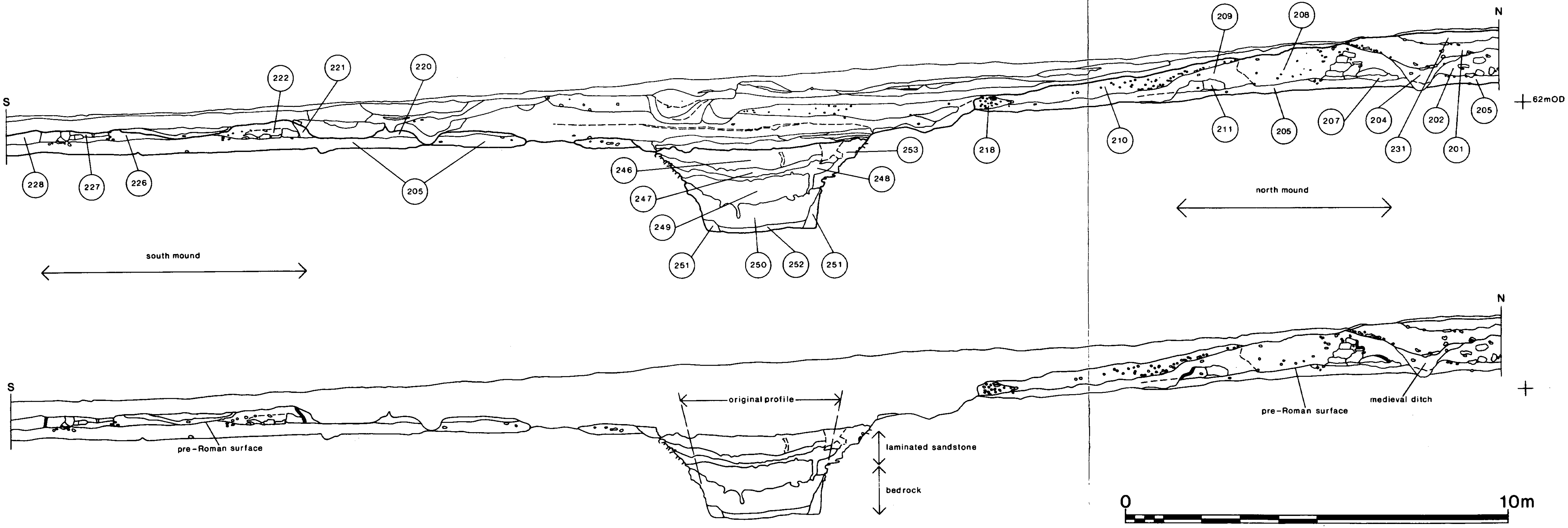


Fig. 24. Section through Vallum looking west. Upper: all layers shown; lower: modern layers not shown. Scale 1 : 100.

Fig. 25 General view of Vallum excavations looking north-east.

the east and was then satisfactorily distinguished in the west-facing section of the original trench.

The mound was built directly on the pre-Roman soil surface. The north revetting bank survived to a maximum height of 0·74 m and a maximum width of 2·07 m. Its two faces had retained a core of mixed clays and sand, the latter probably topsoil. The blocks which formed the faces revetting the core were of clay-loam rather than turf. They were examined by R. Payton who concluded that "they have been cut directly from the slowly permeable gleyed subsoils of typical stagnogley soils similar to those which are buried beneath the Wall itself" (Archive Soil Profile Descriptions, p. 26). Within the excavated area the entire length of the southern inner face of the bank was exposed; it sloped at an angle of 45–60 degrees to the horizontal and was preserved to a maximum height of 0·75 m. Lack of time prevented its complete disengagement and dissection, which might have yielded much information about its construction. However, it was evident that the blocks had not been cut to a regular size. The maximum length or width recorded was 0·55 m, although many of the blocks were much smaller. The thickness of the blocks varied from 0·06 m to 0·14 m. The coursing of the blocks, as far as could be determined, was also irregular.

The south revetting bank (fig. 24, 211) was more poorly preserved, surviving to a maximum width of 1·63 m and a maximum height of 0·53 m. Between the two banks was a filling of mixed material: in the illustrated section (fig. 24, 208) there were layers of sandy silt and small sandstone fragments, and a more compact clayey silt with scattered small sandstone fragments (209). To the east, the filling consisted predominantly of laminated sandstone fragments mixed with sandy silt.

The berm between the north mound and ditch had been terraced removing the earlier soil surface. A cut forming the northern edge of this terrace was seen in front of the south revetting bank at either end of the excavated length; it was filled with material (fig. 24, 209) that had spilled forward from the core of the mound, over the remains of the south revetting bank. No traces of metalling were seen on the surface of the berm.

North of the Vallum mound there was a layer of clay silt (fig. 24, 202) which had a maximum depth of 0·66 m; it diminished steadily northwards petering out at a distance of 5·00 m from the mound. At some stage, a ditch was cut just north of the mound; its fill (fig. 24, 204, 201) consisted of clay-silt. The ditch may be connected with reuse of the north vallum mound as a medieval field boundary. Ploughsoil over the mound produced a sherd probably of fourteenth- or fifteenth-century date. A fragment of a *tegula* was also recovered from topsoil over the mound.

The south mound

The south mound of the Vallum, situated 9·5 m south of the ditch, was poorly preserved and was only examined in section in the sides of the original machine-cut trench. It was 6·8 m in width and survived to a maximum height of 0·32 m. As with the north mound, the core was retained by two banks built of clay blocks; the northern bank (fig. 24, 222) was 2·3 m in width, the southern (fig. 25, 227) 1·8 m in width. The core (fig. 24, 226) consisted of small sandstone fragments mixed with clay. North of the mound the berm was disturbed by modern intrusions; the south side of the berm was abutted by a layer of clay-silt (fig. 24, 228).

THE VALLUM: DISCUSSION

Throughout its entire length there are considerable variations in the materials used to construct the Vallum, and in details such as the profile and dimensions of its ditch (Heywood 1965, 85–6). To some extent these depend on local circumstances, but at Denton the Vallum displays a feature characteristic of every section recorded by excavation as far west as Haltonchesters: the south berm is wider than the north (at Denton the respective measurements are 9·5 m and 8·15 m). At Lemington Middle School, a kilometre west of the Denton site, the south berm was 9·75 m and the north berm 7·92 m in width (Tait 1962, 138-9); at Heddon-on-the-Wall sectioning of only the south part of the Vallum, just to the south-east of milecastle 12, showed that the south berm was 10·97 m in width (ibid., 143). A little to the west of turret 18a at Wallhouses, the south berm was 8·75 m and the north berm 6·60–7·60 m in width (Bennet and Turner 1983, fig. 5). Finally, at Haltonchesters the respective widths were 7·2 m and 6 m (Simpson 1976, Pl XVIII, Section 8). Unfortunately, the cuttings made in 1893 at Heddon-on-the-Wall and at Down Hill, to the east of milecastle 21, did not locate exactly the edges of the Vallum mounds (Anon 1894).

The precision with which the Vallum is set out elsewhere is evident from the ten sections cut across it at Cawfields (milecastle 42) by F. G. Simpson in 1908 (Simpson 1976, 116–19, Pls IX–X). The wider south berm which occurs east of Haltonchesters is therefore scarcely likely to be the result of faulty surveying, but its purpose is uncertain.

Construction of the Vallum mounds with cheeks formed of clay-loam blocks is unparalleled, although Wake's (1935–6, 227) description of the south Vallum mound at Denton Burn as "light coloured . . . over the dark line of the original humus" is certainly reminiscent of the appearance of the mounds found in the

Fig. 26 Vallum ditch looking east. 2 m scale.

present excavations. The use of clay-loam blocks is probably to be explained by the fact that the surrounding area had been under the plough before the building of the Wall; the few years that elapsed before the construction of the Vallum would not have been sufficient to allow the development of thickly-rooted swards of turf. At Lemington Middle School, a kilometre to the west, turf was used in the revetments of the south mound, but the north mound had stone kerbs (Tait 1962, 137–40).

Where the Vallum is well-preserved as an earthwork, it displays crossings at intervals of 45 yards (41·25 m) (Simpson and Shaw 1922, 405–6). At Southway (fig. 2, 11) two crossings are visible, and the centre lines of the fourth and fifth crossings to the east should have lain at distances of 165·00 m and 206·25 m. The excavated length of the Vallum at Denton lay at a distance of between 189·00 m and 204·00 m; the ditch produced no evidence of deliberate filling, nor were there any signs of gaps in what remained of the mounds.

CONCLUDING REMARKS.

Destruction of Hadrian's Wall on the scale seen at Denton is scarcely likely to occur again, given the current apparatus of legislation which protects ancient monuments. The designation of the Hadrian's Wall Military Zone as a World Heritage Cultural Site by UNESCO in 1987 has reinforced the protection of the Wall, and the Management Plan now in preparation will introduce further safeguards. The loss of so much of the Wall at Denton is the legacy of planning decisions taken more than half a century ago, as is explained in the Introduction, and in no way reflects current conservation practice.

In archaeological terms the excavations have contributed much to our knowledge of the Wall. They have furnished further proof of the paradox that the building of the Wall produced one of the most important prehistoric monuments in northern England by sealing and preserving a transect of the pre-Roman landscape some 73·5 English miles in length, thus preventing the degradation through plant growth, erosion and agricultural activities that to some degree affects even the best-preserved early landscapes elsewhere. Important details concerning the construction of the Wall and its associated structures include the plaster rendering of the Wall, the track immediately south of the Wall and the greater width of the south Vallum berm. None of these is an entirely novel discovery: a whitewashed slab from Steel Rigg also suggests a decorative finish to the Wall, an early track has been found close behind the Wall at Tarraby Lane, and the wider south Vallum berm has already been recorded in four other places. What is worth remarking, however, is that despite a century of well-planned research, features such as these have only come to light in recent years. In studying a monument as vast and complex as Hadrian's Wall, it is unsafe to assume that any element was part of the overall design on the strength of a few isolated occurrences. Knowledge of the Wall relies largely on induction, on the accumulation of enough instances of a particular feature to allow a reasonable assumption that it occurred throughout the length of the Wall, whether it is a structure such as a road or track, or a process such as rendering of the Wall or a specific programme of repairs or rebuilding.

The work at Denton might also prefigure the means by which uncertainties about the height of the Wall and the existence of merlons and embrasures will be resolved. The Broad Wall was liable to collapse. It is reasonable to expect that at places along its length, sections of the Wall faces will lie where they fell; even where the stones have been removed, rendering might sometimes survive, allowing the elevation of the Wall to be reconstructed.

The Denton excavations illustrate the importance of the remains of the Wall in the urban areas which extend over about a fifth of its length. Preservation of the actual fabric of the Wall may be poor when compared to rural sectors, but the survival of its associated deposits, often more productive of information than what remains of the Wall itself, can be better than in areas of modern agriculture. Buildings, industrial waste and roads can seal these deposits as they were in the eighteenth century or even earlier, so that they have escaped damage from deep ploughing and other destructive farming activities.

APPENDIX

SOILS ANALYSIS

by R. Payton.

1. RELIEF AND SOIL PARENT MATERIALS

The excavated section of Hadrian's Wall at Denton occupies level ground near the convex break of slope down into the valley of the river Tyne. Much of the land to the north of the site is covered by glacial deposits and consists of a level to gently undulating till plain. The till or boulder clay in this part of north-east England is predominantly a compact, slightly stony, brownish or reddish brown clay to clay loam derived largely from local Carboniferous sandstones and shales or mudstones but also containing a few Carboniferous limestones and occasional igneous erratics from the Lake District, Scotland and the Cheviot Hills. It frequently attains depths of ten metres or more but forms an irregular mantle, locally becoming thinner or absent over sandstone knolls or at breaks of slope where bedrock may occur at or very near the land surface.

A thin brownish clay loam till with common to many sandstone fragments forms the parent material of the soils buried beneath the Wall, overlying hard, medium grained sandstone at a depth of between 1·00–2·00 m. The lithology of the stones in the deposit is strongly influenced by the underlying sandstone. The till thins out towards the Vallum down the moderately sloping upper valley side as sandstone bedrock approaches the land surface more closely. It becomes absent 46·00 m from the line of the Wall. Hard sandstone occurs at less than 1·00 m from the Roman land surface from this point to the end of the trench south of the Vallum; the Vallum ditch is actually cut into the sandstone.

Coarse loamy and sandy materials derived from the sandstone by weathering, 0·7–1·00 m in depth, form the parent materials of the buried soils beneath the Vallum mounds; they overlie hard sandstone rock. The parent materials contain common to abundant angular fragments of hard sandstone and are freely permeable throughout their depth. They have, however, been modified by glacial action in their upper parts where extraneous deposits often contaminate the sandy material, resulting in modifications to the particle size distribution and in a slightly finer soil texture. This effect is most noticeable in the soils which occur upslope beyond the north Vallum mound. Further down the valley side beyond the Vallum, glacial deposits again mantle the bedrock with glacio-fluvial sands being commonly encountered on the lower and midslope sites.

2. SOILS PRE-DATING HADRIAN'S WALL

Field relationships

Buried soils sealed beneath the Wall and immediately to its north were examined at several points. It was apparent that a very dark greyish-brown buried topsoil or A horizon was present beneath much of the Wall and that this rested upon a greyish-brown to olive-grey, prominently mottled subsoil. On average 0·10 to 0·15 m of buried topsoil was present. Black pockets or lenses of apparently burnt material up to 0·02–0·03 m thick and 0·20–0·40 m long occurred in several places at or near the surface of the buried soils. Similar features were encountered as common irregular patches in horizontal section over much of the site during excavation. They were always accompanied by adjacent patches or streaks of hard, reddened soil material and, although recorded at various depths in the buried A horizon, they were most common close to the original land surface.

Ard marks were observed in horizontal sections of the mottled subsoil surface exposed by excavations either side of the Wall. These continued to occur in the upper subsoil in soils buried beneath the Wall. They were clearly present in Buried Soil Profile No. 1B located to the east of Profile No. 1C. This profile also had prominent "burnt" black lenses near the buried soil surface. Profile No. 1C had a well-developed buried A horizon and was located beneath masons' chippings (fig. 12, 135) on the north side of the Wall. Profile No. 1D had a thinner buried A horizon containing black "burnt" lenses and was sealed by the clay and rubble core of the Wall.

Soil characteristics and management

Profiles 1C and 1D are both types of seasonally waterlogged clay loams with compact, slightly porous and slowly permeable prominently mottled subsoils. Such soils are classed as surface-water gley soils. Subsoil structure is either coarsely prismatic or weakly developed resulting in a restricted amount of interconnected water-conducting pores and fissures with consequent impedence of soil drainage. During winter, water stagnates within and perches above these slowly permeable horizons leading to long periods of waterlogging during which anaerobic conditions develop and iron oxides are chemically reduced and mobilized. Subsequent diffusion and reoxidation of this mobilized iron within the soil matrix form the prominent ochreous and grey mottles, and the grey iron-depleted fissure faces observed in the subsoil. This process is referred to as gleying.

The morphology and micromorphology of Buried Profile 1D are characteristic of the subgroup of typical stagnogley soils which possess a clay-enriched, slowly permeable, gleyed argillic subsurface horizon. Where they are developed in brownish fine loamy till, as in the case of Profile 1D, they are classified as the Pinder series which, together with the similar Dunkeswick series which has a clayey deeper subsoil, is widespread on till in Northumberland today. The closely related cambic stagnogley soils of the Brickfield series (Profile 1C) are also very common in the district, but do not show so marked an increase of clay in the subsoil.

The naturally poor drainage of these soils, and the prolonged period when they are at or above field capacity and in a waterlogged state, severely curtail the period suitable for landwork in the autumn. Cultivation after the end of September usually results in damage to soil structure and poor cloddy tilths, and there is little or no opportunity for spring cultivations before the end of April. They are therefore poorly suited to spring crops and only moderately suited to autumn-sown cereals. Nevertheless, despite these physical limitations, they can give high yields of wheat if the crop is established under favourable soil moisture conditions. They tend to retain nutrients well, due to their moderate to high clay contents and slow rate of leaching, tending to resist acidification. They have a high risk of poaching and a low trafficability during the late autumn, winter and spring when the topsoil is often wet and prone to puddling and smearing by trampling or the passage of wheeled vehicles.

Evidence for burning within the buried soils

The black lenses contained within the buried topsoils suggest localized charring of the soil material, such as might result from the burning of plant debris in fires made on the soil surface by man. The localized reddening of the surrounding soil material also suggests intense heating of the soil with consequent changes in the hydration state of the pedogenic iron oxides. However, no coarse fragments of charcoal visible to the naked eye were observed in the field.

A black lens contained in the buried A horizon of Profile 1D was sampled and subjected to the same range of analyses as the surrounding unaltered soil material. Their chemical and physical analytical data show that both materials have remarkably similar properties. The almost identical particle size distribution indicates that the black lenses consist largely of mineral soil particles and the relatively low organic carbon figure, which is the same as that of the adjacent topsoil, shows that the material causing the blackening is not completely extractable by the Walkley Black method used for carbon extraction. It is known that this method does not extract carbonized organic matter effectively. Microscopic observations of soil thin sections reveal common small (1–3 mm) charcoal fragments and opaque charred plant tissue fragments throughout the brown areas of the buried A horizons, increasing to many or abundant in the blackened lenses. The charred plant tissues include carbonized grass stems, roots and woody fragments. These have often disintegrated into micro-fragments <5 μm in size, giving an appearance of finely divided charcoal dust. The fabric of the mineral grains within the black lenses is similar to the surrounding soil matrix but the clay-sized fraction or plasma is opaque or very dark brown suggesting burning of the soil material and charring of the intimately incorporated soil organic matter.

It is concluded that the blackened lenses represent the remains of plant material burnt on the site and the charring of the actual topsoil in a zone beneath the fire. Traces of bonfires remain in the soil for some time but they will eventually become incorporated into the soil matrix under conditions favouring earthworms and faunal mixing. It is apparent that the soils were probably under grassland for a prolonged period prior to the construction of the Wall (see below) and that soil properties would have favoured mixing processes. There are some signs of mixing of burnt and unburnt soil material by faunal action (mainly earthworms) but this was not enough to disrupt the lenses. As there was no evidence of current faunal activity in the buried soils sealed by the Wall, it is assumed that this dates to a short period of activity soon after the episode of burning. The survival of the burnt lenses therefore suggests that the burning episode took place not long before construction of the Wall.

The preservation of the burnt lenses at or near the buried soil surface and weakly disturbed by the final set of plough marks can be explained if the land in this area had been allowed to revert to rough grassland and possibly scrub which was then cut, piled up and burnt in place. Limited ploughing, probably in the year before the construction of the Wall, would then have locally mixed burnt soil and plant debris with unburnt soil resulting in the observed lensoid distribution of charred remains. It would also account for some fragmentation and dispersion of charred microparticles into the immediately adjacent soil matrix seen microscopically in soil thin sections.

Iron Age and early Roman land use

There are several lines of evidence from the soil investigations to suggest that the soils buried by the Wall were cultivated in rotation with grassland probably used for livestock rearing. There is also some evidence to suggest that a relatively long period under grass, perhaps with some invasion of scrub, preceded the construction of the Wall and that this was interrupted by a single episode of ploughing following the burning of plant debris on the soil surface. The latter was possibly associated with the clearance of coarse grasses and scrub from the site not long before building operations started. The data supporting this interpretation is discussed below.

The presence of plough marks in several directions described on pp. 10–13 support several different episodes of cultivation. The relatively low organic carbon levels are similar to present day arable topsoils and suggest oxidation of organic matter under regular cultivation but soil micromorphological observations suggest active bioturbation which is likely to be more pronounced under grassland. This conflicting evidence can be resolved if it is assumed that some organic matter has been lost by decomposition since burial and if a system of arable and grassland rotation was practiced.

The shallowness and irregular thickness of the buried topsoils can be largely accounted for by the removal of soil for the purpose of levelling prior to Wall construction. However, these A horizons rest directly upon poorly differentiated eluvial horizons which contain occasional alluvial clay coatings more characteristic of lower subsoil argillic horizons. This suggests truncation of the topsoil by soil erosion and downward extension of leaching and alluvial processes into the upper parts of the argillic Btg horizon. This might be expected to occur on ploughed land laid bare under fallow at the convex break of slope on which the site is situated and supports episodes of arable farming over a long period.

The following characteristics of the buried soils indicates that the soils along this part of Hadrian's Wall were subject to regular seasonal surface waterlogging and conform to the Pinder series widespread in the area today: the presence of compact, fine textured and slowly permeable subsoils with many voids plugged by clay coatings and infillings; the inclusions in these subsoil horizons of many ferrugineous segregations and nodules and adjacent areas of iron oxide depletion caused by gleying processes; and the loss of iron from both topsoil and Eg horizons relative to the slowly permeable gleyed horizons below. It can be concluded that typical stagnogley soils of the Pinder series existed 2000 years ago much as they do today.

The greater porosity and better developed structure of the buried topsoils, despite the above problems and compression from the weight of the Wall, compared to the dense weakly developed structure of many modern Pinder soils under arable use, suggest that rotations with grass were practised and thus better soil structure was maintained. It is also probable that the cultivation techniques used then caused less deterioration of soil structure than the heavy machinery employed at the present.

3. SOILS BENEATH THE VALLUM MOUNDS AND THE ORIGIN OF SEDIMENTS FILLING THE DITCH

Soils beneath the Vallum mounds

There was clear morphological evidence for the existence of buried soils beneath the Vallum mounds in the form of very dark brown (Munsell Colour 10 YR 3/3) topsoil horizons (fig. 24, 205), underlying a sharp boundary marking the base of more clay-rich materials in the Vallum mounds. These soils conform to well drained sandy loams of the Rivington series classified with the typical brown earths according to the Soil Survey of England and Wales system). The topsoil horizon under the north mound is dark brown, considerably thicker than that beneath the Wall, and rests upon an unmottled brown subsoil. The shallower burial of the soil beneath the south mound means that post-Roman soil forming processes have continued to influence its development, penetrating the Vallum mound above.

The buried A horizon beneath the south Vallum mound qualifies as a distinct topsoil. The macrostructure in the field appears massive but the soil is extremely porous and friable. Its dark colour, organic carbon content of 1·2% and micromorphological evidence of a channelled to spongy microstructure with frequent biotic channels and mammilated chambers indicate rapid breakdown of organic matter by soil organisms and intimate incorporation of the humified organic substances by an active soil fauna and flora. Such features characterize mull humus forms developed in freely drained soils well supplied with exchangeable bases and available plant nutrients. The buried topsoil beneath the north Vallum mound is more compact, with a low to medium packing density and apparently massive but porous structure in the field. Soil thin sections, however, reveal channelled or spongy microstructure similar to that in the buried A horizon under the south mound, with sinuous fine root channels. It is therefore likely that the topsoil was formed in a similar manner.

However, these biotic voids differ by containing occasional to many strong yellowish-brown continuously-orientated microlaminated alluvial clay coatings. The buried A horizon is also traversed by very fine vertical fissures infilled with alluvial material which proved to consist of moderately orientated yellowish brown impure and dusty clay infillings. This is interpreted as direct evidence of post-burial clay alluviation derived from higher up in the earth mound. Similar coatings and infillings are found within fine fissures in the "clay" block construction of the mound and are continuous across the sharp boundary between this material and the buried A horizon. The subsoil horizons have a sandy loam texture and a loose single-grain, very porous structure which allows rapid percolation of water. In the Bw horizon a few dark-coloured infilled earthworm burrows and occasional living earthworms were observed suggesting lateral rather than vertical penetration. However, there was no evidence of modern rooting activity.

Permeable well drained brown earths with sandy loam texture such as these have been mapped as the Rivington series in scattered localities throughout Northumberland on low hilltops and upper valley side slopes. They have formed where sandstone lies near to the land surface and hard rock is encountered within 0·80 m depth. Their high winter rainfall acceptance potential and naturally free drainage mean that the field capacity period is short, so that there is ample time for autumn and spring cultivations. This makes Rivington soils well suited to both autumn and spring sown crops. Limitations to agricultural use include a slight tendency towards summer droughtiness as the soil moisture deficit accumulates in late summer. This gives a slight to moderate drought risk for grass but does not usually affect cereal crops unless the soils have many stones. Their favourable drainage and low risk of poaching by livestock means that grassland can be utilized for most of the year. They also have good trafficability, making them well suited to footpaths and unsurfaced tracks. The rapid leaching of lime and plant nutrients from these permeable soils of relatively low clay content means that frequent dressings of lime and fertilizer are required to sustain yields and prevent acidity.

The deep, well-structured topsoils with mull humus forms showing abundant evidence of former biotic activity observed in these buried brown earths are best developed under long continued grassland but can be maintained under arable cultivation if a system of rotation with grassland is practised. Brown earths under woodland have much thinner Ah horizons, usually no more than 0·15–0·20 m thick. The absence of plough marks in these buried brown earths does not entirely rule out cultivation because the depth of the topsoil, together with the coarse texture, low clay content and non-plastic character of the subsoil, mitigate against their preservation and indeed their formation. Common charcoal fragments seen in thin sections of the buried Ah horizons suggest clearance and burning of woodland cover, followed by incorporation of the charcoal by ploughing and/or earthworm activity. Layered, dark-coloured impure clay coatings and silty clay coatings within large channels in the subsoil contain numerous opaque microparticles of organic matter when observed at high magnification in soil thin sections. This suggests mobilization of fine material from the topsoil during periods of cultivation, with movement of the soil suspension rapidly downwards through the coarser voids, such as earthworm and root channels, during periods of saturated flow.

The evidence discussed above would be best accounted for by a long period of grassland prior to the construction of the Vallum interspersed with periods of cultivation. Certainly, these soils with their easy workability and favourable drainage would have been valued for their flexibility of management by Iron Age farmers much as they are today. Cultivation would have been much easier than on the fine textured, seasonally waterlogged soils upslope. Nevertheless, the latter would have had a higher natural fertility in terms of nutrient reserves despite their poor physical condition. Soils similar to these brown earths would have been sporadically encountered along the line of Hadrian's Wall on sites which coincide with the convexity of the upper slope above the Tyne Valley.

Post-burial modification of the soils beneath the Vallum mounds

The acidic reaction of the profile under the south mound might be taken to suggest long continued agricultural use with little replacement of lost nutrients by manuring or liming. However, this profile shows evidence of modern root penetration in the bAh and the Bw horizons suggesting that roots have also penetrated the earth mound above. This indicates that the "clay" blocks have not acted as an entirely effective seal and that some soil development processes have continued to operate since burial. Post-Roman leaching of bases from this soil is therefore likely and helps to account for the difference in pH values between the two brown earths. Continued small additions of organic matter after burial would also account for the higher organic carbon content. The lower organic carbon content of the buried topsoil under the north mound can then be ascribed to slow post-burial decomposition of some of the soil organic matter under conditions where the more effective sealing of the paleosol has prevented root penetration and any fresh additions of organic material.

Although more effectively sealed from the influence of post-burial faunal activity and rooting, occasional infilled burrows attributed to modern earthworm activity were observed in the subsoil. This is most likely to be due to lateral penetration rather than vertical burrowing through the Vallum mound. There is also morphological and micromorphological evidence of other forms of post-burial alteration in this soil. The irregular compaction of the buried topsoil, the presence of infilled vertical fissures and the evidence for clay illuviation within these fissures and other biotic voids were described above. The sequence of soil development processes indicated by this micromorphological evidence is that slight compaction of the buried topsoil occurred after the construction of the mound when drying and slight shrinkage caused fine fissures to form. These were later infilled with clay dispersed and translocated from the porous part of the earth mound overlying the "clay" blocks. This is particularly interesting because continuously-orientated clay coatings similar to those found within the biotic voids of this buried topsoil are interpreted as evidence of clay translocation over long periods of time under natural forest vegetation by many soil scientists, and by some European workers as an early Holocene process. Certain other authors working in the context of archaeological sites have suggested that such coatings can form more rapidly as a result of prehistoric ploughing. None of these hypotheses would fit the evidence from the buried soils in the present study which suggests that well orientated clay coatings and infillings can form in periods of less than 2000 years where disturbed soil materials have been piled on top of undisturbed soils. The process provides an explanation for the increased clay content of the buried topsoil under the north mound compared to the sandy loam texture of most Rivington profiles.

Origin of the sediments infilling the Vallum ditch

Samples were collected from the major sedimentary units for particle size analysis and for thin section preparation; details of the stratigraphy are in the Archive.

The west section consisted of a basal infill of angular laminated sandstone fragments which had collapsed from the sides of the ditch (fig. 24, 251). This passed upward into a greyish brown poorly sorted silty clay loam still containing many angular sandstone blocks (fig. 24, 250). The sediments above this layer were stoneless and comprised about 0·30 m of olive mottled laminated fine sand, silt and clay overlain, with a sharp contact, by about 0·75 m of dark grey reduced clay laid down under waterlogged conditions (fig. 24, 247–9). A further 0·70 m of finely silty clay with fine sandy and silty layers occurred below the modern overburden (fig. 24, 246). This uppermost unit was strongly modified by gleying and root penetration towards its surface which was sharply differentiated from the overlying modern overburden. In the eastern section this upper unit was replaced by weakly bedded medium to fine sand.

The dark grey clay, which consists of 58% clay and 28% silt, had a very grey hue and low chroma indicative of reduced iron compounds formed under anaerobic waterlogged conditions. In thin section, fine laminations, some with near parallel orientation of component clay particles and others with a greater silt content, are apparent. There is very little disturbance of the sedimentary structures in the form of biotic channels. This combination of features suggests slow deposition in stagnant, relatively deep standing water with little or no current activity and minimal contamination from coarser materials washed in from the ditch sides. The overlying stratigraphic unit handled as a silty clay loam and had little visible sedimentary structure. Thin section observations, however, prove the deposit to be finely laminated silt, clay and very fine sand, individual layers of which were too thin to sample separately. This suggests deposition in water with changing conditions of flow and bottom current activity. The strong mottling of this unit indicates seasonal aeration of the material resulting in segregation of iron oxides and bleaching of iron-depleted zones in the sediment matrix. The higher frequency of fine roots compared to the underlying grey clay suggests that vegetation colonized the accumulating sediments which must have formed a marshy depression along the Vallum. Strong alteration by pedogenetic processes becomes apparent in thin sections sampled towards the surface of the sedimentary sequence. Gleying features are related to root channels which disrupt sedimentary layering and contain common clay and silty clay coatings. Ferrugineous and ferri-manganiferous nodules indicate seasonal waterlogging interspersed with periods of aerobic conditions.

The stratigraphic sequence and sedimentary fabrics described above indicate an early period of neglect and decay of the ditch with collapse of the rock-cut sides followed by a period when standing water accumulated along the lowest parts of the ditch, perhaps separated by debris falls. A period of stagnant conditions and slow fine sedimentation was succeeded by changing flow regimes and bottom current activity leading to the deposition of laminated fine sands, silts and clays. This stage ended in parts of the ditch by colonization by marsh plants which rooted into the uppermost parts of the waterlogged sediments. The habitat has remained a waterlogged seasonally anaerobic one to the present day.

The coarsening upwards of the sedimentary sequence was much more marked in the eastern section where the uppermost layers comprised well sorted fine and medium sands. This deposit proved to have a revealing fabric in thin sections. Well sorted fine and medium sand layers are interbedded with thinner, dark coloured layers containing many rounded granular peds (soil microstructural units) of topsoil material and a few transported iron oxide nodules. This suggests that, at a relatively late stage in the filling of the ditch, the adjacent sandy loam textured soils were exposed and subjected to periodic soil creep and surface wash into the ditch. The origin of the clean-washed, well-sorted sand layers is less clear as they suggest transport by relatively fast moving water. The repetition of these very thin layers of soil granules and thicker layers of fine sand are seen clearly only under the microscope and suggest a cyclic process of infilling, perhaps with periods of soil creep alternating with periods of wash.

FINDS

The plaster

Fig. 20

Many fragments of plaster were collected from above the layer of silt (51) in Trench B. Only the most informative fragments are illustrated here.

1. This is the fragment which was lifted by

freezing the surrounding deposits into a solid rock (*fig. 18, fragment H*). At the base of the fragment, the exterior surface shows the remains of a horizontal groove 50 mm in width and with a maximum depth of 10 mm. The surface is very weathered. The back of the fragment preserves the impression of the joints between the facing stones; the position of the horizontal joint does not coincide with that of the horizontal groove on the exterior surface.

2. The exterior surface preserves one side of a sharply-incised groove 4 mm in depth. On the back is a crisp impression of the joint between two facing stones; above this impression the sides of the fragment are broken over a thickness of 15 mm, which represents the depth of the plaster spreading over the surface of the facing stones.
3. This fragment has a shallow concavity on its exterior surface which probably represents part of a groove accurately positioned above the joint between two facing stones. The left-hand side of the fragment preserves a projecting flange of plaster 15 mm thick.
4. The exterior surface preserves part of a groove 3 mm in depth. The thickness of the plaster that covered the surface of the facing stone is 17 mm.
5. On the exterior surface is the right-angled junction of two grooves positioned over the joints between the facing stones.
6. This fragment appears to preserve a shallow groove running at right angles across the position of a vertical joint between two facing stones.

Pottery

Fig. 27

1: mortarium, Lower Nene Valley, probably third-century in date (identification by Mrs K. F. Hartley); post-Roman context. Also from post-Roman contexts came the base of a BB2 cooking pot, and a handle and bodysherd from two different Dressel 20 amphorae. The only stratified Roman pottery (two sherds of fine, slightly micaceous, oxidized ware, possibly from a Severn Valley ware jar) was found in a dump (70) below the uppermost metalled surface (context). All the pottery was from Area I.

Other finds by A. Croom

Fig. 27.

2. Copper alloy pin (L:20 mm D(head):5 mm W(shank):2 mm). Context 70: layer in trial trench east of Trench B, probably equivalent to dump above first layer of metalling south of Wall.
   Conical-headed pin, with incomplete, short, rectangular cross-section shank.
3. Copper alloy ring (D:19 mm B:2 mm). Context 51: silt above uppermost layer of metalling south of Wall in Trench B.
   Annular ring of circular cross-section.
4. Iron rake prong (L:100 mm W:12 mm B:12 mm). Context 57: in uppermost metalling south of Wall in Trench B.
   Incomplete rake prong of roughly circular cross-section, tapering to a rectangular cross-section tang, *cf.* Manning 1985, pl 25, F65.
5. Copper alloy shoe buckle (L:74 mm W:43 mm B:2 mm). Unstratified.
   Incomplete rectangular shoe buckle with traces of a central iron pin on the lower side. Probably eighteenth- or early nineteenth-century.
6. Iron horseshoe (W (overall):110 mm W:26 mm B:6 mm). Context 77: base of ploughsoil between ruts in Trench A.
   Incomplete horseshoe of shallow hemispherical cross-section with one surviving rectangular nail hole.
7. Sandstone bar mould (L:228 mm W:172 mm D:79 mm; slot L:132 mm W:15 mm D:19 mm). Contest 87: fill of gully associated with uppermost layer of metalling in Trench B.
   P. Bidwell writes: The bar mould is cut into the surface of an irregularly-shaped slab of coarse-grained buff sandstone. Moulds of this type, all presumably for casting metal bars, are fairly common finds on Romano-British native sites in northern Britain and on those of earlier periods, but so far are

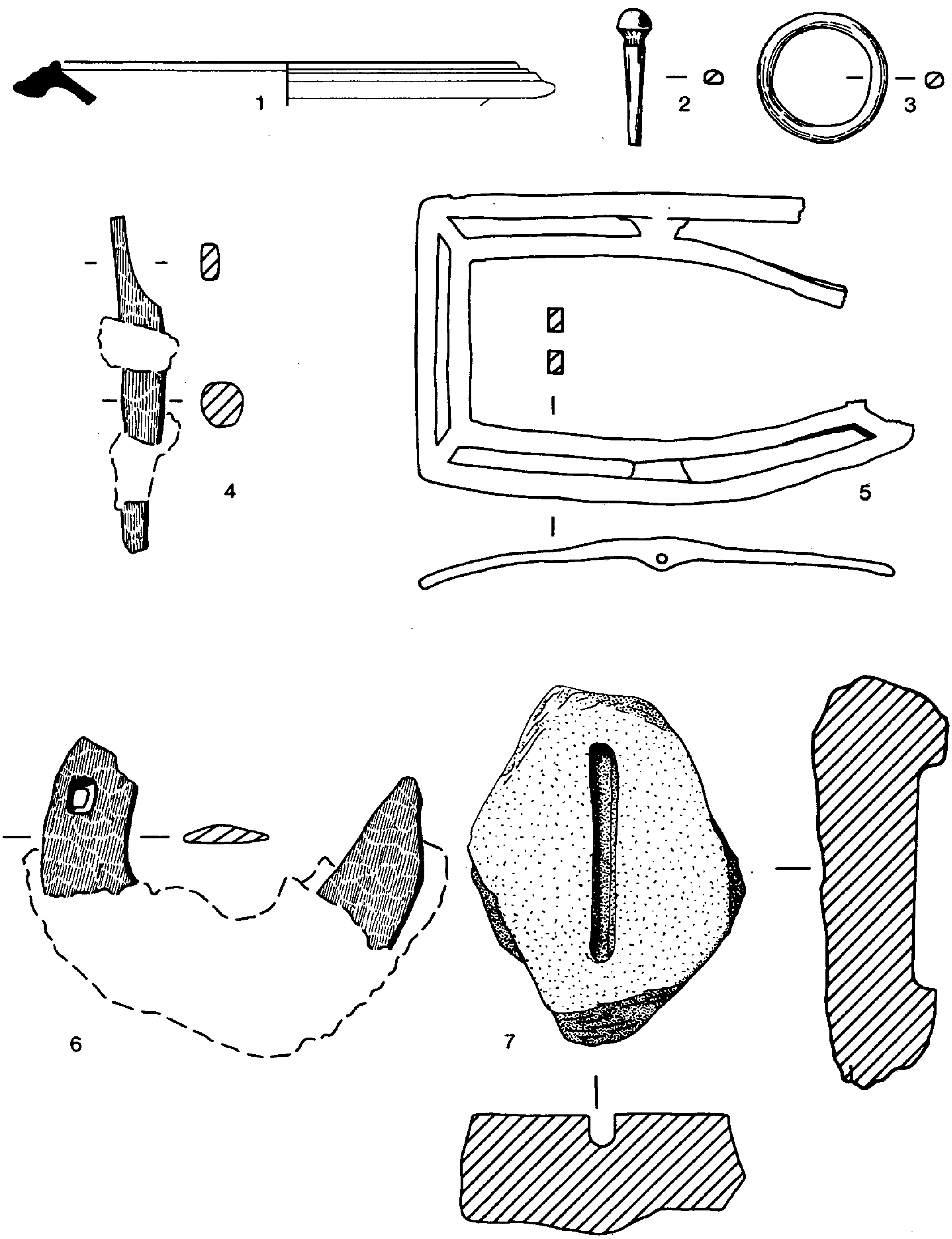


Fig. 27 Finds. Pottery (1) at 1 : 4; copper alloy (2, 3 and 5) at 1 : 1; iron (4 and 6) at 1 : 2; stone (7) at 1 : 4.

only published from one Roman military site, the fort of Vindolanda (Bidwell 1985, 153–4, fig. 59, nos 9–13). It was suggested that the five bar moulds, all from medieval plough soil or piles of stone cleared from the ploughed strips, might have been associated with early post-Roman occupation of the fort. However, five examples have also been recovered from recent excavations at the fort of South Shields, two of which were from deposits of late third- or early fourth-century date; the others were from late fourth-century or post-Roman contexts.

The date of the Denton example is uncertain. It was found in a gully associated with the uppermost metalling of the track behind the Wall, which was still in use in the early third century. It is possible, however, that the mould occurred residually in the gully, and that it was associated with pre-Roman occupation nearby.

COIN

by R. Brickstock

SEPTIMIVS SEVERVS

denom:	*denarius*
obv:	SEVERVS-PIVS AVG
rev:	FVNDAT-OR-PACIS
	Severus veiled standing left, holding branch and roll
date:	202–10 mint: ROME cat: RIC265
diam:	19 mm wt: 3·1 g Die axis: (7) wear: UW/UW

From the final layer of metalling in Trench B (fig. 17A, 57); the coin could have been pressed into the metalling by traffic passing over its surface.

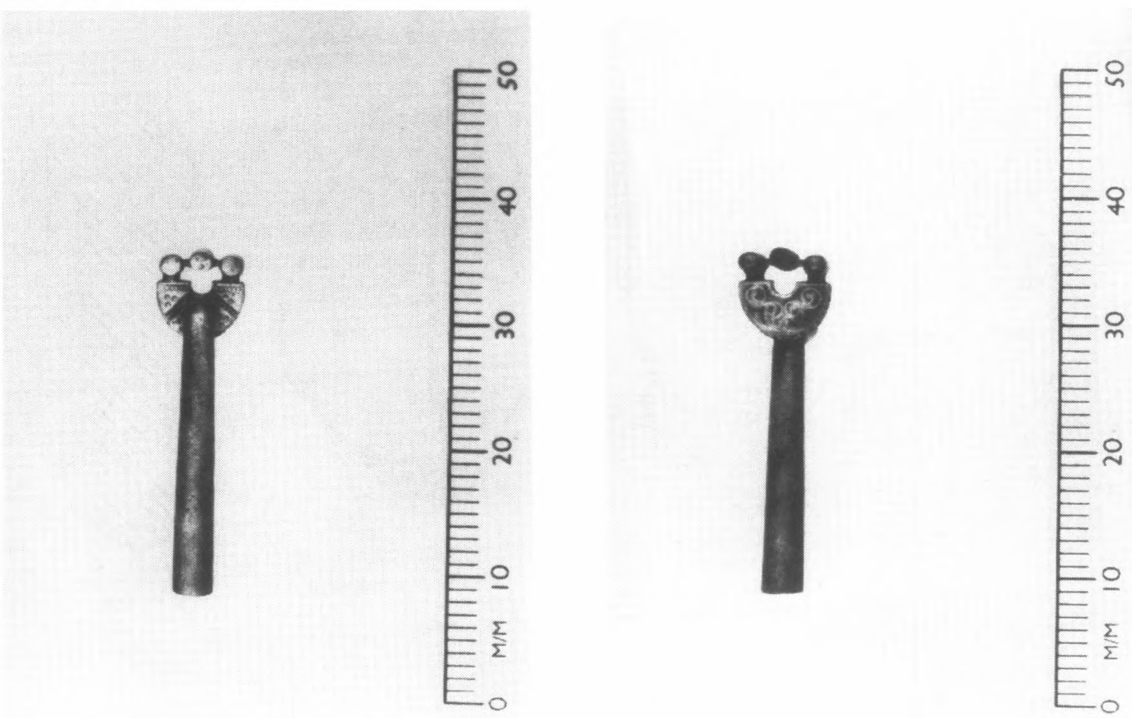


Fig. 28 Silver hand pin: left, front view; right, rear view.

Fig. 29 Silver hand pin: enlargements of front (left) and rear (right) of head.

SILVER HAND PIN FRAGMENT

by C. Batey

Figs 28–30

The fragment was found in post-Roman plough soil in Trench F south of the Wall. (At the time of discovery it was recorded from the dump under the final layer of metalling (fig. 22, Sects 1 and 2, 113); however, it was found on the southern edge of the dump which was truncated by medieval or later cultivation, and the correct context of the fragment is the post-Roman plough soil). The piece is cut part way along the shank but is otherwise complete and a particularly fine example of the *genre*.

The significance of this piece lies in the very high quality of the workmanship occurring on a particularly small example. The pin has an overall length of only 2·8 cm; the maximum diameter of the shank is 3·5 mm and it survives for a length of 2 cm. The head has a maximum width of 7·5 mm. The decoration on the front face, beneath the three projecting "fingers" (the terminology is derived from the fact that the form of the head is similar to a hand with the palm facing forwards and the fingers bent forwards) is made up of four inter-connecting spirals raised within the overall semicircular field. There are three minute pin-sized depressions at the lower central part of the decoration. There are no traces of enamelling visible to the eye or through more detailed analysis, but the central socket of the fingers probably originally held either a piece of glass or millefiori. However, it is possible that the piece was enamelled and that the insert has fallen away leaving no trace. There is no evidence either way. The outer edge of the palm or semicircular field is also decorated, in the form of rilling. The rear face is unusual in that it is relatively highly decorated: each of the three fingers has three impressed circular motifs, and these are echoed in the semicircular element which is divided into two main fields either side of the

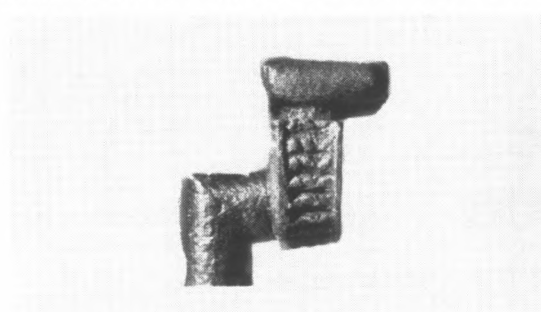


Fig. 30 Silver hand pin: side view of head showing rouletting and view from above showing three "fingers".

shank, and in each of the four fields formed by a cord-like decoration, the same groups of three impressed or punched circular motifs are located. Additionally, the top of the shank has this motif.

The silver itself is of a high purity, possibly as high as 95–98%, with minor traces of copper, lead, zinc and gold (see report below by P. Clogg). This purity may have been of significance, given that the pin was cut off at the shank and presumably no longer functioned as a pin, but as a piece of scrap silver or bullion when the pin style was no longer fashionable to its owner. The test was only on the silver of the shank, but some of the shanks of larger examples were cast separately from the head (pers comm S. Youngs) and may be of different composition. However, the size of the Denton pin meant that only the shank could be analysed.

This hand pin, with such elaborate punched and incised decoration, must have been made at the *floruit* of this style and it would seem to be by far the smallest highly-decorated one so far recorded (I am grateful to Dr. R. B. K. Stevenson, Edinburgh, for his comments on this piece which are incorporated in the discussion). There are obvious similarities in the decoration with the larger pins from Gaulcross and Norrie's Law (Stevenson and Emery 1964, pl XI), including the groups of three dots of the back of the fingers. The subdivision of the rear face can be paralleled at Craigywarren Bog, Skerry, Co. Antrim (front view in Youngs 1989, 24, no. 5; I gratefully acknowledge the information and photographs of the rear face of this pin from Susan Youngs, British Museum), but found on a pin with the full five fingers, rather than three. I am also grateful to Susan Youngs for supplying information on a new find of a penannular brooch from south Herefordshire (Newport Museum Acc No 89.390) which has punched decoration on its face, similar in form to that found on the rear of this hand pin. Lines of punched beading and repeated three-dots are a feature of Irish zoomorphic brooches of Kilbride-Jones' Group B1 (1980, fig. 29). The rouletting around the outer edge of the semicircular field of the pin has similarities with that on an example from Castletown Kilpatrick, Co. Meath (front face illus., Youngs 1989, 24, no. 3).

The usual cultural affinities of this kind of pin are Irish and Pictish, but clearly post-Roman. Dating would conventionally dictate an ascription to the late sixth century into the seventh century, probably leaning slightly to the later part of this period. However, recent excavations at a site in North Uist, Loch Olabhlat, seem to suggest a third-century A.D. context for a mould for a four-fingered hand pin (Armit 1986, fig. 4): confirmation of this radical re-dating must be sought, however, before the type is so re-dated. The shank of the Denton pin has of course been deliberately cut down, presumably militating against its original function as a pin, and suggesting use as hack-silver, presumably post seventh-century AD. It is interesting to note that another site along Hadrian's Wall, the fort at Haltonchesters, has also produced a hand pin (Hedley 1923–4). The recovery of such items along the line of the Wall is most interesting and forms part of a database for the examination of activities in the area in the immediately post-Roman period, which is currently being studied by P. J. Casey, Reader in Roman Archaeology at Durham University.

ACKNOWLEDGEMENTS

In preparing this note, I acknowledge the information supplied by Dr. Robert Stevenson and Susan Youngs in particular, and thank them for the stimulating discussions on the topics of post-Roman pins. I also thank Phil Clogg of the Conservation Laboratory, Durham University Archaeology Department and the help of Jenny Jones of that Laboratory who was responsible for the conservation of the pin.

REPORT ON THE ANALYSIS OF THE SILVER HAND PIN FRAGMENT

by P. Clogg

Due to the physical shape of the object and hence the problems of alignment within the X-ray beam the area chosen for analysis was the shank of the pin. This had been mechanically cleaned to remove the outer corrosion layers thereby providing a representative "section" of the area for non-destructive analysis. Qualitative analysis of this area was undertaken using a Link Systems energy-dispersive X-ray spectrometer in order to establish the general elemental composition of the object.

The X-ray tube, operating with a rhodium target, was run at a voltage of 20 keV and a current of 250 uA for a live time of 100 seconds. A 2 mm diameter collimator with no filter was used to control the distribution and quality of the X-ray beam.

From the printout of the X-ray spectra it can be seen that the pin was constructed of a high purity silver, possibly as high as 95–98%. Present in minor concentrations are copper (0·5%), lead (0·25%), zinc (0·4%) and gold. Iron manganese and silicon were identified in trace amounts; however, these probably originate from remaining corrosion products on the surface of the pin. The concentrations of sulphur and chlorine at 1% to 1·5% suggests the presence of the silver sulphide and silver chloride as the major corrosion products whilst the detection of bromine may indicate the existence of some silver bromide as a corrosion component.

It should be noted that the concentrations are approximate as no similar standard was available for calibration.

MORTAR ANALYSES

by G. C. Morgan

Fig. 31

The mortars were examined microscopically and broken down with acid for aggregate analysis. The soluble component approximates to the lime content.

1. Fragment of fallen wallplaster or rendering in Trench B. Cream coloured lightweight mortar with fine angular aggregate, about 35 mm thick. This mortar appears to be made with hydraulic lime derived from a siliceous limestone. The aggregate is mainly crushed or weathered micaceous sandstone, with smaller amounts of rounded quartz, amorphous silica, traces of slate or shale, bituminous coal and the more common charcoal. The particle size distribution curve shows a peak around 0·18 mm. The coal may possibly have been used in the lime burning or simply found with the aggregate.

2 and 3. Grey mortar attached to the back of the rendering. Only small fragments of the grey mortar could be extracted by wet sieving from the sample supplied. The two largest pieces were numbered 2 and 3. Both had the same type of aggregate, being mainly micaceous sandstone with rounded to angular quartz, amorphous silica, fossil fragments, slate or shale, igneous fragments, red brick or tile, charcoal and iron concretions. The particle size analysis for these two samples shows a peak at 0·425 mm, being quite different to sample 1.

4. From fill of robber trench, south face of Wall, Trench F. This appears to be a concreted mixture of coarse cream mortar with soil, grey mortar and lime. It is very tuffa like, with "grass" impressions or replicas. The aggregate is mainly micaceous sandstone, with smaller amounts of round to angular quartz, red brick or tile, bituminous coal, charcoal and slate or shale. The micaceous sandstone varies in nature from fine to coarse.
5. Pointing of foundation course, south face of Wall in Trench A. This is very similar in appearance to sample 4. It is also a tuffa-like concretion. The aggregate contains quantities of amorphous silica together with micaceous sandstone, flint, fossil fragments, tile, fuel ash, slag/kiln residue, slate/shale and charcoal. The large size of the amorphous silica and high lime content suggests that this could possibly include some waste lime.

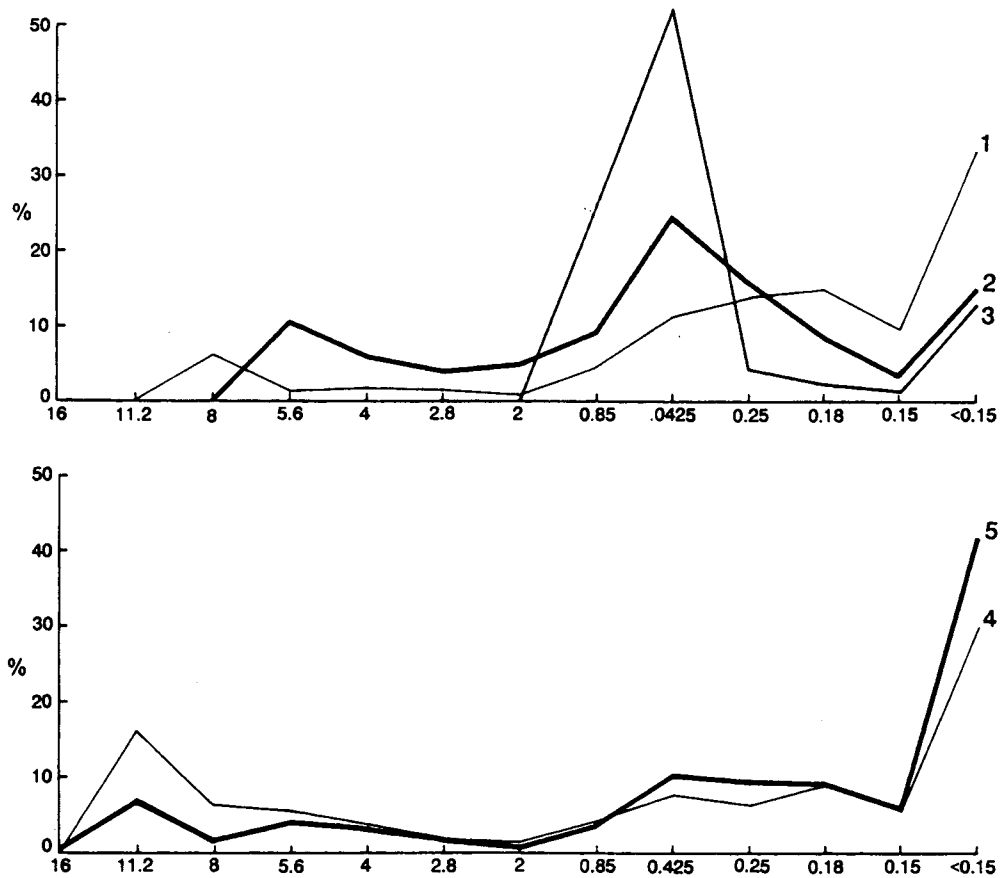


Fig. 31 Bulk composition of mortar samples divided into aggregates.

Particle size distribution analysis of these last two samples shows a similarity between both the grey and cream mortars. Together with the concreted nature of the samples, this does point to the accretion of fragments of both types of mortar and subsequent consolidation by lime leached from the mortar and re-deposited to form the tuffa-like material.

Presumably the micaceous sandstones are local, and the lime derives from siliceous limestone. Examples of existing limestone deposits should be compared to see if in fact it could have been used as a source of lime for the mortar used in the Wall.

Table 1 shows the bulk composition of the mortars divided into aggregates: "gravel", "sand", "silt" and lime/acid soluble (percentages).

Table 1

No.	<2mm	2–0·15 mm	>0·15 mm	"lime" %	Comments
1	11	55	34	68	cream render
2	24	61	15	31	grey mortar
3	0	87	13	16	grey mortar residue
4	35	35	30	31	tuffa concretion
5	19	40	41	62	tuffa concretion

Report received 31.10.90.

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