

# The Antonine frontier in Callendar Park, Falkirk: its form and structural sequence

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## ABSTRACT

*Excavations by Falkirk Museums Service in 1989 discovered the presence of defensive pits, or lilia, on the berm of the Antonine Wall. The possible significance of this find is discussed, as is the less tangible evidence for a timber building behind the Rampart and a timber tower within the body of the Rampart. The choice of constructional materials suggests the possibility that the Wall from Wauling Lodge to Carriden was a late addition to the frontier. In 1990 further defensive pits were located 120 m to the west and a complete section excavated across the Ditch.*

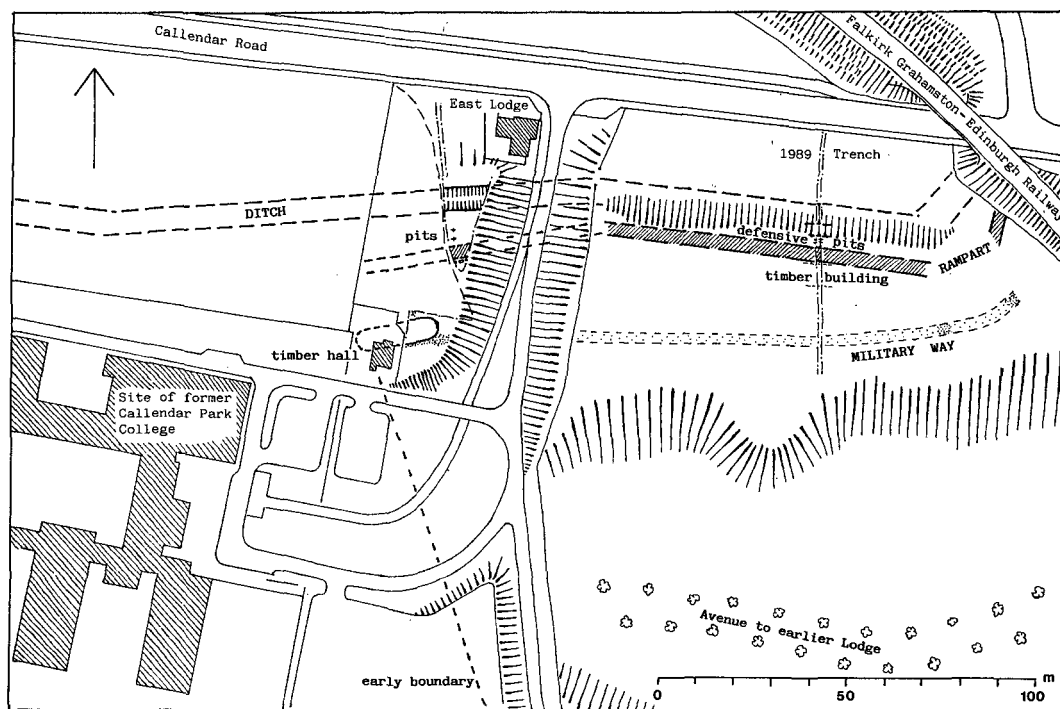
## THE 1989 EXCAVATION

In December 1989 Falkirk Museum undertook an excavation along the line of a proposed 24-in. water main which was to be diverted to facilitate the construction of the Laurieston Bypass (NS 90537950). The pipeline had been arranged to pass perpendicularly through the line of the Antonine Wall and consequently the excavated trench was almost 80 m long by only 1.4 m wide.

The Roman frontier was found to consist of the usual defensive features – a large Ditch and Rampart – as well as certain new features. The earliest feature, which occurred at the north end of the trench, was a shallow pit 7.4 m to the north of the site of the Ditch. The pit had been dug into the natural hill slope for a width of almost 6 m, but to a depth of only c 1 m. It appeared to start within the excavated trench, the western side shelving at a bank of hard gritty gravel. There was no sign of any upcast material on the surrounding surfaces which might have been derived from the pit. The fill consisted of alternating layers of fine brown grit and a coarse orange-grey grit with sand; these rested at an angle parallel with the south edge of the pit. The laminated deposits continued southwards for a distance of 6 m beyond the pit. There was little sign of silting except around a few large stones randomly thrown into the pit bottom.

The Ditch appeared to be of the usual V-shaped profile and was 7 m wide. Although only the upper 1.2 m of the Ditch was emptied, the original depth can be estimated at 2.6 m by extrapolating the angle of the exposed sides. The first 1 m or so of the Ditch had been dug through the orange clay loam natural, below which the natural deposit was a mixture of lignite and grit. The excavated layers of the Ditch contained little of interest. Most of these layers had been deliberately dumped into the Ditch to fill it up in recent times, and only on the two margins at the bottom were naturally derived silty deposits encountered. At a depth of c 1 m some boulders were

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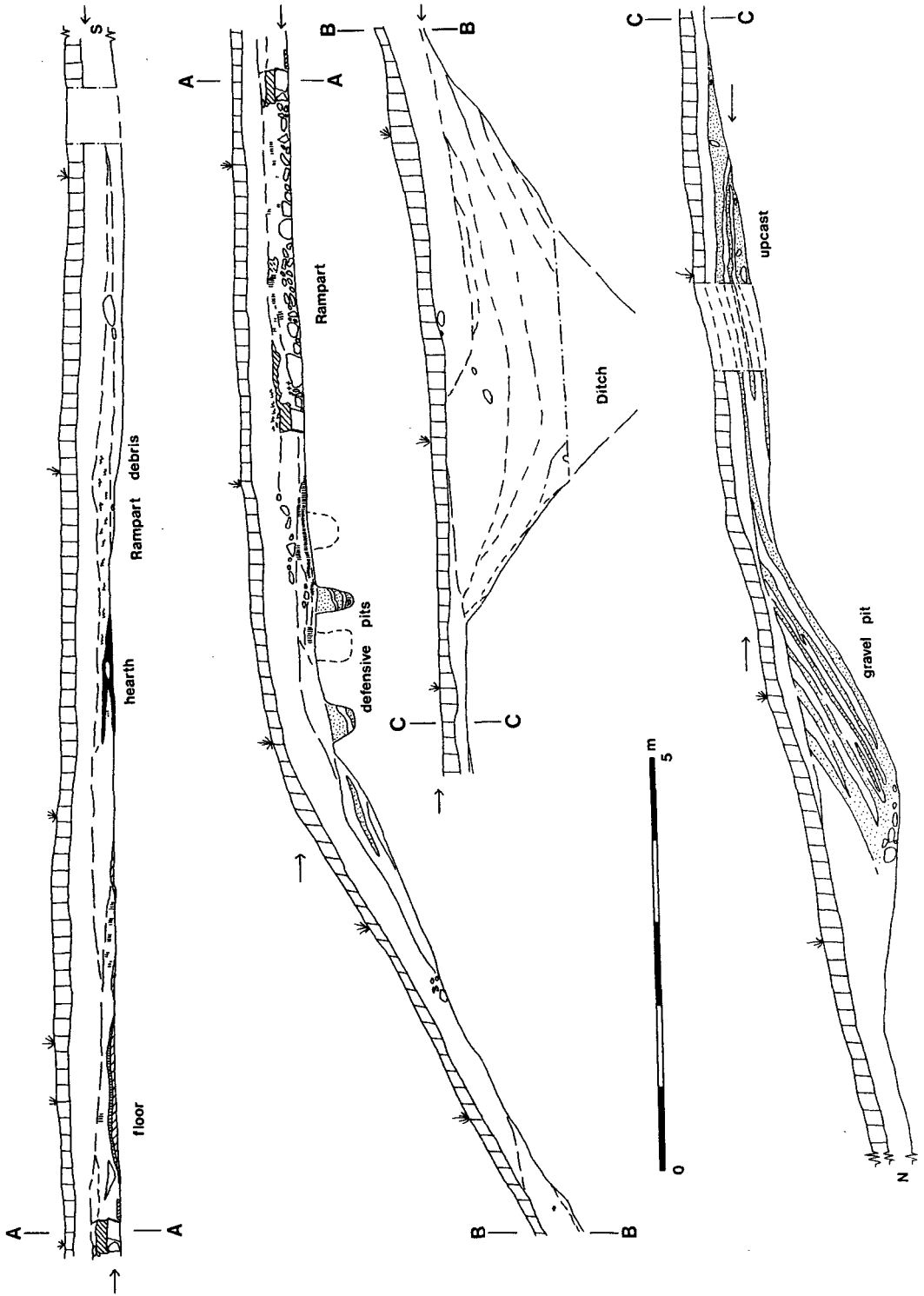


ILLUS 1 Plan showing the locations of the 1989 pipe trench and the 1990 excavation beside East Lodge, Callendar Park

found in the centre – these may have been part of a rubble drain as is commonly found in this position (for example see Lockpark Cottage, Allandale – Keppie *et al*, this volume; and below).

The southern edge of the Ditch blended almost imperceptibly with the scarp for a further 6.4 m, effectively adding just over 3 m to the depth of the Ditch. This left a level area of only 3.8 m in front of the Rampart. In this area four elongated pits had been dug, two on the west side of the trench and the remaining two, set slightly forward, on the east side; all with the same east/west alignment. The pits averaged 0.40 m wide by 0.35 m deep, with a length in excess of 0.70 m. The northernmost pit had been slightly misaligned, due no doubt to its proximity to the hill slope. This pit also showed signs of having been incompletely dug, this time due to the presence of a large boulder in the natural orange clay (see illus 3). Despite this obstruction it had been made to conform to the standard plan and relative position. All the pits were filled with clean gravel interleaved with narrow bands of clay. Then, over the whole of the berm and the backfilled pits was a layer of off-white clay containing yellow patches, with black striations running across it. This is the type of material that is usually found in the Rampart and obviously represents laid turf. This in turn was overlaid by a narrow band of cobbles.

The Rampart base itself was of standard width at 4.3 m, with north and south kerbstones intact and laid directly upon the natural clay surface. Some of the kerbstones had been wedged with their outer faces in an upright position using stone chippings. Behind the kerbstones a row of medium-sized boulders had been packed. Nearer to the centre of the base the stones decreased in size and were arranged more randomly, except for one large flat-topped stone amongst them which occurred 0.7 m from the north face.



ILLUS 2 Eastern section of the 1989 pipe trench from south (top right) to north (bottom left)

The superstructure of the Rampart proved to be of more than one phase, the first of which (A) is seen in plan in *illus 3*. Cheeks of a puddled blue clay, 0.36 m wide, had been built above the kerbstones. This clay was very clean and did not exhibit any signs of vertical division into blocks within the excavated area. However, the upper part of the section hinted at a possible horizontal break at a height of only 0.12 m. The south cheek had been interrupted by a rectangular-shaped feature with a reddish-brown loamy fill and sharply defined straight edges, which was of the same width as the cheek and measured 0.30 m across. It rested directly upon the kerbstones and presumably represents a decayed timber upright. The clay cheeks of the second phase (B) were 0.70 m wide and were white in colour. The northern of these cheeks spread out beyond the limit of the stone base and its front rested partly on the cobbled area of the berm and partly upon the decayed turf there.

The core of the Rampart was an orange-brown clay-loam similar to that through which the Ditch had been dug. Incorporated into this matrix were some turf blocks, c 0.20 m by 0.40 m in size, which seemed to have been heaped towards the centre of the base. Between the second-phase cheeks the core was more mixed and darker in colour and it was found that this material overlapped the orange-brown clay-loam to the east.

Some 0.30 m south of the Rampart a thin layer of white clay and blue-grey loam c 0.07 m thick lay on the natural surface. This is unlikely to represent erosion from the clay cheeks as it continued in a patchy form for a further 4.6 m to the south. In the top of this layer 22 pottery sherds from a single vessel were found. Seven metres from the south kerb of the Rampart lay the centre of a hearth. This also rested on the natural and consisted of an area of charcoal at least 2 m square. Small flat pieces of sandstone had formed a temporary work surface around the hearth, and some small fragments of the same pottery as had been found on the clay layer were found incorporated amongst the charcoal, as were some small pieces of burnt bone. At a later date the northern part of the hearth was rebuilt at a higher level (*illus 2*).

The excavated trench was continued for 37 m to the south of the Rampart. No trace of the Military Way was found. At 24.4 m another area of clay occurred, 5 m wide; after a gap of 0.30 m it began again, finally ending at 35.4 m. This clay was stiffer than that encountered immediately behind the Rampart and appeared to be entirely natural.

## THE 1990 EXCAVATION

As a result of new roadworks on the site of the East Lodge of Callendar House an 11 m section of the Antonine Ditch was excavated in May 1990. The shape of the area excavated was dictated by the works associated with the provision of a newly aligned slip road from the Callendar Estate Technology Park to a roundabout on the site of the former East Lodge on Callendar Road. This produced a triangular plot of land (*illus 4*), bounded on the east by the old approach road, on the north by Callendar Road, and on the west by a portion of the Antonine Wall for which there was no scheduled monument consent (NS 90437952). Consequently, more of the Antonine Ditch was available for excavation than of the Rampart.

The Rampart did not survive well and was represented by an area of cobbling measuring about 3 m by 2 m, laid directly upon the natural purple-blue clay and orange-brown sand. Even this small patch had been cut through by an electricity cable trench, and was disturbed by a Scots Pine tree. This foundation lay on the crest of an east/west ridge which runs along the north side of Callendar Park. To the south of the cobbled foundation were three shallow elliptical shaped pits. The depths varied from 0.05 m to 0.20 m below the surface of the surrounding natural sand. Patches of white/grey clay were apparent in their brown sandy loam fills.

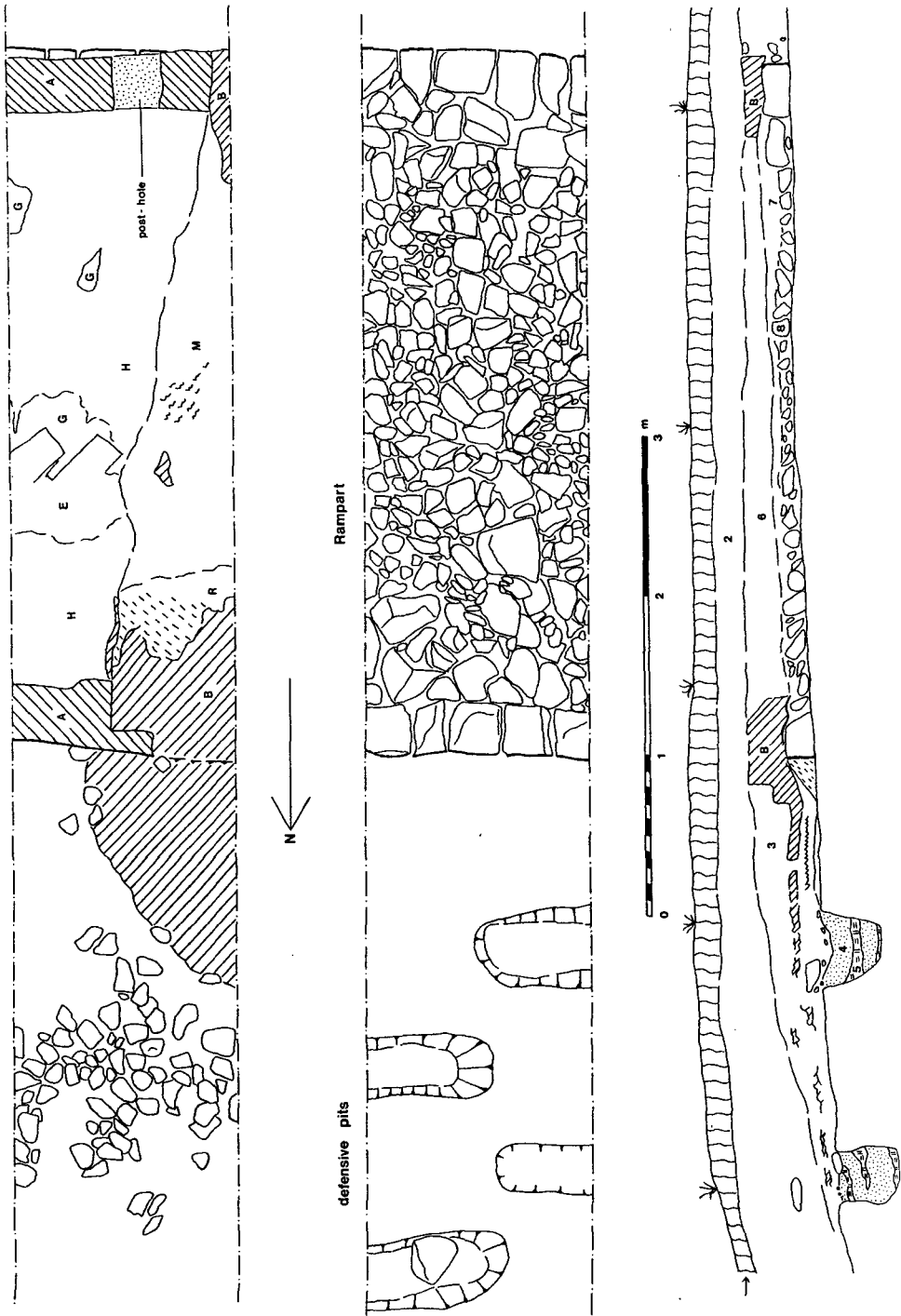
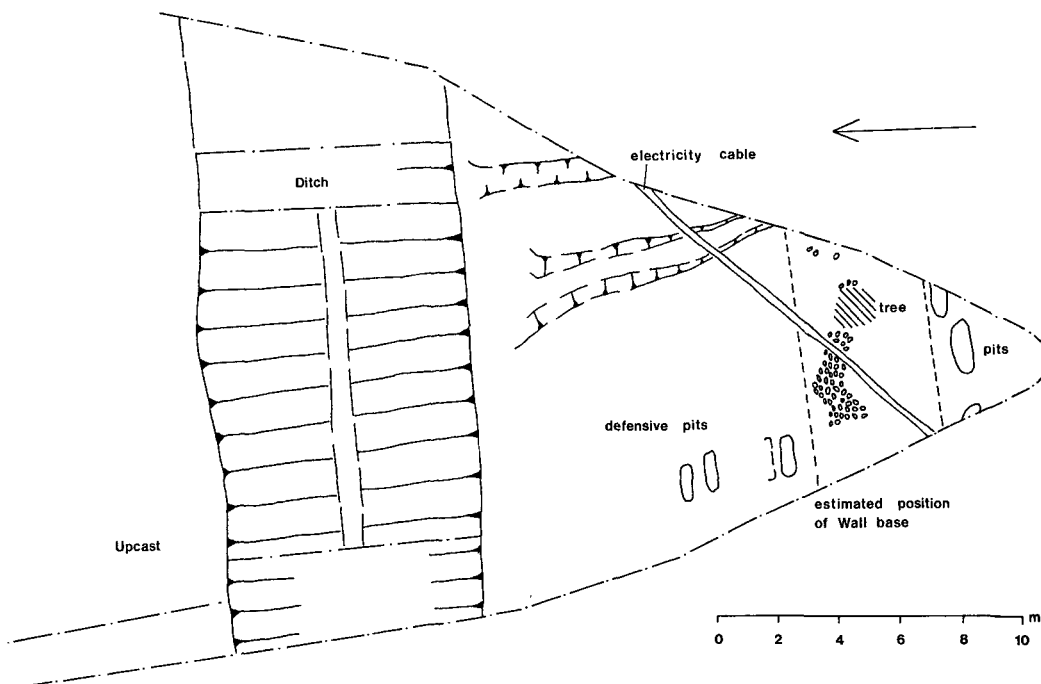


FIGURE 3 (Top) Plan of the 1989 trench showing the Rampart superstructure at 0.1 m above the stone base. A = blue puddled clay cheek; B = white clay cheek; E = decayed turf; G = grey clay loam; H = orange-brown clay loam; M = mixed grey, brown, orange silty clay loam. (Centre) Plan of stone Rampart base and the defensive pits. (Bottom) Western section of the trench showing the northern white clay cheek (B) overlapping the turf layers on the berm (3), which in turn cover the defensive pits filled with alternating bands of gravel (4) and clay (5)



ILLUS 4 Plan of the 1990 Trench

The Ditch lay 10.7 m to the north of the cobbles, on gently sloping ground; the southern lip of the Ditch was 1.6 m lower than the ground upon which the foundation had been set. The Ditch was V-shaped in profile, with sides at 45°, and with a narrow slot in the bottom. It measured 8.2 m across and 3.4–4.3 m deep (illus 5). The Ditch had been cut through several bands of gravel and grit of varying degrees of coarseness. The lowest fill in the Ditch was a compact brown-orange sand and silt (14) only 0.08 m thick but extending up the Ditch sides. Above this was what might be described as a 'washed grit' (13), and then a lens of loose pebbles and cobbles (12) followed by a layer of loose pebbles in a brown-orange sand matrix (11). These four layers filled the Ditch to just over a metre. At this level lay a line of boulders along the central axis of the Ditch (9). Butted against these, and resting on the north edge of the Ditch, was a loose gravel in a dark brown matrix (22). The rest of the fill consisted of various shades of orange-brown loam (8, 7).

The dark brown gravel (22) continued northwards beyond the lip of the Ditch for some 3.7 m. Here, it overlay an orange-brown sandy loam which averaged around 0.20 m in depth (20). Whilst the southern end of this layer rested directly on the natural orange-brown clay loam most of it covered interleaved layers of yellow sand and gravel (24, 23, 21, 25) with some boulders (24). These bands tailed off 7 m north of the Ditch, giving way to a covering lens of loose stones ranging in size from 10 mm to 250 mm (27). Below all these was a compact horizon showing heavy iron panning (30) as rust-coloured stains on either side of a 0.03 m thick grey clay. The iron panning continued on to the natural surface under 21 and 20. Trapped below this band was a dark orange-brown sandy loam with charcoal flecks, up to 0.35 m thick (26). A pollen sample was taken from this soil horizon but unfortunately grain survival was too poor to make analysis worthwhile (information from C Dickson). The grey band (30), dark orange-brown sandy loam with charcoal

flecks (26) and stone (27) were interrupted 11 m from the Ditch by a more evenly mixed gravel and loam soil. Above the dark brown gravel (22) was a further layer of finer gravel (28) which continued down the slope for a considerable distance before merging imperceptibly with the topsoil.

Between the Ditch and the Rampart base were gullies and pits (illus 4). Two linear gullies ran roughly north/south; the eastern side one was only c 0.17 m deep in the centre by 1.4 m across. Both had gently shelving sides and were poorly defined. They broadened out to the north (downhill) and stopped just short of the surviving south lip of the Ditch. Four shallow pits had straight sides, aligned roughly east/west, with rounded ends, averaging 1.4 m by 0.45 m. The deepest of these pits measured 0.16 m, the shallowest only 0.06 m.

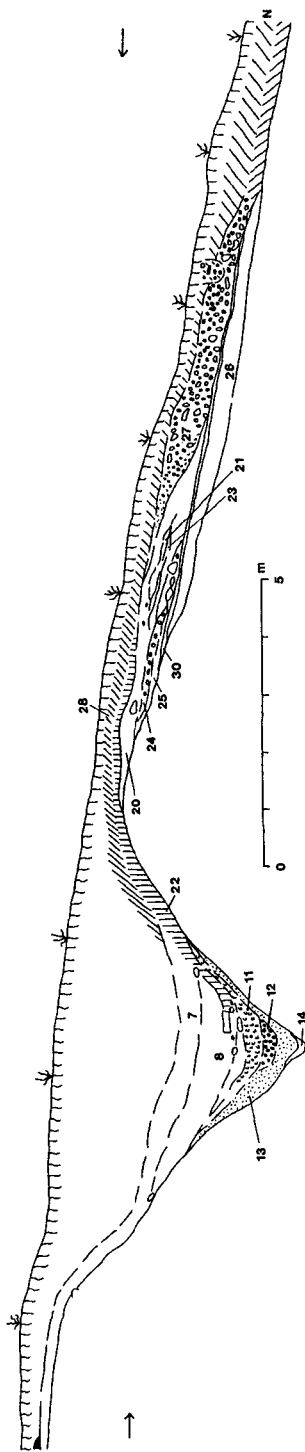
## INTERPRETATION AND DISCUSSION

The two most conspicuous features of the Roman frontier are the Ditch and the Rampart. Sufficient of the Ditch was excavated to give an alignment which corresponds closely to that on the most recently revised Ordnance Survey maps. It is clear that there was a short change in the alignment which must have started on the eastern edge of the modern access road to Callendar Park and finished some 162 m to the west, approximately half-way along the walled kitchen garden. The reason for this change appears to have been the local topography as it maintains the Rampart's position on the crest of the east/west ridge with its northern aspect. A more radical change in direction occurs at the extreme east end of the park where the Wall turns abruptly northwards (Keppie & Walker 1989, 145). Again this seems to have resulted from topographical features, namely the steep descent into the valley of the Gallow Skye and then up the Gallow Hill on the far side. There is also an almost imperceptible change in the alignment of the Rampart at the point where the 1989 trench was excavated, which may have occurred at the site of a watch tower (see below).

The state of the remains of the Rampart in the 1990 excavation made it impossible to determine its alignment there, for no kerb stones remained. However, the space between the pits to the north and those to the south would have left sufficient room for a Rampart the same width as that found 120 m to the east, that is 4.3 m. Assuming that both sets of pits were laid out after the Rampart was constructed this then gives us an indication of the Rampart's line. It produces an alignment diverging westward from that of the Ditch. As the berm in the 1989 trench was only 3.8–10.2 m, as against at least 10.4 m in the 1990 trench, it is quite evident that there was some divergence. This began on the eastern side of the later estate avenue (see illus 1). It will be noticed that this alignment is parallel to that of the ninth-century timber hall to the south (*Discovery Excav Scot* 1990, 8).

The Rampart was of average width for this part of the frontier. The stones in both trenches had been set directly upon the natural; to the east of the avenue they had been protected by the Wall's superstructure, but had been left proud of their surroundings to its west by subsequent activity. In this latter case, the prominent position of the stones indicates that c 0.30 m of the natural soil has been removed along the north front of the Rampart, probably at the same time as much of the base itself. As the layer of orange-brown sandy loam (7) which lay directly upon the natural sand of the berm continued into the upper fill of the ditch, it may be concluded that the event that removed so much of the berm was the deliberate infilling of the Ditch.

An upcast mound is readily identified to the north of the Ditch. It lay on the old soil horizon which was represented by the band of grey clay and iron panning (30). Below it was a sandy loam with charcoal flecks (26), the nature and position of which show it to have been a pre-Roman



ILLUS 5 Section of the Ditch and upcast mound in the 1990 Trench. For context numbers refer to main text



cultivation soil. It is difficult to understand how the shallow layer of grey silty clay (30) was formed. It may well have been the result of numerous Roman legionaries tramping about in this area, compacting the material and destroying the soil structure, making it impermeable to iron salts. A similar lens was noted at Bantaskine, towards the west of Falkirk (Keppie 1976, 72).

Stratigraphically it can be argued that the earliest feature of the 1989 excavation was the pit immediately to the north of the Ditch (illus 2, gravel pit). This area would normally be occupied by the upcast from the Ditch and it is therefore reasonable to assume that the laminated layers in the pit and to its south represent the remnants of the counterscarp mound. The pit was partially dug through a seam of gravel which it had probably been its purpose to exploit. This could have provided material for the construction of the Military Way serving the primary forts, which in turn would allow easier transport of building materials to the Wall itself. A quarry-pit was found under the expansion added to the Wall at Bonnyside East, the turfwork of which itself bonded with the rampart (Steer 1959, 164) showing that the road was built before it, but the evidence from Callendar Park may indicate that in this sector the road was also earlier than the Ditch.

The primacy of the road is to be expected. One of the first stages in the development of Roman frontiers in the Hadrianic/Antonine period was the provision of an arterial line of communication studded with a chain of forts. Only later was this supplemented by a linear barrier in the form of a rampart and a ditch. Thus Hadrian's Wall had slowly evolved from the Stanegate road. The Antonine frontier, however, was planned as an integrated system to replace the developed Hadrianic model. The imposition of the road across the landscape was just the first step in the creation of this artificial barrier. The small quantity of silt that accumulated in the gravel pit before it was infilled with material derived from the digging of the Ditch shows that there was only a short interval before the implementation of the subsequent stages.

The 1989 excavation demonstrates that on this part of the Antonine Wall the work on the Rampart was undertaken in conjunction with that on the Ditch for the latter provided a convenient quarry for earth which was incorporated into the body of the Rampart. The synchronization of the work schedules would have allowed for the turf to be stripped from the surveyed line of the Rampart immediately in advance of the laying of the stone foundation directly upon the subsoil. The loose turves derived from this operation were thrown indiscriminately upon the central line of the advancing foundation. Work on the foundation was systematic. The stones must have been collected elsewhere and carted to the building site along the roads. The medium-sized boulders were then roughly dressed on site to form kerbs as is demonstrated by the presence of chippings in the rubble foundation (noted previously on numerous occasions, for example at Cadder – Keppie 1976, 65; and at Beancross – Keppie *et al.*, this volume). These were laid out in two rows with the kerbstones wedged with their outer faces in an upright position using the sharp stone chippings (cf Polmont Park – Steer 1961, 322). Medium-sized boulders were then carefully packed against their back edges. It was then possible to pitch the smaller cobbles into the central area without having to worry about hitting the kerbstones. Differences in stone types in the Wall base at Beancross suggested that they had been dumped straight off a cart.

Once the stone Rampart base had been put down a large timber post, 0.30 m square, was placed on the south kerbstones, using them as a pad. It is unlikely that this was part of a timber framing for the Rampart itself as there was no corresponding post-hole on the north kerb and no such features have been observed on previous occasions. (At Wroxeter the remnants of a clay cheek on the outer face of the rampart were interpreted as the bedding for a timber sill which formed part of a revetment; this was anchored to the rear of the rampart by timber bracing (Webster 1991, 125). If the same design had been used for the Antonine Wall here then it is still difficult to explain the solitary post.) A careful search was made in vain to find a partner post-hole

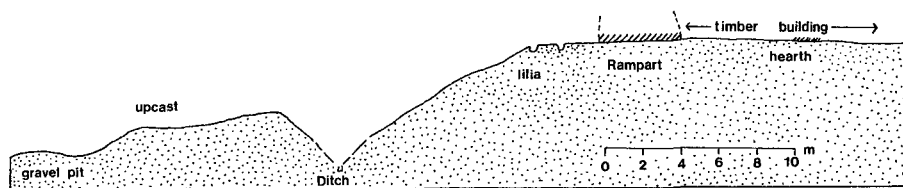
for it within the core of the stone base. However a post-pad had been used on the line of the south kerb, and the large flat-topped stone set 0.7 m back from the north face could well be significant in this context. It lay in an area where anything above it had been removed in the secondary phase of the Rampart and any evidence of a post-pipe in the first phase would have been removed with it. As a post-pad this stone would give a north/south external distance of 3.2 m across the two possible posts. Given the substantial nature of the southern post, and the location of the probable set, it is possible that we have here two posts of a timber tower or turret such as has been postulated by Gillam (1975, 55–6) and Maxwell (1985). The external dimensions would be similar to those of the Roman signal tower on Beattock Summit (Maxwell 1976).

A substantial timber watch tower with its main uprights resting upon stone pads forming part of the Wall base would be impossible to detect unless the superstructure survived to a reasonable height and was of a homogenous nature as at Callendar Park. Further, had the timbers been extracted in the Roman period then the loose fill of the Rampart would have quickly entered the void and obscured any sign of it. Towers of this nature would be entirely feasible as their structural integrity would be derived from cross-bracing of large timbers, with the lower 3.5 m or so embedded into the earthen core of the Rampart imparting considerable stability. Essentially then, the post-holes for these turrets would have been above ground as the existence of the Rampart rendered digging into the ground unnecessary. To do this the front posts would need to be set back from the toe of the Rampart, which also has the advantage of fireproofing them on the side facing the enemy and of concealing a possible climbing aid, a practice commonly followed in the interval towers of forts (Manning 1981, 69,80–6). Watch towers are an essential component of all the other Roman linear frontiers and are most likely to have occurred here as well. The unusual and slight nature of those on the Antonine Wall might explain why they have not been recognized hitherto.

The Rampart into which the putative tower had been embedded was not of the normal turf construction but of clay cheeks retaining an earth core. This must have been built up in a series of steps. First, wooden planks would have been placed along the front edges of the kerbstones with a second parallel plank positioned 0.36 m inside each of them. These would have been braced on their outer edges to keep them vertical, with spacing bars within to keep them apart. Wet clay dug from the nearby carse was then thrown between the planks and puddled *in situ* by soldiers tramping up and down on the encased material. In this way a dense compact wall of clay was built up between the wooden shuttering over each kerb. This explains why these clay cheeks had straight front and back edges. Had clay blocks been used, as at Brough on Humber, then the inner line at least would have appeared serrated (Wacher 1969). Whilst the evidence of the upper part of the sections is not totally reliable, it may be possible to detect a staged break in the process of puddling the clay at a height of 0.12 m – a manageable and convenient depth at any one time.

Between the two clay walls the core of the Rampart was of dumped earth which was derived from the digging of the Ditch. The soil types show that it was the first soil to be taken from the Ditch that was used for this purpose, whereas the material from the digging of the lower part was used to create a small counterscarp mound to the north which covered the former gravel pit. The level of the Rampart core would have been raised each time that the cheeks were built up.

Behind the Rampart the area of clay associated with the two-phase hearth is significant. It is probable that the white clay layer represents the floor of a timber building lying in the shelter of the Rampart. A lean-to structure constructed on sill beams would have left no other trace within the excavated area. Even if post-holes had been used these could easily have straddled the narrow excavation trench. Such a building would have been associated with the timber watch tower and may have functioned as a bothy – a small hut where the tower's garrison cooked and slept. The presence of the pottery and of the burnt animal bones support this hypothesis. The soldiers



ILLUS 6 Schematic section across the Antonine frontier in the 1989 Trench

stationed at the stone turrets along Hadrian's Wall had similar facilities on the ground floor of these structures. The equivalent space here was occupied by the earth rampart and a lean-to shelter is the obvious solution to this requirement. This would also have reduced the direct fire risk to the tower itself. The small garrison, of say six men, would have been posted out on rota from the nearby fort at Falkirk. Their tour of duty would require them to be away for lengthy periods when they would need to fend for themselves.

The pits on the berm can have been dug only after the completion of the Rampart, otherwise they would have impeded the access of the construction gangs. Their arrangement and location clearly demonstrate that they performed a defensive function and that they were contemporary with the occupation of the Wall. A fuller discussion of their nature and significance will be found below, but here we will consider their sequential position. The survival of only a single line of these defensive pits in the 1990 excavation may be a mere coincidence, or it may hint at the division of work. Is it possible that the man, or men, given the task of digging that one line did so with slightly greater zeal than their neighbouring teams and dug them just that little bit deeper and thus they survived the subsequent degrading of the berm?

During the life of the frontier barrier at Callendar Park a number of alterations were made. The defensive pits were deliberately filled in with gravel and the berm covered with several layers of turf. That these two events were coincident is suggested by the presence of 0.07 m of turf forming the uppermost fill of the southern defensive pit on the east, indicating that the gravel had not had time to fully settle. The length of time which elapsed between the defensive pits being dug and then backfilled is difficult to judge. The western section shows that silt had accumulated to a height of 0.2 m at the foot of the Rampart before the turf was laid. Why did the Romans feel it necessary to dispense with the defensive pits? Perhaps the reason was more practical than tactical; the very narrow berm here could have made the Rampart unstable and the laid turf would have helped to consolidate it (cf York: Jones 1975, 108). The steep north-facing slope into the Ditch consists of patches of loose gravel, and water draining off the Rampart down this slope might easily produce severe erosion. Two layers of turf have previously been found on the berm at Cadder, one of which extended almost 5 m beyond the Rampart (Keppie 1976, 65).

Subsequent to this consolidation work the western part of the Rampart was rebuilt from the top of the stone base upwards. (That the Rampart was demolished after the pits had been filled in is indicated by the lack of Rampart material in them. The vexed question then arises as to whether they were filled in to allow easier access to the Rampart for demolition, or whether the two events were unconnected. It is clear that the Rampart had not collapsed northwards into the pits at this point, and a deliberate demolition would have commenced with material being thrown down from the top; it seems on balance that the two events were separate.)

New cheeks were provided of a white clay which contrasted sharply with the blue clay of the original cheeks. The new cheeks were wider, over 0.70 m wide as compared with the previous 0.36 m,

presumably to increase stability. The north cheek projected forward beyond the facing of the kerbstones, which by this time had been concealed by silt and laid turf. The clay of this cheek splayed out at the base covering the turf. Along the northern edge of this clay spread a narrow band of cobbling seems to have been a further attempt to consolidate the berm (cf Bearsden – Breeze 1984, 36; Rough Castle – Christison & Buchanan 1901, 462). The core of the Rampart was also replaced at this point using a more mixed soil.

To the south of the Rampart there was also evidence for more than one phase of activity. At some stage the Rampart was partially demolished and spread out to the south, initially for just over 4 m, and thereafter further levelling probably took it a further 2 m. Subsequent to this levelling, the hearth, mentioned earlier, was reused, but now its northern portion lay over the tail of the demolition material. Burnt bones from the charcoal of the hearth at this level suggest that it had been used for domestic purposes and was thus probably unconnected with the work of demolition. This can have been only a limited dismantling of the Rampart as it represents only sufficient material to add a further height of c 0.10 m to that remaining. It may therefore be derived from the demolition of the Rampart to the west.

Only more extensive investigation will reveal if the demolition was necessitated by structural failure. The lack of material on top of the turf to the north may be due to the site having been tidied up after the reconstruction work. An alternative hypothesis is available if we accept the rather tenuous evidence for the turret/tower; it is possible that its replacement would have necessitated the almost total reconstruction of the adjacent rampart.

The sequence can thus be reconstructed:

- (1) Before the arrival of the Roman army the area was under cultivation by the indigenous population.
- (2) Gravel pit dug, probably to provide material for the road.
- (3) Line of Rampart and Ditch carefully surveyed.
- (4) Turf cleared from the line of the Rampart.
- (5) Kerbstones dressed on site.
- (6) Kerbs placed in two lines and propped upright using the chippings.
- (7) Medium-sized stones placed by hand behind the kerbs.
- (8) Smaller stones dumped in the core of the base.
- (9) Presumed timber turret constructed.
- (10) Puddled clay cheeks placed on kerbs using wooden shuttering attached to the turret uprights, 0.12 m of clay being puddled at each stage.
- (11) Turf from the line of the Ditch and Rampart dumped on the centre of the base, quickly followed by the upper fill of the Ditch. The area to the north of the Ditch heavily trampled by Legionaries in this process.
- (12) Repeat 10 and 11.
- (13) Lower part of the Ditch material thrown northwards filling the gravel pit and forming the counterscarp mound.
- (14) Defensive pits dug on berm, one line at a time.
- (15) Timber building with a hearth constructed behind the Rampart.
- (16) Erosion of berm and decay of tower, defensive pits filled with gravel.
- (17) Layers of turf placed on the berm to consolidate it.
- (18) Rampart demolished on the west side, the material spread to the south.
- (19) Rampart rebuilt on the west using wider clay cheeks, and cobbles spread on the berm.
- (20) Hearth reused.

No Rampart superstructure survived *in situ* in the 1990 excavation. White clay from it was found in the pits to the south. It is possible that these pits had been dug through the collapsed Rampart, and then backfilled with the same material – in which case they are impossible to date and might be associated with the timber hall. However, as the pits appear to respect the line of the Rampart they might be associated with its life rather than its demise. Here we encounter a further difficulty, for, although there is no direct evidence for it, it is possible that the defences were reinstated in the Early Historic period. The function of the pits could not be determined. Their disposition, forming an awkward line, suggests that they may have been dug sequentially and may have been latrine pits.

On the eastern side of the site two linear gullies were found on the berm. Their function and date are unknown. Could they have been roadside ditches leading to a wooden bridge? Perhaps they issued from the fortlet that Keppie was searching for (Keppie 1989, 144), with the latrine pits as an internal feature. More mundanely they might merely have been erosion gulleys.

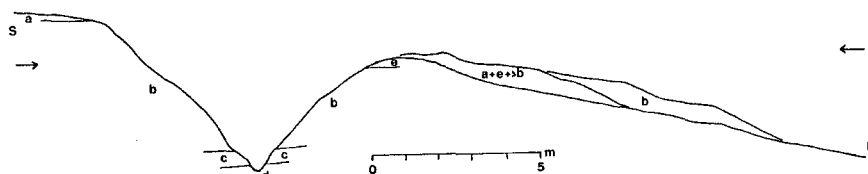
#### THE DITCH

The first lens of upcast material to be placed upon the old cultivation soil was a yellow sand (25). This must have derived from the sand layer on the very southern edge of the Ditch, and gives a further indication of the amount of material removed from the berm at a much later date. The next layer on the upcast was gravel in a yellow sand matrix, representing a mixture of the natural sand from the edge of the berm and the gravel of the next layer down. These two layers appeared to have been deliberately retained on their northern side by boulders which could themselves have originated in the gravel layer. At Tentfield it was observed that the initial material excavated from the Ditch had likewise been used to retain the northern side of the upcast (Robertson 1964, 194), and Maxwell has noted a low delimiting mound on this side (1989a, 177). These layers were in turn covered by a series of interleaved layers of yellow sand and gravel (21, 23, 24), presumably derived from the same source. Then came the orange-brown sandy loam (20) which may have derived from the first layer taken out of the north side of the Ditch.

Over these, and extending northwards was the loose gravel from the middle depths of the Ditch digging. This pattern suggests that work on digging the Ditch began on the south lip and proceeded northward to create a flat terrace, and thereafter material was thrown onto the northern scarp of the upcast mound. In this case, the southern edge would have been the line surveyed by the Roman engineers. This imparts a practical solution to the task being undertaken as it keeps the area between the source of the excavated material and its destination free from obstruction as long as is practicable. It also implies that the northern edge, the destination of the material, was likewise demarcated at an early stage. It is difficult to see how this complies with the concept of a fixed distance between the centre line of the Ditch and that of the Rampart as suggested by Keppie (1974, 162).

	actual	predicted
total volume of Ditch per m	= 16.5	
volume of initial material in upcast (a+e)	= 2.3	2.6
volume of remaining upcast material (b)	= 2.3	13.9

(Units are in cu m, see illus 7)



ILLUS 7 Section of the Ditch and upcast to show the source and destination of the excavated earth

The gravel thrown onto the upcast mound would have naturally sorted by gravitational action to leave the larger pebbles and cobbles down at the bottom of the slope (27). This layer was found to be still quite loose and soil free, perhaps the result of the leaching action of rainwater. It is easy to imagine this area remaining free of luxuriant vegetation for some time after the Ditch had been dug, leaving a very visible scar on the landscape as the frontier was approached from the north. The upcast had been truncated at some time, as can be seen from the disposition of its upper layers. The gravel (27) ought theoretically to have spread over the entire top of the mound. The table above also shows that under half of the material from the Ditch can be accounted for in the existing mound. Some may, of course, have found its way back into the Ditch, but certainly not enough to make up the shortfall of almost 14 cu m/m of Ditch. Much of this material would have gone into the construction of the Rampart, filling the space between the clay cheeks at approximately 13 cu m/m length. As the material concerned would have been gravel it is probable that some of it was also taken away in the Roman period for use on the roads being constructed in connection with the frontier.

The Ditch was a formidable obstacle. Although its width is in the lower range of those recorded for the Antonine frontier, its sides at  $43^\circ$  are the steepest so far observed (Appendix 1).

Variation in the angles of the Ditch sides can be explained in a number of ways. Their steepness bears a close correlation to the type of material through which they were dug (AWR, 136) and hence the natural angle of rest of the scarps. It might therefore be expected that the angles would vary considerably in accordance to the natural geology. However, the angle of rest of gravel is not greater than that of boulder clay. Indeed, it is evident from the nature of the lower Ditch deposits that the angle of rest here was exceeded.

A glance at the table (Appendix 1) gives a range of  $20^\circ$  to  $40^\circ$  for these sides, with the average between  $30^\circ$  and  $35^\circ$ . In many cases these angles were obtained from the upper part of the Ditch which alone was excavated, or even from existing open lengths of the Ditch, both of which may produce slighter angles than a full excavation. The local topography must also have played a role in deciding the form of the Ditch. In the 1989 Callendar Park section the south scarp of the Ditch merged into the hill slope, concealing the change to the berm. Consequently it ought to have been possible to reduce the width of the Ditch.

The lowest fill of the Ditch was a silty sand (14) derived from the natural erosion of the fine material on the Ditch sides. As the Ditch was dug through grit and gravel, a layer of coarser material might have been expected in this position. Indeed, within two weeks of the archaeological re-excavation of the Ditch a similar quantity of just such larger grained material had collected. This suggests that the Ditch bottom had been regularly cleaned out by the Roman army before the silt was allowed to accumulate, after the Ditch sides had been consolidated by the establishment of a vegetational cover.

Above the silt were several bands of gravel and grit (13, 12, 11), representing the

inundation from the sides. This does not conform to the concept of stable sides suggested for the silt/sand (104). There must have been a dramatic episode between the two which destabilized the cutting, such as a recut. There are two occasions in the history of the Ditch at this point which might have provided a fitting context for such an operation. First was the Antonine reoccupation of the frontier after a short interval of abandonment and the consequent refurbishment of the defensive works. This episode must now be considered to have a dubious existence, and it would be a matter of making the evidence fit the theory rather than of directly interpreting the findings. Second, and considerably later, was the occupation of a large timber hall in the ninth century (*Disc Excav Scot* 1990, 8), at which time it is reasonable to postulate the reinstatement of the defences of the site.

Lying on top of these layers of gravel was a line of boulders (9) set along the central line of the Ditch. The consistent nature of this line proves that it was not an accident of erosion and was man-made. The only reason can have been to create a rubble drain in the base of the Ditch at a time when material was beginning to slump in from the north. This material was a dark brown gravel and loam which spread across the top of the upcast mound. It would appear to represent an early road. Indeed, that location was ideal for that function. On the south was a large man-made ditch, and on the north a slope down to the carse land. In between, the upper part of the upcast mound, was a spread of gravel, which was thus freely draining. It may be then, that this was the medieval King's Highway from Linlithgow to Falkirk and on to Stirling or Glasgow. Such medieval roads often follow the upcast mound (eg at Dean Road in Bo'ness, and at the High Street in the village of Kinneil).

The greater part of the Ditch was filled with an orange-brown sandy loam which had been deliberately dumped here from the south to level the ground surface. The origin of this material is not known, though some of it may have derived from the cutting of the East Avenue into Callendar Estate around 1840. The Ditch is clearly depicted here on a plan of 1818. Partly interleaved with this material was a band of further metalling on the upcast which clearly formed part of an estate road.

The berm to the west of the estate avenue was wider than usual owing to the divergence of Rampart and Ditch. Only recent deposits, which included the ash from the greenhouses of the walled garden, were found here lying directly upon the natural. It is evident that the area had been heavily truncated, presumably to facilitate the filling of the Ditch in the 1840s. The position of the surviving remnants of the Rampart base have suggested that at least 0.30 m had been removed from the south end of the berm, and presumably the loss had been greater nearer the Ditch.

The breadth of the berm along the Antonine Wall has attracted much comment. One suggestion that it was so wide as a structural necessity for the Rampart (*AWR*, 133) cannot account for its inconsistent size and is in any case unrealistic. Keppie (1974, 162) noted that the size of the berm varied in accordance with the size of the Ditch. This, he suggests, could have been due to the paramountcy of the distance from the centre of the Rampart to the centre of the Ditch. However, the correspondence is not great, and at Callendar Park the method of digging the south lip first and dumping it beyond the north lip shows that these were marked out at an early stage.

Further explanations for the berm have been forthcoming: 'It certainly made undermining of the vallum very difficult, and the use of a battering ram from the opposite side of the ditch a virtual impossibility. Perhaps it was also furnished with defensive obstacles ... and the absence of such indications proves nothing' (*AWR*, 135). Hanson and Maxwell believed that without such obstacles the broad berm would have constituted a weakness in the defensive system (Hanson & Maxwell 1983b, 79).

## THE DEFENSIVE PITS

The 1989 excavation proved very informative and permits speculation on the original form of the frontier. It immediately becomes obvious just how little is known. For example, at that time very little work had been done on the berm in previous excavations. The author had had just three opportunities to examine this area of the frontier. The findings had been varied and could not have provided a firm base for extrapolation. At Beancross the Ditch had an unusual shape, perhaps an unfinished profile, due to its location on very low-lying ground where most of it lay under the water table. The berm was 5 m wide and was relatively level and stable, but given the wet moat in front, the frontier required little additional defensive strength. At St Mary's, Bo'ness, a very narrow trial trench found a small U-shaped channel measuring 0.35 m across located 1.8 m south of the lip of the Ditch on a 7.8 m wide berm (Keppie *et al*, this volume). The channel ran parallel to the frontier and can best be seen as a defensive feature similar to that found at some forts (eg Camelon – Christison & Buchanan 1901, 368; Strageath – Frere & Wilkes 1989, 15). The Callendar Park excavations then turned up four rows of defensive pits at two locations 120 m apart.

The berm has been more carefully examined in subsequent excavations as a result of these discoveries. In 1991 a solitary example was identified in front of the fort at Inveravon, 4.65 km to the east (Armit & Dunwell 1992, 6). The year after, the author explored the berm at Garnhall, some 13 km to the west of Callendar Park, and found three rows of pits along a 5-m frontage. These confirm that the defensive pits formed part of an extensive series, probably extending the full length of the Wall. They also suggest that the pits originally had been left open (0.05 m of silt in the 1992 pits) with probably two stakes embedded in each. The elongated shape is consistent with the double provision of stakes. It is interesting in this respect to see that those depicted on Trajan's Column also have two protruding wooden stakes (Lepper & Frere 1988, Plate XX, scene 25). These probably portray defensive pits in Dacia. Presumably the stakes were removed when the Wall was rendered non-operational on the withdrawal of the Roman army, and this would account for the poor survival of stake-holes or pipes. The pits were then filled with debris thrown down from the Rampart, those nearest to it receiving the most infill.

Caesar refers to such pits as *lilia*, a term used by the excavator of similar pits found at Rough Castle. At the latter site they were located in 10 rows to the north of the Ditch and were approximately twice the size of those in Callendar Park (Christison, Buchanan & Anderson 1905, 456). They served the specific function of covering a weak spot in the fort's defences occasioned by the valley of the Rowantree Burn and seem to predate the linear component of the Wall.

	Rough Castle	Callendar Park	Garnhall	Inveravon
length	7 ft = 2.13 m	1.40 m	1.00 m	1.55 m
width	3 ft = 0.91 m	0.40 m	0.50 m	0.28 m
depth	2½ ft = 0.76 m	0.35 m	0.20+ m	0.21 m

*Lilia* have also been observed at the Antonine fort of Glenlochar (St Joseph 1951, 60; St Joseph 1965, 79) between the defensive ditches; and similarly at Crawford (Maxwell 1972, 153) where they might have occurred in conjunction with the type of trench found on the Wall berm at St Mary's. A defensive slot of this type lay beyond the outer of three eastern ditches in the first



phase of the Antonine Wall fort at Falkirk. That slot held ash and hazel stakes at intervals of 1.4 m and had been filled in to wedge them firmly in place, leaving only a part of them protruding above ground (Bailey forthcoming). The difference between the pits with stakes and the slots with stakes appears to have been that the former were left open whilst the latter were not. Indeed, the shape and form of the pits only makes sense if they were to be left as a trap themselves. Their occurrence as part of a fort's outer defences was undoubtedly far more widespread than is at present recognized. Part of the problem has been the lack of work on the perimeters of the forts throughout Britain. The solitary example known at Manchester is just part of the late second-century refurbishment of the military establishments in that area (Goodburn 1976, 319).

Caesar, too, used a variety of such defensive features as a form of 'passive' defence to conserve manpower (Caesar, *The Conquest of Gaul*, VII, 5). As the Antonine Wall was some 61 km long it would have been sensible to use such mechanisms liberally for the selfsame reason. The Germans used similar 'wolf pits' in the First World War, and they were also used in Vietnam. Such obstacles and deterrents would also act to funnel traffic through the controlled crossing points. Caesar also mentions charring or fire-hardening the tips of the stakes; perhaps the hearths or fires that are occasionally found set up against the north kerb of the Antonine Wall are associated with this task. In recent years these have been found at Bantaskine and at Peel Glen (Keppie 1976, 72; Keppie & Walker 1989, 155).

If we can accept that the defensive pits were once extensive, to reduce the size of the garrison required to patrol the Wall, then why should we stop at defensive pits? Caesar also notes the use of goads and boundary posts which could have been incorporated with ease into the Antonine frontier. Even with a stone base a rampart with thin clay or turf cheeks would have required timber strapping to bind the cheeks to the earthen core. There are suggestions at Inveravon and Beancross that large sections of the clay revetments did collapse periodically (Armit & Dunwell 1992, 6; Keppie *et al*, this volume). At the Roman fort at Strageath the strapping was at vertical intervals of 0.3 m and at Caersws the interval was 0.45 m (Frere & Wilkes 1989, 15; Jones 1975, 89). Unfortunately, not enough of the superstructure of the Antonine Wall survives to answer this point and it is necessary a priori to accept the former presence of strapping. This could easily have performed the double function of structural bonding and protection by protruding beyond the front of the Rampart proper and terminating in numerous sharpened points.

At Wallsend on Hadrian's Wall large post-holes arranged in the quincunx pattern have now been found on the berm in front of the vicus. These probably held vertical timbers sporting spiked projections to form an impenetrable barrier in their own right (Snape 1992). Perhaps the pits on the berm of the later fort at Piercebridge were of this type, although they do not conform as strictly in their spatial distribution and may therefore be merely rubbish pits (Grew 1980, 363; Fitzpatrick, pers comm).

#### THE EARTH WALL

It is difficult to imagine how the clay faces of the Rampart withstood the Scottish climate. Construction of ramparts from clay, or with clay cheeks, is not unknown in Roman forts in Britain (cf Brough on Humber where clay blocks retained a sandy core – Wachter 1969, 11; for the distribution of clay-revetted ramparts see Jones 1975, 87). Clay walls in buildings were quite common. In dry weather the clay would harden and bake, and during the wet weather it would become slippery and remain cohesive. The result might be expected to take the form of

slow silting in front of the cheeks, but the Rampart would be protected by its outer skin of clay.

However, the use of clay in the frontier appears to be limited to the Wall curtain east of Watling Lodge. Macdonald believed that the whole of this eastern sector had been constructed with clay cheeks, but work by Keppie suggested that this view required to be modified (Keppie 1976, 77). The evidence presently available is summarized in Appendix 3. The overwhelming impression remains one of a sector built with clay cheeks. At Kinneil the turf rampart formed the northern defences of the fortlet. The fortlet was constructed in a gap left for it by the builders of the curtain wall and is undoubtedly a special case (Bailey & Cannel, forthcoming). At Inveravon, likewise, the turf section occurs at the site of a fort/fortlet and later work by Edinburgh University has shown that the earlier observations are questionable. The fort at Mumrills does not conform to this pattern as it possessed clay ramparts, but turf was found 122 m west of the north-west corner of the fort where the Antonine Wall forms the north defence of the annexe (Steer 1961). Here the cheek was a mere 0.46 m broad and it is difficult to see how this could have effectively retained the sandy earthen core. Two further sections, 18 m and 27 m west of the same corner, contained unquestionable evidence of clay cheeks, again only 0.46 m wide. The annexe may complicate matters at this location. A special case can also be made for Kemper Avenue where the Rampart crosses the East Burn of Falkirk and where again another work junction was identified. At Bantaskine the excavator had difficulty in identifying the cheeks due to very weak 'turf lines'. The difficulty of distinguishing between clay and turf is considerable. If the subsoil of the sod had been of clay then the surviving deposits will reflect this. On the other hand, if the clay had been puddled in stages it too might possess horizontal banding at the temporary halt between work shifts. In this case excavation in plan should reveal whether the cheek is continuous or segmented. The 1989 excavation at Callendar Park revealed a continuous length of 0.66 m along the south cheek, with straight edges on either side. With turf the inner edge, at least, might have been expected to have changed line with each turf. Re-examination of the photographs of the 1981 excavation in Callendar Park leads the present author to believe that they too show clay cheeks, with a turf core in one instance.

The turf cheeks found at Polmont Park may suggest the site of an unknown fortlet, or perhaps more simply repairs to the curtain which used a different material. At Bantaskine evidence for extensive repairs was found which included the replacement of substantial lengths of the retaining cheeks (and might have been missed in a small excavation cutting a narrow section). Similarly turf cheeks could have been replaced by clay and it is interesting to note that on the turf sector of Hadrian's Wall at Appletree a deposit of red clay, probably puddled, had possibly been used to stabilize the front of the rampart (Whitworth 1992, 53).

Whatever the case, there is no doubt that by and large the Wall sector from Watling Lodge to Carriden possesses clay cheeks. Indeed, given the extreme narrowness of the cheeks they could have been formed only by using puddled clay with its greater cohesive qualities. Normally the revetment would be expected to occupy approximately one-third of the width of the rampart (Jones 1975, 81). That this material was used due to a shortage of turf in the east seems hardly credible. It is hard to believe that this area could have been under such intense cultivation that no pasture existed as this suggests a very high degree of agrarian specialization for the time. Surely turf must have been scarcer on the high moors in the central sector of the wall than here. Furthermore, we have indications that turf was at times dumped randomly into the earth core, having presumably been derived from the line of the

Ditch and even that of the Rampart itself. At Beancross, and possibly Callendar Park, laid turf was actually used in the core as well as being used to cover the defensive pits at a subsequent date.

An analogous situation occurred on the turf sector of Hadrian's Wall between Banks Burn milecastle 53 and Howgill turret 54b. Here the turf Rampart was replaced by one entirely of clay, and even the milecastles were given clay ramparts. This short length of Wall corresponds with the line of the geological deposits known as the Brampton kane belt which consists of sands and gravels. It was suggested that the localized geology supported a woodland landscape with the consequent diminution of the readily available supply of turf (Simpson 1935, 247), but these soils could equally have supported grassland. Where did the clay come from? What this sector does demonstrate is the versatility of the Roman approach.

According to established theory the Wall was built from east to west, starting at Bo'ness. This then would be the first sector to be constructed and this primacy might suggest that it was the intention of the Wall builders to use clay cheeks for the whole wall. However, as it was an immediate replacement for an existing turf wall on the Hadrianic frontier this seems a little incongruous. Another explanation is possible. Maxwell has recently suggested that the rather dubious evidence for the narrowing of the Ditch in the sector from the River Avon to Bo'ness could be due to its having been an addition to the original Wall line (1989, 163). This would parallel Hadrian's Wall where the addition of the curtain wall from Newcastle to Wallsend is generally accepted as an afterthought. The differing constructional materials may well be a better indication of this separate phase in Wall building.

The rigidity of a building programme which starts at one end of a 61-km-long barrier and then dogmatically continues along it in a single direction until the far end is reached is embedded in our concept of the Antonine Wall. Yet, there is no practical or logistical reason for such a belief. An eastern terminus for the Wall at the fortlet at Watling Lodge would not be inappropriate as the fort at Camelon, which lies only one mile to the north, could have guarded its eastern flank as well as the road northwards at the lowest crossing of the River Carron. To the east the River Carron and the Firth of Forth would provide some protection, especially with Roman control of the seas, and the Roman road to Inveresk via Carriden could be used to patrol the southern shore. In this case the road would have bypassed the Wall on the alignment suggested for the earlier Flavian road to the fort at Camelon (RCAHMS 1963, 112). Watling Lodge would then be the first fortlet on the line of the Wall itself, and the Roman monument known as Arthur's O' would commemorate the building of the Wall. The eastern sector would then have a low priority in the building sequence, and once the central sector had been secured, as occurred on Hadrian's Wall, it could be completed as the last phase.

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## APPENDIX 1

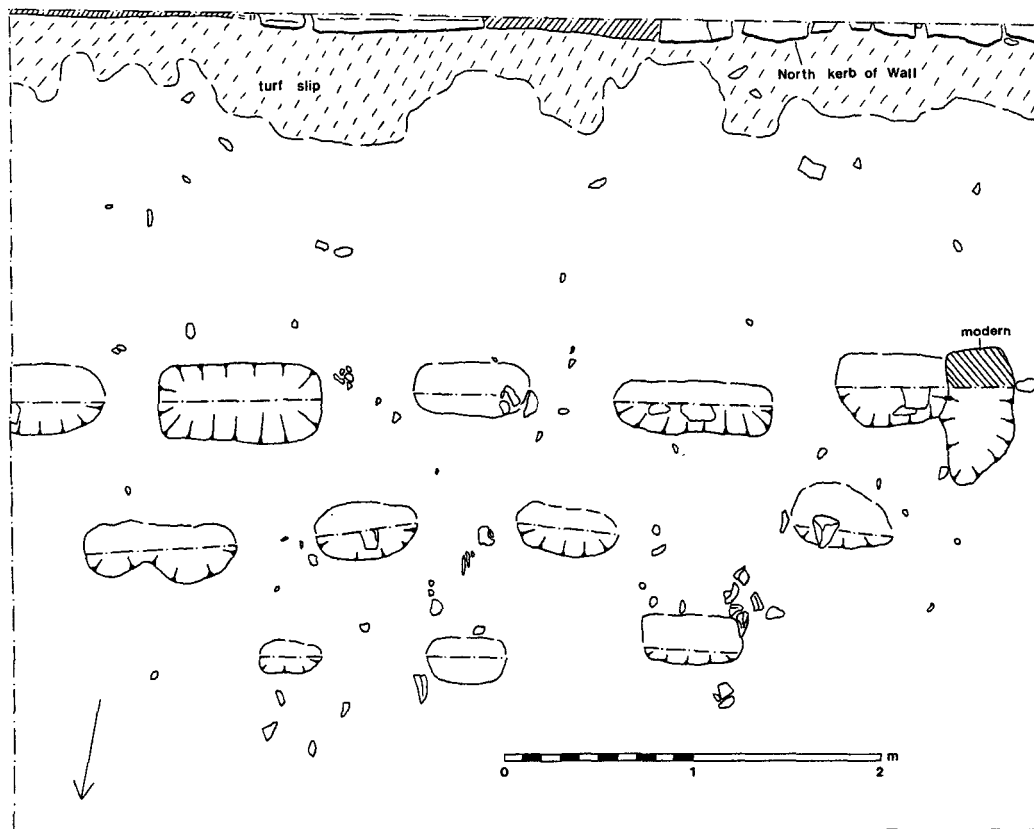
Falkirk District location	Ditch width	scarp angle	berm width	ref.
St Mary's, Bo'ness	8.6	30	7.8	<i>PSAS</i> 1995
Dean House, Bo'ness	c 5.5			<i>PSAS</i> 1961, 323
Kinneil House	c 8.5			<i>GAJ</i> 1971, 107
Kinneil Fortlet, E	c 11.0		4.0	forthcoming
Kinneil Fortlet, W	c 6.0		8.4	forthcoming
Summerhouse Park	10.6			<i>GAJ</i> 1971, 105
Nether Kinneil	9.7			<i>DES</i> 1974, 68
Inveravon, E	7.3			
Inveravon	9.7			<i>PSAS</i> 1976, 63
Inveravon fort	8.0	20–60	9.2	<i>PSAS</i> 1995
Beancross	c 8.8			<i>DES</i> 1973, 55
Beancross	c 8.8	varied	5.0	<i>PSAS</i> 1995
Mumrills Fort			7.0	<i>PSAS</i> 1961, 93
Callendar Park, 1989	7.0	33–40	3.8+	
Callendar Park, 1990	8.2	43	10.5	
Kemper Ave, Falkirk	8.5		6.7	<i>PSAS</i> 1981, 249
Bantaskine	12.0	20–30	8.3	<i>PSAS</i> 1976, 72
Tayavalla	15.2		5.4	<i>PSAS</i> 1995
Tentfield	12.8	30	6.9	<i>PSAS</i> 1964, 193
Rough Castle	12.2	37	8.2	<i>PSAS</i> 1905, 451
Rough Castle, W	12.2	30	6.9	<i>AWR</i> , 116
Bonnyside 3	12.7	25–30	6.9	<i>AWR</i> , 111
Bonnyside 2a	11.4	30–35	7.8	<i>AWR</i> , 110
Bonnyside 1	12.2	30	7.5	<i>AWR</i> , 104
Seabegs Motte	15.2		5.5	<i>PSAS</i> 1934, 61
Seabegs Motte	12.8	35–40		<i>PSAS</i> 1934, 64
Seabegs			8.4	<i>PSAS</i> 1981, 237
Seabegs 2	12.2	30	7.2	<i>AWR</i> , 99
Bonnybridge	8.0			<i>PSAS</i> 1989, 148
Bonnybridge	9.0	30		<i>PSAS</i> 1989, 148
Lochpark	5.0?	40	22?	<i>PSAS</i> 1995
Dundas Cottages			9.0	<i>PSAS</i> 1989, 150
Castlecary, E	12.2	20–30	6.4	<i>PSAS</i> 1903, 287
Castlecary, W	4.6	27	3.7	<i>PSAS</i> 1903, 288

(All measurements are given in metres. The cluster of values for the ditch width at 12.2 m is due to the rounding off of the older reports at 40 ft.)

## APPENDIX 2

Following the publication of a short note on the subject (Bailey 1992), the author was invited by David Woolliscroft to explore the berm at Garnhall (NS 779778). This provided an opportunity to determine whether the defensive pits extended beyond the eastern sector of the Wall. Despite the wet weather three subrectangular pits were located on an alignment parallel with the Rampart, and approximately 1.7 m away from it. These were the only features in this trench and it was clear that here, too, the berm had been severely scarped.

Although the pits had roughly the same width as those at Callendar Park, that is 0.50 m, they were shorter at only 1.0 m long. An interval of 0.45 m separated them from one another. The truncation meant that the pits survived to only a depth of 0.15–0.20 m. In the base of two of them were possible traces of stake-holes, 30–40 mm in diameter, located on the central axis and dividing it into three more or less equal parts. The fill consisted of almost 0.05 m of silty loam covered by a patchy pink and white clay closely resembling the adjacent natural. The following year a larger area measuring 5.5 m long and 4.25 m wide from the north kerb of the Rampart base was opened up further to the west. This proved more productive, with three rows of pits being uncovered to reveal the conventional quincunx pattern (illus 8). The first row was again 1.7 m from the Rampart and consisted of pits of approximately the same size as the earlier ones. Five of them occurred within the trench. 0.5 m in front of them were four smaller pits, and the same distance further out were three even smaller ones. This diminution in size resulted from the uneven scarping of the berm to partially backfill the Ditch. The third-row pits were only c 0.05 m deep, whilst those of the first row averaged 0.25 m. Given such damage it is not surprising that no trace of a possible fourth row was forthcoming. An original depth of c 0.40 m can be conjectured from the presence of part of the sloping contemporary ground surface immediately in front of the Rampart which had been covered with turf slip. The pits were all longitudinally sectioned, but produced no evidence of stakes. Their fills were of orange-brown clay loam, over which was a soil containing patches of white and grey clay. The latter represents rampart material. Whilst it may be an accident of survival, it was noted that the pits contained less of this patchy material the further away they were from the Wall.



ILLUS 8 Plan of the defensive pits on the berm at Garnhall excavated in 1993

## APPENDIX 3

Location	Base Width	superstructure	ref
St Mary's	3.9+		<i>PSAS 1995</i>
Kinneil Fortlet	4.2	turf cheeks? earth core	<i>PSAS forthcoming</i>
	4.3		
Meadows	3.7+	clay cheeks	<i>PSAS 1925, 276</i>
Summerhouse	3.8	clay cheeks	<i>PSAS 1925, 275</i>
Summerhouse	4.3		<i>GAJ 1971, 105</i>
Stey Step	4.9	clay cheeks	<i>PSAS 1925, 274</i>
Nether Kinneil		clay cheeks	<i>PSAS 1924, 274</i>
?Inveravon fort	4.4	clay cheeks, earth core containing some turf	<i>PSAS 1995</i>
Inveravon	4.3	turf	<i>GAJ 1969, 40</i>
Polmonthill	4.7	clay?	<i>PSAS 1915, 138</i>
Little Kerse		clay cheeks	<i>PSAS 1915, 137</i>
Polmont Church		clay cheeks	<i>PSAS 1915, 135</i>
Polmont Park, E	4.6	earth core	<i>PSAS 1961, 322</i>
Polmont Park, E		turf cheeks	<i>PSAS 1961, 322</i>
Polmont Park, W		turf cheeks	<i>PSAS 1961, 322</i>
Beancross	c 4.6		<i>PSAS 1976, 63</i>
Beancross	4.3	clay cheeks, turf core	<i>PSAS 1995</i>
Mumrills, E of		clay cheeks	<i>PSAS 1915, 122</i>
Mumrills, E of		clay cheeks	<i>PSAS 1961, 95</i>
Mumrills Fort	4.5	clay/earth	<i>PSAS 1961, 93</i>
Mumrills, W of		clay cheeks of stiff yellow clay 18in wide	<i>PSAS 1961, 94</i>
Mumrills, W of	4.9	clay cheeks	<i>PSAS 1915, 133</i>
Mumrills, W of	4.4	turf cheeks	
		whitish grey, 18in wide	<i>PSAS 1961, 94</i>
Northby 1	4.5	clay cheeks	<i>PSAS 1915, 133</i>
Northby 2	4.5	clay cheeks	<i>PSAS 1915, 133</i>
Callendar Park	4.5	turf cheeks? earth & turf core	<i>PSAS 1989, 144</i>
Callendar Park	4.3	clay cheeks, pale blue clay 36cm wide, earth core	
Callendar Park		clay cheeks	<i>PSAS 1915, 132</i>
Callendar Park		clay cheeks	<i>PSAS 1915, 131</i>
Kemper Avenue	4.5	turf cheeks, 1 m wide, earth core	<i>PSAS 1981, 249</i>
Falkirk, Rosehall	4.6	clay cheeks	<i>PSAS 1915, 128</i>
West Burn	4.2		<i>PSAS forthcoming</i>
Falkirk, Mayfield		clay cheeks	<i>PSAS 1925, 284</i>
Bantaskine	4.6	turf cheeks? 1 m wide, earth core	<i>PSAS 1976, 71</i>
Watling Lodge, E		clay cheeks	<i>PSAS 1925, 284</i>
Watling Lodge, E	4.6		<i>DES 1961, 55</i>
Watling Lodge, W		turf	<i>PSAS 1974, 171</i>
Watling Lodge, W		turf	<i>PSAS 1925, 284</i>
Oakvale Cottage		turf	<i>PSAS 1976, 63</i>
Tayavalla	4.6		<i>AWR 128 n 2</i>
Tayavalla		turf, different quality turf used as cheeks	<i>PSAS 1995</i>

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