Proc Soc Antiq Scot, 130 (2000), 223–281

Excavation of an Iron Age and Romano-British enclosure at Woodend Farm, Johnstonebridge, Annandale, 1994 & 1997

Iain Banks*
with contributions by D Alldritt, J S Duncan, E Photos-Jones, I A Simpson, K Taylor & B Simpson

ABSTRACT

Excavations were undertaken at a multi-vallate enclosure on Woodend Farm by GUARD in the late summer of 1994 in advance of the construction of the M6 motorway extension. Geophysical survey and excavation revealed a third bank beyond the two upstanding banks. Within the interior, seven separate blocks of superimposed buildings were observed, together with an eighth, single-phase structure interpreted as an animal pen. Artefacts were few, consisting of worked stones and querns, while the radiocarbon dates indicated occupation substantially in the Romano-British period, although the enclosure was built in the pre-Roman Iron Age. A return was made to Woodend in 1997 during the topsoil operations for the construction work and three further structures were recorded.

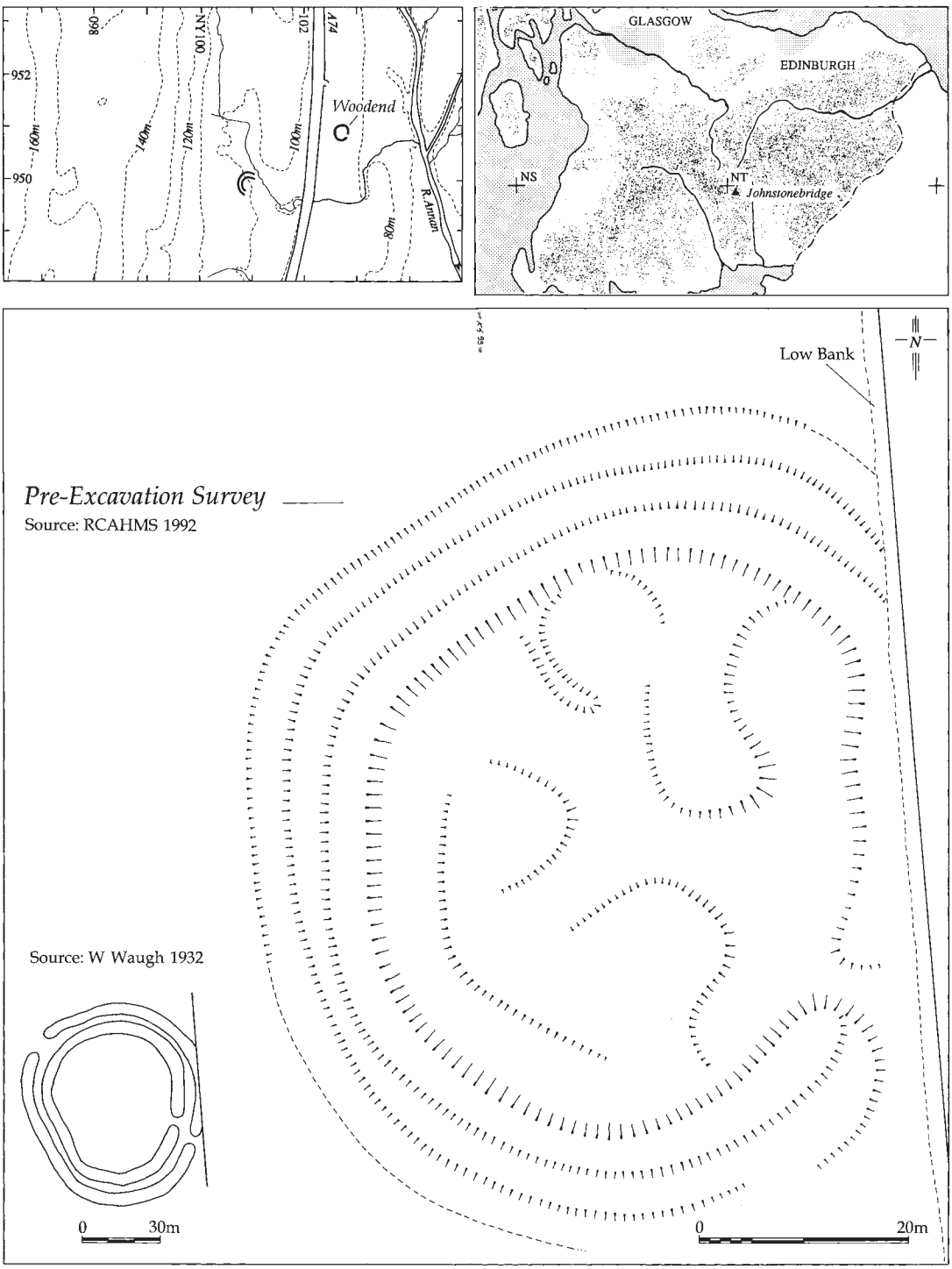
INTRODUCTION

In August and September of 1994, Glasgow University Archaeology Research Division (GUARD) carried out an excavation on an oval-banked earthwork enclosure at Woodend Farm in Annandale, Dumfriesshire (NMRS NY19NW4; NGR NY 1053 9516) on behalf of the National Roads Directorate of the Scottish Office Development Department under the auspices of Historic Scotland. The proposed route of the M6 extension ran adjacent to the site, but an access road for local traffic would run under the motorway to destroy roughly 75% of the enclosure. Excavation took place in 1994, with further work in 1997 during the topsoil stripping for the construction of the carriageway and all-purpose road.

The enclosure at Woodend Farm in Annandale was located 7 km south of Beattock in a field on the eastern side of the A74 dual carriageway (illus 1). This field was largely flat, running north/south along a ridge above the river Annan, with the land dropping away sharply down to the farm and then continuing down to the river. The enclosure lay at the edge of the field at a height of 90 m OD and was partly truncated by a field boundary.

The local soils were brown forest soils with gleying developed on drifts derived from Lower Palaeozoic greywackes and shales of the Ettrick Association (Soil Survey of Scotland 1982), and

* Glasgow University Archaeological Research Division (GUARD), Department of Archaeology, University of Glasgow, Glasgow G12 8QQ



ILLUS 1 Location map (*Based on the Ordnance Survey © Crown copyright*)

patches of boulder clay locally (BGS 1:50,000 10W). This drift geology caused the field to be prone to waterlogging, exacerbated by the interruption to the natural drainage patterns caused by the 1960s construction of the A74. Parts of the field were saturated and under standing water during the course of the excavation.

The predominant modern landuse in the area consists of pasture. The *Old Statistical Account* (OSA IV, 248) has a reference to a farm of Woodend in 1790 that suggests the land was used mainly for pasture, although it is not entirely clear whether this is the same farm. During the Second World War, with the large-scale use of marginal land for crops, the area was ploughed and, in planning the excavation strategy, it was assumed that the site would be plough-damaged. The low height of the banks, which in some parts of the circumference were virtually invisible, suggested that ploughing had caused serious erosion.

ARCHAEOLOGICAL BACKGROUND

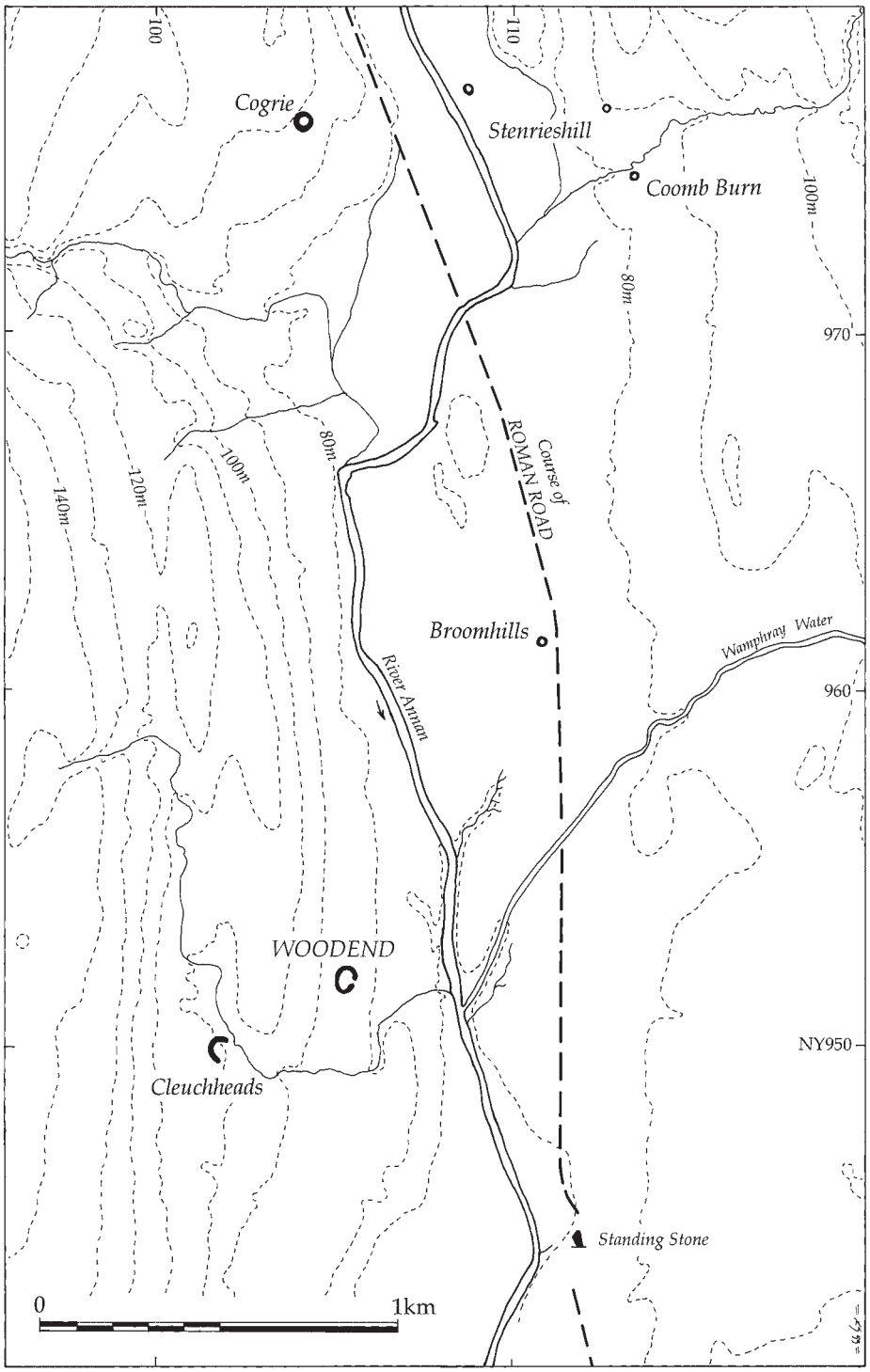
The enclosure on Woodend Farm measured some 59 m by 48 m internally, the banks increasing this to 80 m by 70 m externally, and was roughly oval with at least two banks visible on the surface before excavation. At the time of excavation, only one entrance, to the south-east, was visible and appears on the most recent survey by the Royal Commission on the Ancient and Historical Monuments of Scotland. This entrance lay outwith the road-line and remains unexcavated (see illus 1 & 3). However, both the Ordnance Survey field drawing and a survey from 1931 (Waugh 1931) indicated a second entrance to the north-west.

A number of enclosures and settlements of presumed Iron Age date are in the area of Woodend (illus 2), several being quite similar to this site although few have as many banks. The nearest of these, confusingly also called Woodend, lies some 400 m to the south-west on the bank of a burn at Cleucheads (NY19NW17; NY 1018 9501). It is roughly the same size as the present site and also has fragmentary remains of a double or triple bank. To the south-east, some 1.2 km from Woodend, is a cropmark of another enclosure at Gateside Farm (NY19SW11; NY 1100 9402) (not illus).

Several similar sites have been recorded as cropmarks in the area: a ring-ditch at Broomhills roughly 1 km to the north-east (NY19NW22; NY 1109 9614) and two cropmark enclosures at Stenrieshill roughly 2.5 km north-east; the more certain (NY19NW29) at NY 112 976, the less certain (NY19NW25) at NY 1122 9783. Nearby, immediately to the south of Coomb Burn, is a scooped enclosure (NY19NW35; NY 1132 9744). This site is roughly half the size of Woodend, and contains two house platforms within a large bank. Cogrie, a settlement 2.4 km north of Woodend (NY19NW3; NY 1041 9759), is again roughly half the size of Woodend with a 5 m wide bank, but lacks any indications of house platforms.

Sites elsewhere in Dumfriesshire resembling Woodend include Brieryshaw, Broomhillbank, Westside, Tamlaw Hill, Newland Hill and Cauldkinefoot (Jobey 1971), all with double banks and internal scoops, while Tamlaw Hill is also on the edge of a slope. Boykenburn and Crooks show strong morphological similarities to Woodend, despite only having one bank each (Jobey 1971). In Lanarkshire, the excavated site of Candyburn, though roughly half the size, was a similar shape with a single bank (Lane 1986).

The Woodend Farm enclosure resembled other sites across Britain and Ireland, such as Walesland Rath in Pembrokeshire (Wainwright 1969) and Castell Odo in Caernarvonshire (Alcock 1961). The form is known in Ireland, where many of the raths or ringforts seem to have the same internal dispositions. The scooped settlement of Ballyutoag, County Antrim, also resembles Woodend although it produced radiocarbon dates in the mid first millennium AD



ILLUS 2 Later prehistoric sites in the vicinity of Woodend Farm

(Williams 1984). In England, many Northumbrian enclosures resemble Woodend internally, such as Coldsmouth Hill and Riding Wood (Jobey 1966). These provided a good idea of what to expect, although such morphological similarities can be deceptive.

Internally, the RCAHMS survey indicated several upstanding features (illus 1), a number of which could have been interpreted as the remains of houses (see Banks 1995a). The features in the survey plot suggested at least two phases. Thus, on the pre-excavation field evidence, the expectation was that the enclosure contained a number of probably stone-built structures covering more than one phase and possibly involving an open phase of settlement.

AIMS AND METHODS

The intention of the excavation was to recover evidence concerning three main elements: the date and chronology of the occupation of the enclosure; its function; and its environmental context. Banked enclosures are normally considered Iron Age in date but there is no reason to assume that such enclosures could not have been used into the post-Roman period. The enclosure was assumed to have been a farming settlement, but there has been debate over the nature of the agricultural regimes at other sites, some interpreted as stock-rearing sites, others as crop-processing sites and some as practising a mixed economy. Botanical evidence was to be a critical element in determining the nature of the economies practised on site. Palaeoenvironmental investigation of the economic practices on the site was intended to reveal information about the surrounding landscape, to allow some characterization of the environmental context of Woodend. Micromorphological analysis of the soils was another key element in order to examine the use of any structures and the construction of the banks.

The first element of the fieldwork was a large-scale geophysical survey covering most of the field, an area of around 20,000 sq m. This was intended to guide the subsequent excavation and to assess any associated works around the site. The survey was carried out using a Geoscan FM36 fluxgate gradiometer using 20 m grids at 1 m intervals. The results were processed in the field and plotted using Geoscan's Geoplot v2 (not illus).

As the RCAHMS survey of the enclosure suggested the presence of upstanding remains, test-pits were dug across the interior. The pits suggested a maximum of about 0.3 m topsoil overlying cobbling, and machine-stripping of the interior appeared to be inappropriate; it was decided to hand-strip the site. In fact, the overburden was a minimum of 0.3 m, parts of the site having about 0.5 m of overburden, while the cobbles proved to be an accumulation of stone from ploughing. The process of stripping and cleaning the site was consequently much more onerous than had been anticipated.

Once stripped, a 5 m site grid was established and the site divided into two areas: Areas A & B (illus 3). Although the interior of the site was cleaned by hand, sections across the banks were machine-cut. Three sections were cut initially: one 5 m wide section to the north on the edge of the road-line (Section W); one 2 m section to the west (Section X); and a further 2 m section (Section Y) to the south. In addition, adjacent to Section Y, a 5 m wide trench (Section Z) was also opened. It was cleared down to the top of the bank material to investigate the possibility of a palisade. The machine also excavated a 5 m wide halo some 10 m beyond the outer bank to investigate any traces of settlement pre-dating the enclosure. This was labelled Area C to the north and Area D to the south.

The excavation of the banks also provided four sections of the ditch, intended to recover evidence for any re-cuts and also environmental material for analysis. A further six sections were

machine-dug at the end of the excavation to investigate the construction of the ditch. Thus, in all, a total of 10 sections was cut across the earthworks (illus 3).

A sample of the silts was taken from the ditch for palaeobotanical analysis, along with micromorphological samples from the banks and ditch. Micromorphological samples were also taken from the interiors of some of the buildings, while phosphate samples were taken from the 5 m grid intersections across the site. Background samples for both the palaeobotanical and phosphate analyses were taken to identify modern contaminants, to avoid any uncertainties in the dating and to indicate the levels of phosphates to be expected in the natural soils of the area.

GEOPHYSICAL SURVEY

The geophysical survey (not illus) covered the whole of the field up to a former field division, represented by a low bank. The most obvious feature in the results was a linear anomaly running roughly SW/NE across the plot, representing an old water pipe. This lay just below the turf-line.

Two of the banks of the enclosure appeared in the plot. There was a trace of the third, but this was very faint and did not appear around the full circumference of the enclosure. However, the plot is extremely difficult to use because of the amount of background 'noise', quite apart from the effects of the water-pipe. Anomalies making geometric shapes could be seen in the enclosure after extensive processing, but none gave the impression of being unequivocally related to human activity. The same was true of the remainder of the field. The results of the survey were thus not capable of guiding the excavation and were too inconclusive to suggest areas for further investigation. Additional stripping would have caused considerable inconvenience to the business of the farm, so no attempt was made to test anomalies beyond the excavated areas.

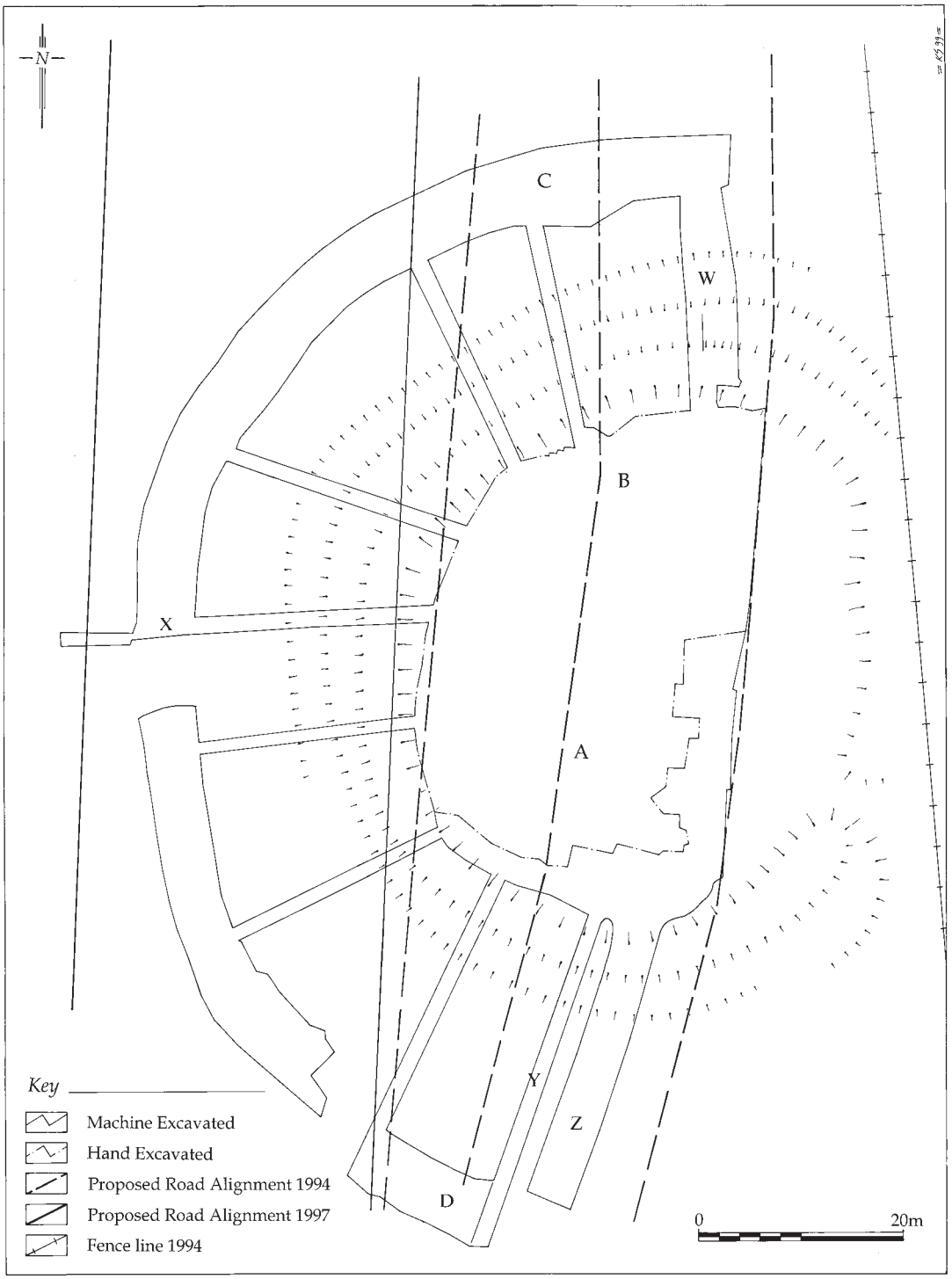
The line of the motorway carriageway was examined during the 1997 topsoil operations, revealing features below the banks and outside the enclosure.

EXCAVATION

The initial strategy, based on the results of the test-pits, was to remove the turf and topsoil within the enclosure by hand. After stripping the turf, it rapidly became apparent that there was a considerable deposit of topsoil present. It also became apparent that the surface detail did not relate to upstanding features, nor to any archaeological features cut into the subsoil. It is possible that the surface hummocks represented the remains of later turf structures, but there was no associated material to suggest they were anything other than natural.

There was one advantage to hand-stripping. Artefact recovery during the excavation was very poor, even allowing for the problems of retrieval without sieving. The site assemblage consisted entirely of coarse stone tools and quernstones. In other circumstances, this would have been seen as a combination of plough disturbance and machining. In this case, however, it is clear that the paucity of artefacts relates more to an absence of material than its accidental removal during excavation.

Below the topsoil deposit, much of the interior was covered with stones, the 'cobbling' noted in test-pits. Some of these deposits of stones appeared purposeful, others less so, either the result of dumping or chance accumulation during ploughing. The pre-excavation plan recorded each of the stone accumulations in case any of these was structural; initial impressions in the field were of a series of circular and rectangular structures, although these proved to be largely illusory. Stones sitting solely in topsoil were removed along with the last of the topsoil and the drawing amended to show any changes in detail.



ILLUS 3 Plan of excavated areas

At this stage, the most obvious element was a linear feature (F212/057) running roughly north/south across the eastern side of the enclosure. Stratigraphically the most recent archaeological feature, it was nevertheless earlier than the modern drains. Filled with a grey-black silty loam, there was no indication of a ceramic pipe or of stone to aid drainage, although originally it probably served as a drain and certainly post-dated occupation of the site. It was partly obscured by the stones which covered the rest of the features on site once the turf had been removed.

AREA A (ILLUS 3 & 4)

This southern half of the site was initially thought to contain three isolated buildings (illus 5): Structures 1–3 (hereafter S1, S2, S3, etc). With all loose stone removed, S2 proved to be illusory and work concentrated upon S1 and S3. As the excavation progressed, it became apparent that there were four separate blocks of superimposed buildings within this area (illus 4).

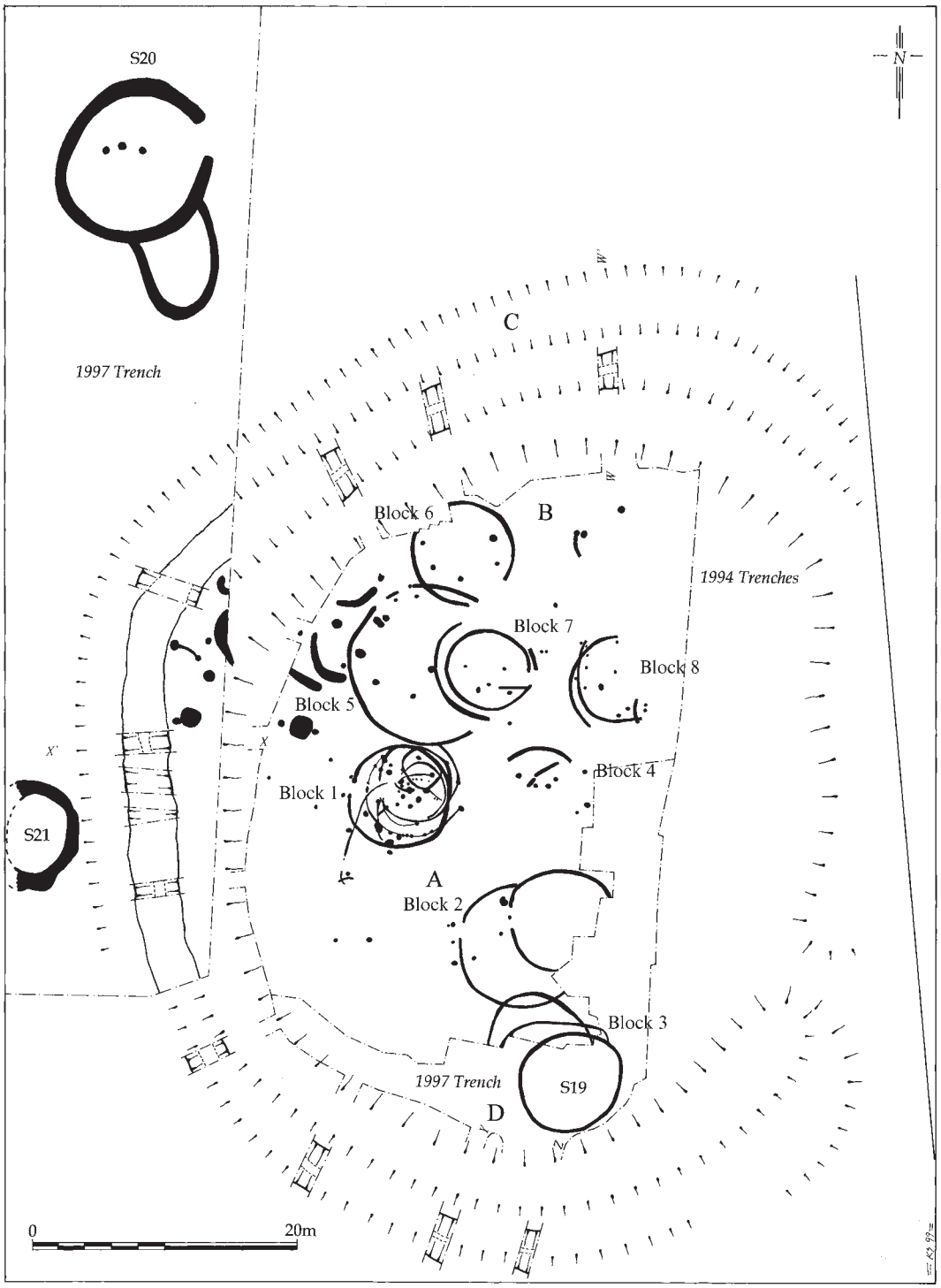
Block 1 was based upon S1. The first phase of cleaning revealed a sequence of three separate roundhouses, S1, S4 and S5, of which S1 was the most recent and the most substantial (illus 5). Further cleaning brought the final tally for the block to five buildings, with part of a sixth construction.

S1 measured just under 8 m in diameter and was defined by a slot trench (F030/049) with stone packing and a series of stake-holes in the base, varying between 0.1 m and 0.2 m in depth. An accelerator date from *Hordeum* grains in the fill of this slot provided a date of 1935 ± 40 BP (AA-24952). The entrance appeared to be on the western side and consisted of terminals to the slot trench, two terminal posts and two external posts. S4 consisted of a less substantial slot trench (F032/065) containing a number of stake-holes and was roughly 12 m in diameter. This also had a reasonably well-defined entrance, again on the western side. The accelerator date from *Hordeum* grains in this fill provided a date of 1865 ± 45 BP (AA-24949). S5 was more ephemeral, constructed from a series of post-holes and stake-holes, where the posts would have formed the strainers for wattle sections of walling. It measured roughly 7 m in diameter and had an entrance to the east, one side of which was clearly defined by post F576. It was not possible to obtain a date for this building.

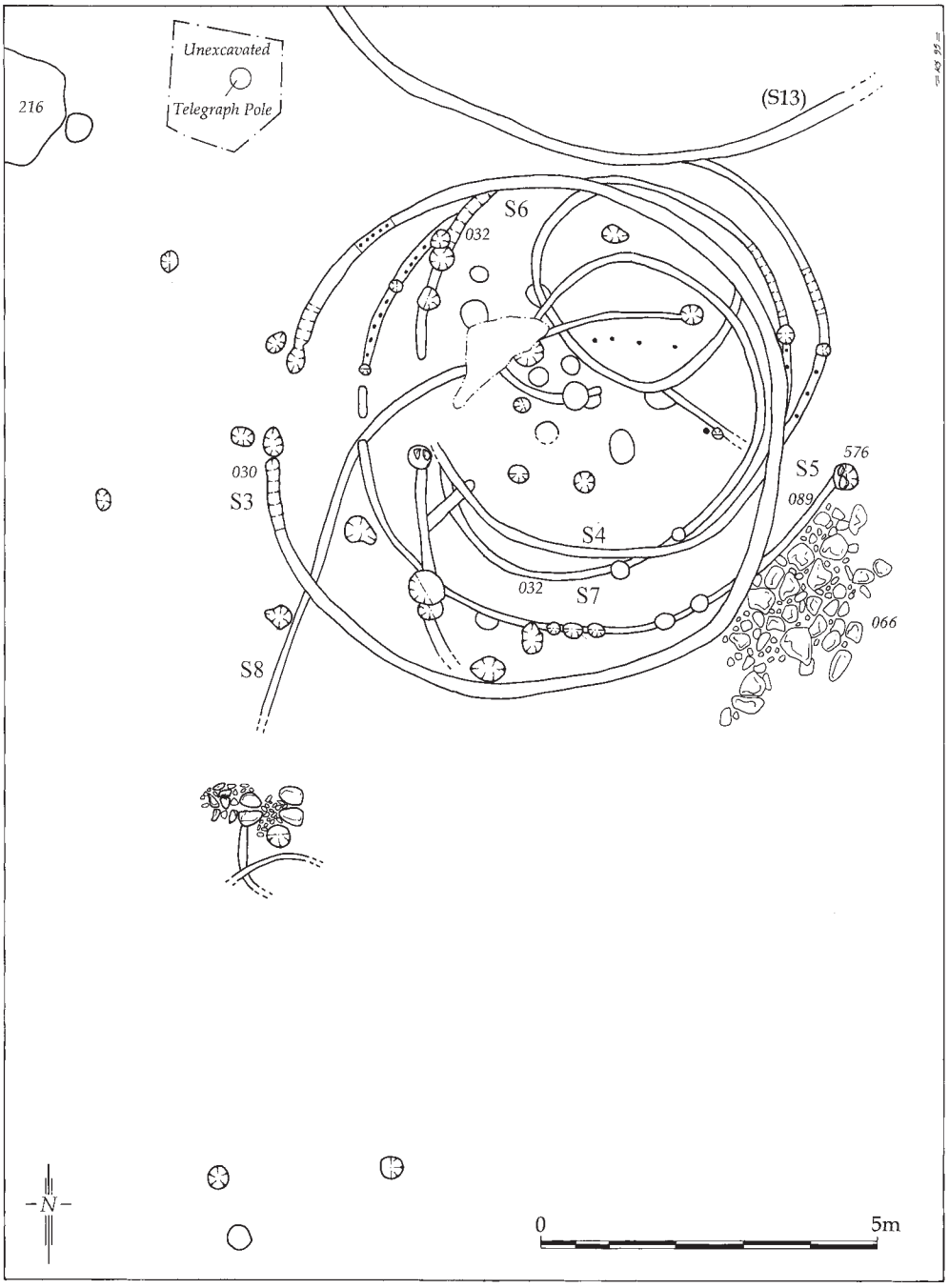
There was one point where the circumferences of S4 and S5 overlapped, which would have allowed precise definition of their relationship, but unfortunately this was destroyed before the existence of S5 was suspected. A section had been excavated across the slot of S4 to characterize the constructional techniques employed and this was coincidentally in the one place where the relationship between the two buildings could have been demonstrated. The best interpretation is that S4 is later than S5; S4 matches the more substantial construction of S1, the more recent building, while S4 was revealed earlier in cleaning than S5. This interpretation is supported by the radiocarbon date for Structure 13 (Beta-129443, 2000 ± 40 BP), which cuts S5; this date is earlier than S4 (see above), and it suggests that S5 is pre-Roman.

There were two other buildings within this complex which lie early in the constructional sequence (illus 5). These were stratigraphically earlier than S4, but could not be related to S5 since there were no points of contact between them. Both were extremely ephemeral and were recognized only towards the end of the excavation; neither provided a radiocarbon date. The earlier was S6, a small construction running out from the north-east arc of the S1 trench. It measured roughly 3 m across and consisted of a 0.12 m wide slot with a series of stake-holes in the base. It was cut by S7, the second of these ephemeral buildings. This was a sub-circular construction of 4–5 m diameter. Again, this was a small slot trench with a series of stake-holes at the bottom. There was no evidence of an entrance to the building, unsurprising given the ephemeral nature of the features. The only relationships which could be determined were that S4 cut S7 and S7 cut S6.

S8 was the final construction located in this complex (illus 5). This was cut by both S5 and S7 and was probably the earliest element in this complex, although no date was obtained for it. S8 consisted of a narrow slot trench with evidence of stake-holes in the base like the other structures, but unlike the others it was not a circular or sub-circular building and instead perhaps part of a much larger feature. The line of the feature



ILLUS 4 General plan of excavated structures



ILLUS 5 Structures in Block 1

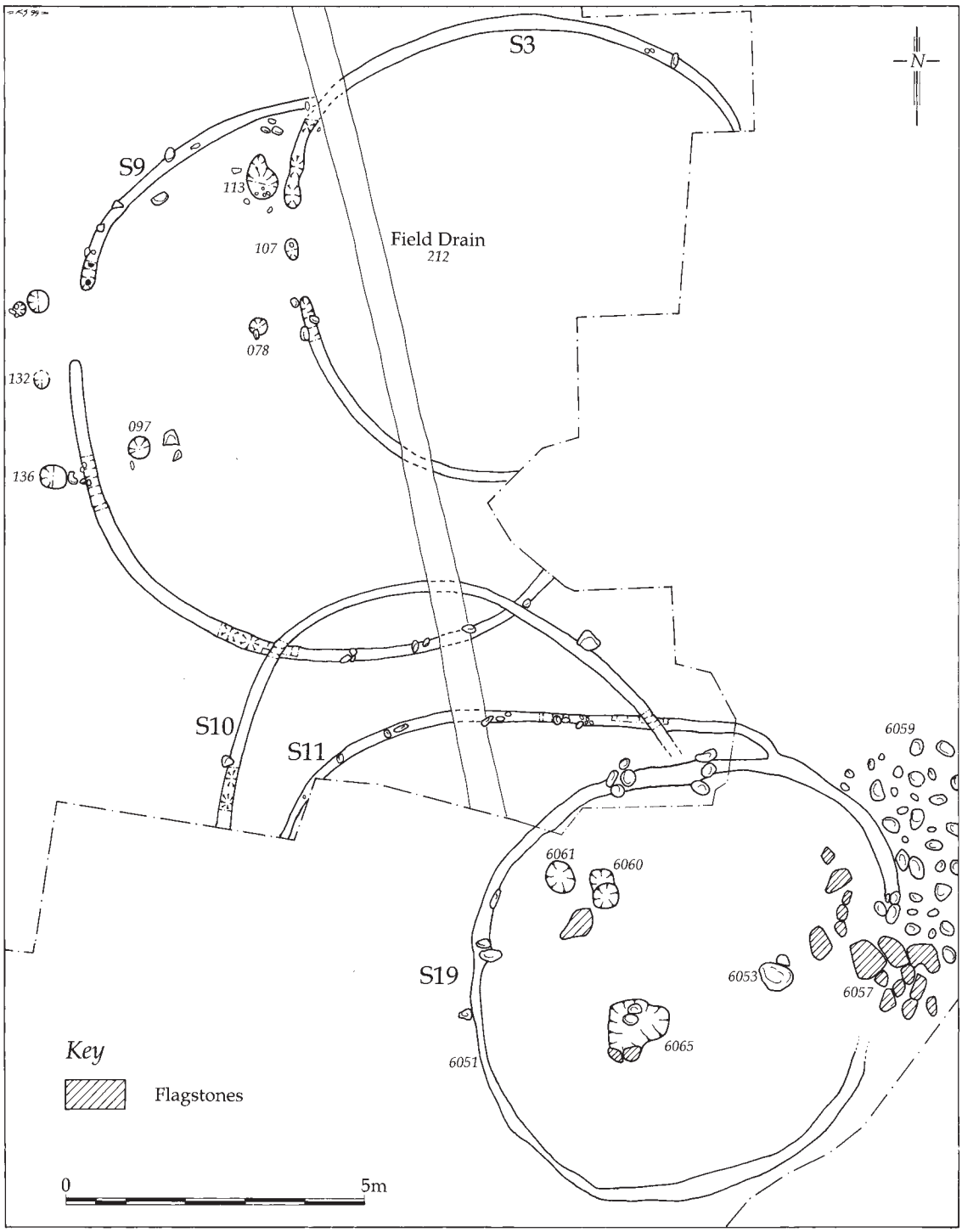
as recovered curved through Block 1 from a post-hole close to the north-east arc of S1, ran under the south-west arc of S1, then in a relatively straight line for a further 6.75 m, making a full length of over 13 m (illus 5). It ran through an area of laid stones where it was cut by a short line of stakes; after this, the line of the wall appears to cut back as though forming a 'back wall'. However, the rest of this putative structure was lost; it may not have been a building and may be the remains of a fence from one of an early episode in the history of the site. The area of laid stones consisted of two lines of two large stones laid either side of a patch of rubble with an apparently paved area abutting the western side (not illus). This appeared to respect a circular stone-lined pit ringed with stake-holes and which was in turn respected by the line of stakes which cut S8.

Overall, there was a rough constructional division between the reasonably substantial S1 and S4 and the other buildings, which all relied largely upon stakes for the walls. This reflects the chronological sequence since S1 and S4 were the latest buildings in the sequence. The sequence is likely to have been S8 as the earliest, then S7, S6, S5, S4 and finally S1. The four earlier elements probably date to the pre-Roman Iron Age, while the two later buildings have been radiocarbon dated to the Romano-British period.

The last feature of note in Block 1 lay along the eastern edge of S5. It consisted of several square metres of loose black soil (F066) (not illus), containing a large amount of stones ranging from small chips to large slabs, filling an apparently natural depression. Many of the stones were fire-cracked; some were very substantial, being up to 0.5 m in length, and many appeared to have been at least partly dressed. Many of the smaller-sized stones proved to be the remains of broken coarse stone tools, including a butchering tool, hammerstones, rubbers and chisels (see Taylor, below). There was a large amount of charcoal from the bulk soil sample taken (see Alldritt, below), particularly when compared to samples from the rest of the site. The micromorphological analysis also indicated a higher charcoal incidence than elsewhere, as well as bone fragments, high biological activity and fungal spores indicative of animal manure (see Simpson, below). This seems to have been a midden for at least one phase of Block 1, although there is no way of connecting the deposit to a particular building. Although there was sufficient charcoal within the deposit to provide a radiocarbon date, no sample was submitted for dating because of the mixed nature of the feature.

Block 2 lay to the west of Block 1 (illus 6). This block consisted of two separate buildings, S3 and S9, both of them reasonably substantial. The relationship between the two could not be shown since the only apparent point of contact had been destroyed by the drain (F212/057) which ran north/south across the site. However, since S3 was the first to be revealed in cleaning, it is likely to be the more recent. The building consisted of a 0.23 m wide slot trench with a number of post-holes giving a diameter of just over 8 m. The entrance lay on the western side and contained a central post-hole (F107). Outside the entrance were a post-hole (F078) and a pit (F113). These were initially considered to be part of a porch, but pit F113 was evidently not a post-hole and the overall alignment of the features was too skewed for this interpretation. Also just outside the entrance was an earthfast stone about 0.75 m across which was heavily cracked and had a distinctive red hue. This was considered a strong possibility for a hearth site, but later testing with a magnetic susceptibility field loop failed to produce any indication of enhanced thermomagnetism.

The complete circumference of S3 was not recovered. The south-east arc lay under an area of particular waterlogging which was not cleaned because of time-pressure. Part of the north-east arc was uncovered and recorded, allowing a reasonable idea of the size and shape of the original slot trench. Much of the northern arc was lost in an area of disturbance, although it was just discernible by the pattern of stones trampled into the trench. A problem common to all of the buildings on the eastern side of the enclosure was that the features were heavily abraded, with fills much the same as the background soils, in contrast to the buildings on the western side. The best interpretation is that the area was trampled by cattle after the abandonment of the structures. Trample would account for the damage to the features and the similarities between fill and background. This is given some support in the micromorphological analysis of a sample to the east of these structures, indicating open, grass-covered space with some degree of livestock grazing (see Simpson, below).



ILLUS 6 Excavated structures in Block 2 (above) and Block 3

Another effect of the disturbance to the area was that it proved impossible to locate any post-holes which could be confidently identified as supports for the roof. Finally, because of the truncation of the features in this area, there was insufficient material for dating this structure.

The second building in this group (S9) was similar in size to S3, a diameter of around 9 m, and had a similar level of preservation; no date was obtained. The constructional technique was similar to S3, consisting of a 0.35 m wide slot trench containing a series of post-holes. The entrance again lay on the western side, but in this case was a simple gap between terminal posts with no central post. There were again exterior posts; posts F136 and F132 lay close to the line of the slot trench on the south side of the entrance, but there were no posts with a similar relationship to the northern side. There does not appear to have been a porch structure. Internal posts, as with S3, were notable by their absence, with only post F097 as a possible survivor of an internal post-ring. However, it could be argued from looking at the features in plan that the post-holes do not relate to the two known buildings but instead form the remains of a third structure. In such a case, the posts involved would run in an arc from post F107 in the entrance of S3 to post F136 outside the wall of S9, giving a possible diameter of around 9 m. However, there was no indication of a slot trench, even where it would have intersected with the wall of S9, and on balance it seems unlikely that there was a further structure.

Block 3 lay to the south of S3 (illus 6). This area was only partly excavated in 1994 because of the depth of the overburden and the amount of flooding. However, two circular houses were revealed during the main excavation, both better preserved than those in Block 2; a third, the best preserved of the group, was excavated in 1997.

Neither of the buildings from the 1994 season retained evidence of a hearth. The first to be noted in excavation was S10, observed as a feature cutting S9 at two points. It consisted of a narrow slot trench of around 0.2 m width with a series of stake-holes in the base of the trench. There were no internal post-holes to be related to the house and no indication of an entrance; insufficient environmental material was recovered to provide a date. The other construction, S11, was rather more problematic. When initially seen, the slot trench appeared to form an arc of a circular building; on further excavation, however, the line of the slot trench straightened out and ran off towards the east in a straight line. In this respect, S11 most closely resembles S8 from Block 1. The slot trench was around 0.18 m wide; there was no trace in the sections excavated of any post-holes or stake-holes in the base, and there was no evidence of any internal features or an entrance. However, most of this feature lay within the area still covered with mud, and it might be the case that some of the internal features of S19 belong to this feature instead. S10 clearly cut S11, as well as S9; the accelerator date for S11 was 1740 ± 40 BP (AA-24950). This means that Block 3 was later than the majority of the blocks on site and probably relates to the latest phase of occupation. Accordingly, although the date for S10 is relative, Block 2 (S3 & S9) can be seen to be earlier than this third- to fourth-century phase.

In 1997, there was an opportunity to examine this area further. The 1997 excavation, carried out by John Duncan of GUARD, revealed a new structure (6050; S19, illus 6), which was the best preserved of the buildings in this area. It does not appear to have undergone the same degree of trample-damage as the other constructions.

It was almost circular in plan, with an average diameter of 7.5 m and an entrance on the ENE side. The construction trench (6051) ranged from 0.3 m to 0.4 m wide and was filled with a dark grey-black sandy silt (6052) with a large concentration of medium and large sub-angular and sub-rounded stones. The slot trench had a flat base with a depth of 0.16 m. The entrance area was indicated by the presence of a partly paved area (6057), 1.5 m wide, which projected out of the structure towards the east. A cobbled area (6059) extended north-east into the eastern baulk from the edge of this paved area, measuring 3.5 m wide. This cobbling consisted of firmly packed small and medium-sized sub-angular and sub-rounded stones. Also present were several post-holes (6055, 6060, 6061, 6071 & 6072) and a pit (6053).

The pit produced the largest amount of carbonized material on site. In total, 179 carbonized grains (consisting of 25 grains of *Hordeum vulgare* var *vulgare*, 57 *Hordeum vulgare* sl, 36 *Hordeum* sp and 61

indeterminate poorly preserved cereals) were recovered from the fill. No charcoal was present, so while the feature cannot be considered as a hearth, it demonstrates that a hearth had been present. It also shows that much of the evidence from the site (botanical as well as archaeological) has been lost to post-depositional factors.

Block 4 lay on the north-eastern edge of Area A (illus 9), and was the final block in the area. This block consisted of a single structure, S12. Preservation in this area was particularly poor and only the northern arc of the slot trench was recovered, with some post-holes that may not relate to the structure. It consisted of a slot trench about 0.2 m wide with post sockets at roughly 0.4 m intervals. Within this was another very ephemeral slot, roughly 0.12 m wide, which disappeared very rapidly into the putative livestock trample. Based upon the trajectories of the cuts, this trench should have intersected with S12 if it were part of a separate building, but no such intersection was observed. However, it would have occurred at a point where the line of S12 was already being lost to view, and its absence cannot be taken as evidence that this trench did not form part of a complete structural ring. A radiocarbon date of 1840 ± 40 BP (AA-24951) was obtained from a post-hole within S12. It should be noted that the sample was a mixture of alder and indeterminate fragments, so the date should be treated with caution, although it does match the dates from Block 1 quite closely.

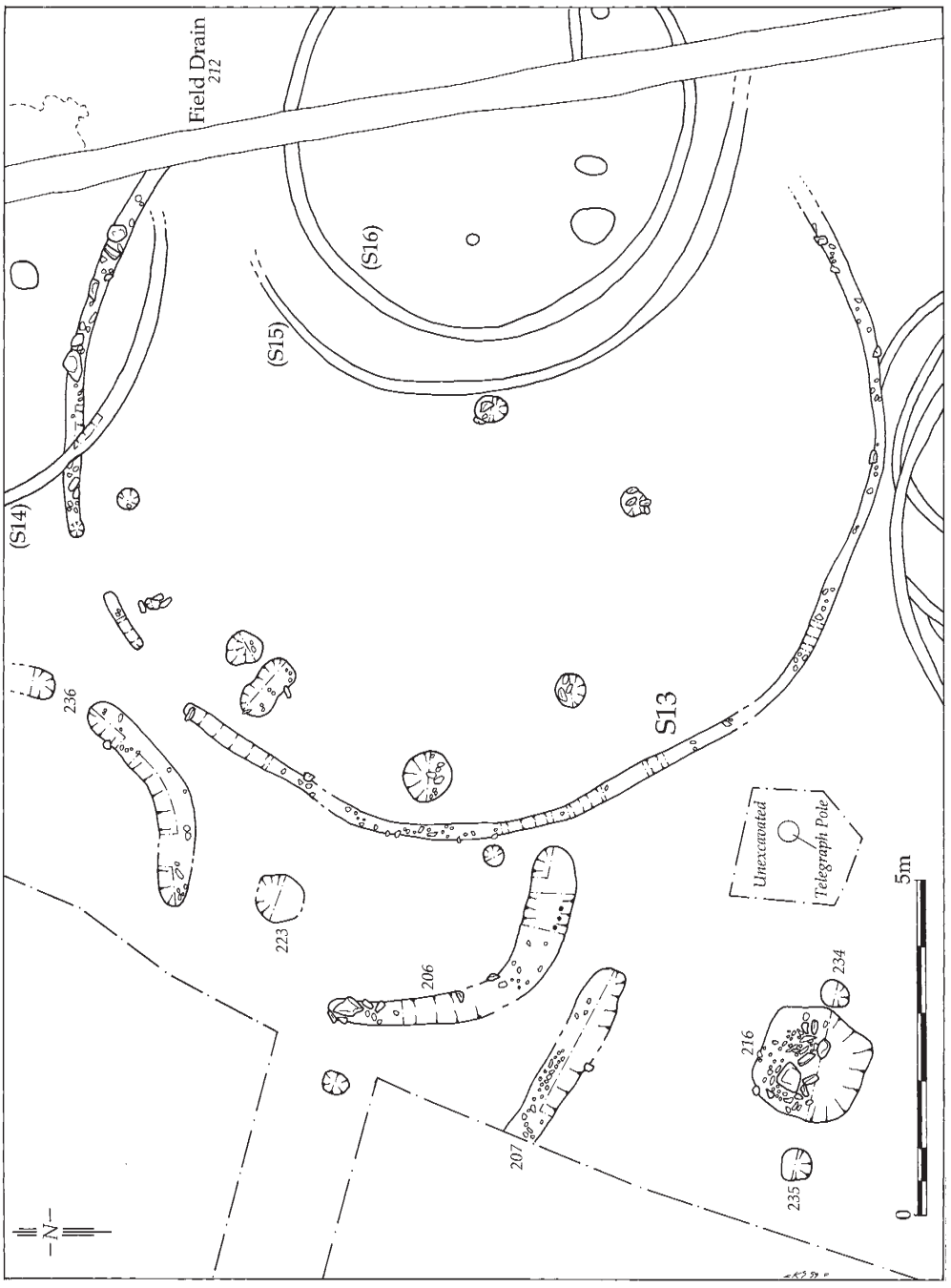
Hearths A general point to be made about all of the blocks in Area A is that there was no visible evidence of hearths. A rapid scan across each structural block was made using a magnetic susceptibility field loop, but there were no indications of enhanced magnetic susceptibility consistent with the location of former hearths. Some of the post-holes demonstrated increases in magnetic susceptibility and may indicate burning of the original post *in situ*, but there was no indication of an area of the size required for a hearth. Fortunately, the micromorphological study of samples taken from the floor of Block 1 indicated that a hearth had indeed been present (see Simpson, below). The pit in S19 containing the large cereal deposit suggests the presence of a hearth, and it can be assumed that several of the houses did have hearths at one time. The most likely explanations for the disappearance of the hearths are either that the evidence has been removed by ploughing (supported by the truncation of the features across the site) or that the hearths were originally situated on hearth stones which were later removed. This would have left little or no enhanced magnetic susceptibility in the soil.

AREA B (ILLUS 3 & 4)

The northern portion of the site also contained at least four structural stances (illus 7, 8 & 9): Block 5 (S13), Block 6 (S14), Block 7 (S15 & S16) and Block 8 (S17 & S18). None was of the complexity encountered in Block 1 in Area A. Three of the blocks (6, 7 & 8) were interpreted as houses; Block 5 was different and lay on the very edge of Area B, adjoining Block 1.

Block 5 consisted of a single building, S13, which cut S5 in Block 1. It had an internal diameter of over 12 m (illus 7) and consisted of a 0.2 m wide slot trench with chocking stones to support a wall. The structure had a clearly defined entrance to the north-west, consisting of a wide gap between the terminal posts with a small central section of trench forming a division. There were few internal post-holes and little indication of features consistent with the presence of a roof. Two or three of the post-holes within this enclosure might have been roof supports, but these were only located within the north-west arc. The other internal posts do not follow the trajectory of the slot trench, and indeed the overall pattern of the internal post-holes suggested the potential of another, smaller building within S13. However, despite repeated cleanings, no further evidence, such as a slot trench, was discovered.

The diameter of S13 did not preclude its identification as a roofed building. However, the lack of a post-ring suggested that it had not been roofed. The best evidence that the structure had no roof comes from



ILLUS 7 Excavated structures in Block 5 (centre) and Block 7 (right)

the micromorphological analysis which noted pedological features consistent with an unroofed area. The analysis also showed an increased organic input (see Simpson, below) together with chemical analysis which, while taking account of the coarse sampling interval, showed high levels of phosphates within S13, in contrast to the other structures on site (see Duncan, below). The implication of these results is that this was an animal pen where livestock was held intermittently. Similar results were obtained from the micromorphological sample taken from S15/S16, but the sample may relate to the use of S13 rather than of the later buildings. A radiocarbon date of 2000 ± 40 BP (Beta-129443) was obtained for rowan charcoal from the slot trench and is thus earlier than the dated houses in Block 1. Stratigraphically, S13 cut S5 and is thus the later construction and means that S13 lies between S5 and S1/S4 in the chronological sequence.

Block 6 lay on the north-eastern side of Area B close to the inner bank (illus 8), consisting of a single-phase building, S14. This house had a slot trench varying between 0.3 m and 0.2 m wide, with a series of post sockets for the wall and a diameter of 8 m. A rough ring of four post-holes inside the wall trench is likely to be the post-ring for the roof. The ring did not make a complete circuit of the interior, so some of the post-holes may have been lost, but enough was preserved to suggest an internal ring of supports spaced at a reasonably regular 1.9–2 m.

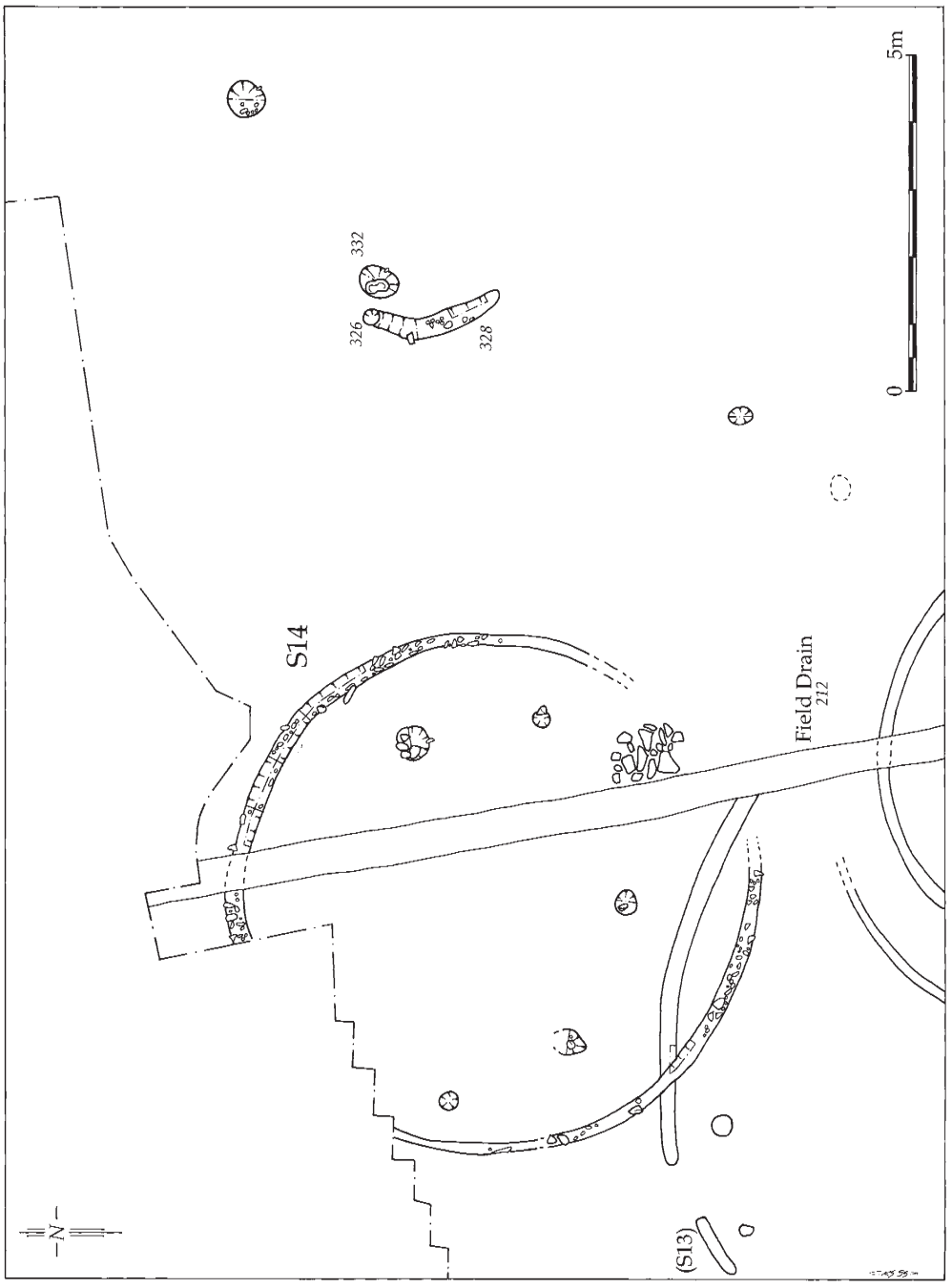
No hearth was found within this house, but the micromorphological analysis suggests that the floor was a laid deposit of vegetative material on soil which was replaced a number of times (see Simpson, below). The entrance probably lay on the south-east side, this being the only point where the slot trench was not visible. It seemed to peter out at this point, coincident with a patch of stone slabs which may have been a hard-standing for the entrance.

In terms of stratigraphic relationships, although the intersection of S14 and S13 was investigated, the nature of the soils made it impossible to determine which was the earlier. The only help comes from the radiocarbon dates, albeit with the associated problems of imprecision and the lack of single entity dates from either structure. S14 provided a radiocarbon date of 1825 ± 40 BP (AA-24953). This is significantly later than the date for S13, and matches the dates from S1 and S4. Accordingly, S14 was in use at the same time as either S1 or S4, at a later period than that of S13.

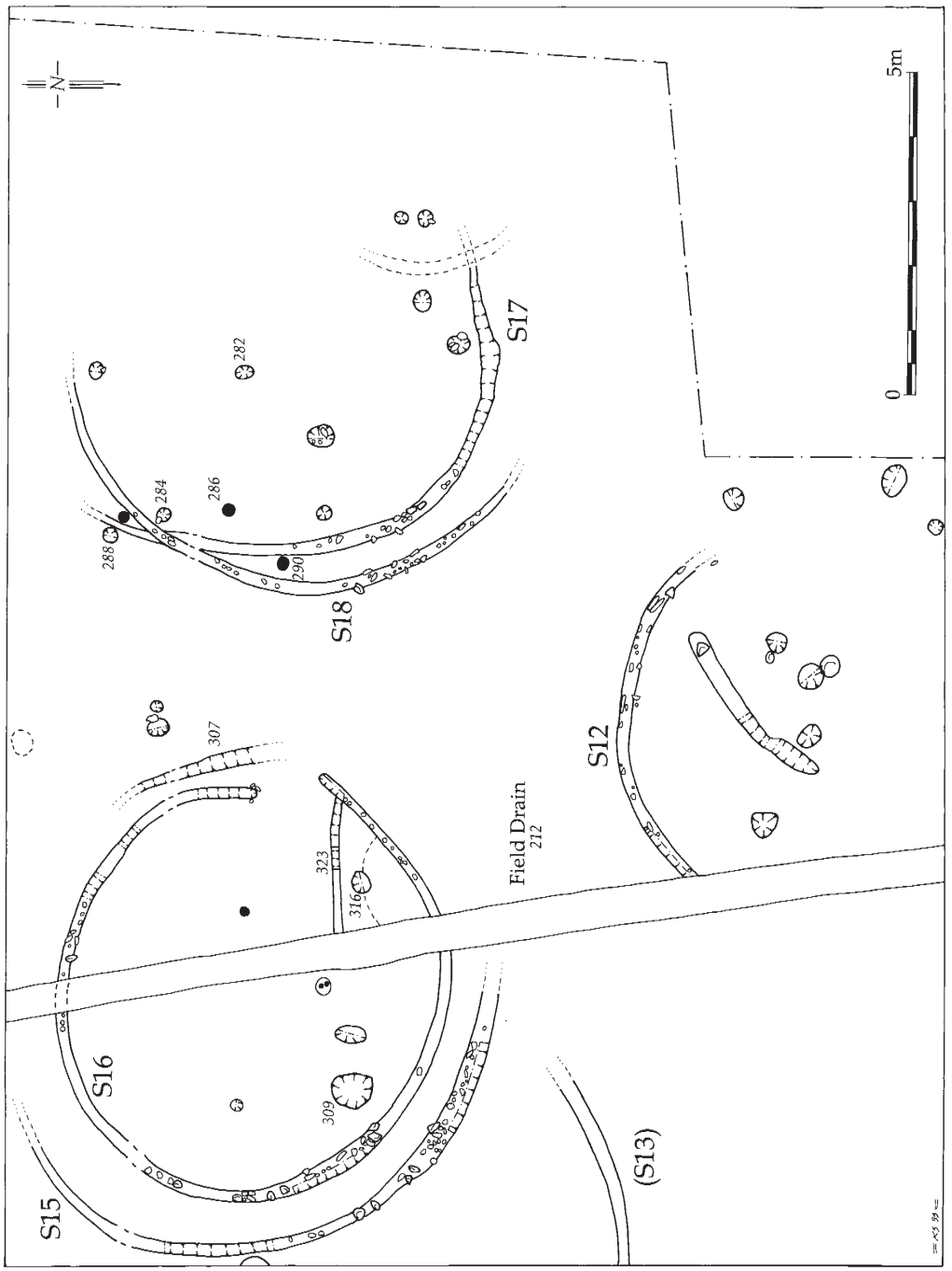
Block 7, consisted of S15 and S16, and was also stratigraphically related to S13. These two buildings were on the eastern side of S13, at a point where the line of S13 disappeared (illus 9). The eastern arcs of the two smaller houses were difficult to establish, while the eastern arc of S13 could not be determined at all. Both buildings are likely to post-date S13. The radiocarbon date obtained from S15 matches S4 and S14 at 1825 ± 45 BP (AA-24955).

The S15 trench consisted of a 0.18 m wide slot with some evidence for chocking stones. Although little of the trench was still visible, with perhaps two-thirds of its circumference lost, a diameter of about 8 m was indicated, roughly the same size as S14. There was no indication of a post-ring for the roof, but the position of S16 inside S15 made it very likely that any such evidence would have been destroyed. This also makes it likely that S15 is the earlier, since S16 lies on the probable line of any post-ring for S15. If S15 were the later building, its post-holes would have cut S16.

The whole of the 0.2 m wide slot trench of S16 survived, indicating a diameter of roughly 7 m, with an entrance on the eastern side. The slot trench had the remains of individual post sockets in its base, demonstrating the wall construction, while two post-holes (F309 & F316), both with post-pipes and packing stones, may have been the last vestiges of the post-ring for the roof. S16 was better preserved than S15, again suggesting that it was the later of the two constructions. Since S16 was entirely contained within S15, the possibility existed that the two slot trenches were part of a single double-ring building. However, as the circumferences were not entirely concentric in plan and there was some difference in their relative preservation, the two slot trenches have been interpreted as separate buildings. None the less, the close correspondence of the slot trenches for S15 and S16 suggests a direct relationship between them, and it is likely that S16 was a direct replacement for S15.



ILLUS 8 Excavated features in Block 6



ILLUS 9 Excavated structures in Block 4 (below), Block 7 (top left) and Block 8 (top right)

The final feature of note in S16 was a short slot trench (F323). Of similar dimensions (0.15 m) to the wall trench, it ran 1.7 m due west from the south-east terminal of the wall trench until it was truncated by the later drain feature (F212). Its surviving terminus abutted the slot trench for S16, suggesting a direct relationship. The most likely explanation is that it channelled entry into the house, but the position of the feature gives no obvious practical function.

Block 8 lay to the east of Block 7, consisting of two separate buildings on overlapping but separate alignments (illus 9). The earlier was S17, formed by a truncated slot trench some 0.2 m wide containing chocking stones for wall support. This gave an original diameter of around 6 m, although the building may have been sub-rectangular rather than circular. The remains of the building consisted of the western and southern arcs, while several post-holes lying close to the slot might suggest a post-ring (F211, F284, F286 & F300). However, post-hole F284 lay adjacent to the intersection between S17 and S18 and thus could have related to either. A small post-hole (F282), roughly in the centre of S17, might have been the central post for the roof, although a width of 0.2 m seems rather insubstantial for the task. However, it is possible that the post-hole is truncated and the original post was much larger than the dimensions now suggest.

S18 consisted of the western, and part of the northern, arc of a slot trench which varied between 0.2 m and 0.3 m wide (illus 9). The original diameter would have been at least 8 m, based on the arc preserved. As with S17, the base of the trench bore the remains of chocking for wall supports. The position of the chocking stones indicated clearly that S18 cut S17 and was therefore the later.

Few of the internal details of S18 were extant, probably because of the greater level of trample which the later building would suffer should the hypothesis concerning the truncated features of the eastern side of the site be correct. However, several post-holes survived that might have been the remains of the post-ring of the structure. Post-holes F288 and F290 seem likely to relate to it, and were of similar dimensions, although on opposite sides of the trench. Post-hole F284, as discussed above, could have related to this building or to the earlier S17. A radiocarbon date was obtained from post-hole F282; unfortunately, this post-hole lay in the centre of the two houses and thus cannot be assigned directly to either, while there is a slight possibility that the post-hole is a remnant of an earlier phase of activity. This is particularly important because the date is substantially earlier than the other radiocarbon dates on the site at 2175 ± 45 BP (AA-24954). This is pre-Roman Iron Age and thus earlier than the rest of the occupation, and even for the construction of the ditch. However, there is a lot of undated activity on the site, including several buildings in Block 1 in Area A which pre-date the Roman period S1 & S4. These may also represent an earlier occupation of the site. Unfortunately, the date of the post-hole does not date this putative earlier activity because of the lack of stratigraphy between this post-hole and the other features. None the less, if the date is accepted (although it derives from indeterminate fragments and may be old wood or residual), the possibility that the site was occupied before the Romans is made stronger.

Other internal features Various features in the north of Area B excavated in 1994 (illus 3 & 4) did not fit into recognizable structures and the 1997 fieldwork recorded further similar features lying under the bank. At the northern end of the site, near Section W, was a cluster of features which might have represented the last remains of a further structure (illus 4 & 8). A curvilinear slot trench F328 some 0.25 m wide contained a terminal post (F326) that seemed to have been burnt *in situ*. Adjacent to this terminal post and on the 'inside' of trench F328 was a larger post-hole (F332) some 0.25 m wide that preserved a post-ramp. A pit (F330), measuring about 0.58 m wide, lay within 3 m of these features. In view of the small length of the surviving slot trench, it would be rash to label the cluster as part of a further building but it remains a strong possibility.

There was a number of features on the western side of Area B, between S13 and the inner bank (illus 4 & 7). The function of these features was not determined in 1994. The positions of the 1994 features, very close to S13, might have suggested a relationship between them, but the dimensions of the features differed markedly to S13. Furthermore, while F236 lay at the entrance to the animal pen, it is difficult to see how it

could have been in use at the same time as S13. When road construction work in 1997 removed the north-western arc of the banks, it became apparent that these features related to others sealed by the bank; they must all relate to an earlier phase of activity which includes at least two buildings outside the enclosure.

On the border between Area B and Area A (illus 4 & 7) was a large pit (F216) some 0.6 m wide and 0.2 m deep with evidence of a re-cut. The fill consisted of a compact grey-black silty loam containing a large number of angular stones in the upper parts of the deposit. A patch with a similar concentration of angular stones on the surface further to the north proved to be a patch of bedrock, the only point on the site where this occurred. Immediately alongside pit F216 were two small scoops that initially appeared to be part of the same feature. Scoop F234 to the east was 0.5 m wide, while scoop F235 to the west was 0.45 m wide. There is no explanation for this group of features.

Between the western arc of the wall of S13 and the inner bank (Block 400) was a series of trenches (F206, F207 & F236), the most northerly of which (F236) lay in front of the entrance to S13 (illus 4 & 7). This 0.3 m wide slot, which appeared to have an entrance defined by two further well-defined butt ends, was initially interpreted as a house slot. However, the southern section of the trench had a well-defined butt end at the western end, apparently forming a terminus to the slot; this means that the trench did not form a continuous slot, and at best was a segmented trench. On the northern side of the apparent entrance, the slot disappeared very rapidly and only a very small length of the trench could be found. There was no indication of posts or stakes in the bottom of the slot, unlike the slot trenches described above as parts of structures. It must therefore be concluded that the slot related to something different to the dated Romano-British structures on the structural stances. There was no evidence to date trench F236 and the only possible interpretation is that the feature differs considerably from the dated features on site and is probably earlier.

To the south of trench F236 was a large post-hole (F223) of roughly 0.45 m diameter, containing some evidence of post-packing. Unfortunately, this feature had been truncated by a modern field drain.

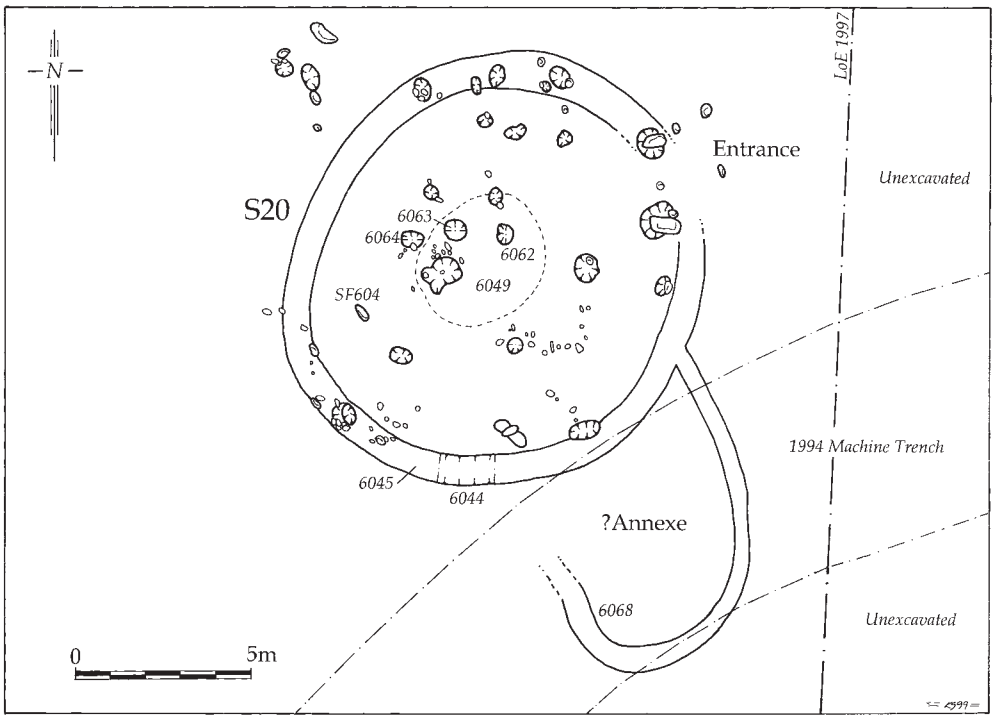
Two slots were located south of post-hole F223 (illus 7). The more apparent was slot F206, a 0.15 m wide slot containing stake-holes in the base. It was a rough L-shape, the eastern arm terminating in a butt-end adjacent to the slot trench for S13. The butt-end was clearly defined but there was no evidence of a continuation on the inside of S13, as might have been expected. At the northern end of the other arm of the trench, the slot terminated in a less clearly defined butt-end with a number of stones. This feature seems to be discrete and there is no indication of any related slots to suggest a building, although this was the initial interpretation. The stake-holes found in the base of the trench are the best support for this interpretation.

The second slot (F207), measuring 0.4 m wide, lay on the southern side of slot F206. It ran roughly east/west, for a distance of around 3 m, with a well-defined terminal at the eastern end, and petering out just short of the bank itself.

Sub-bank features In 1997, several features were recorded lying under the bank and very close to the ditch (illus 4 & 10). This was not a surprise, since section X in 1994 had revealed a scoop (F336) located under the inner face of the inner bank (not illus), and a small slot trench with a V-profile (F430; not illus) cut into the substance of the inner bank. There was no evidence to suggest the nature or function of these features. The 1997 material, because a wider area had been revealed, was more informative.

The first feature was a pit (6024) closely resembling pit 216 in size and shape, and measuring 1.75 m by 1.2 m across and 0.28 m deep. Immediately adjacent was a small post-hole (6016) containing the remains of post-packing, in a relationship similar to pit 216 and scoop 235. There was another post-hole with stone-packing (6019) and a series of shallow features suggesting both pits and truncated post-holes (6021, 6024, 6026, 6028 & 6038).

In addition to these features, there was evidence for two further buildings (6043 & 6003). S20 (6043; illus 10) was about 12 m in diameter and roughly circular. The trench for this building was ephemeral, while a soil mark (6068) on the SSE of the house gave the impression of an annexe. However, there was no indication of a cut feature, so this element remains tentative. There was an occupation deposit (6048) including some charcoal, which appeared to concentrate in the centre of the structure. Unfortunately, there was insufficient identifiable material to provide a date for the structure. Several post-holes lay inside the



ILLUS 10 Sub-bank features in the north-west sector of the excavated areas

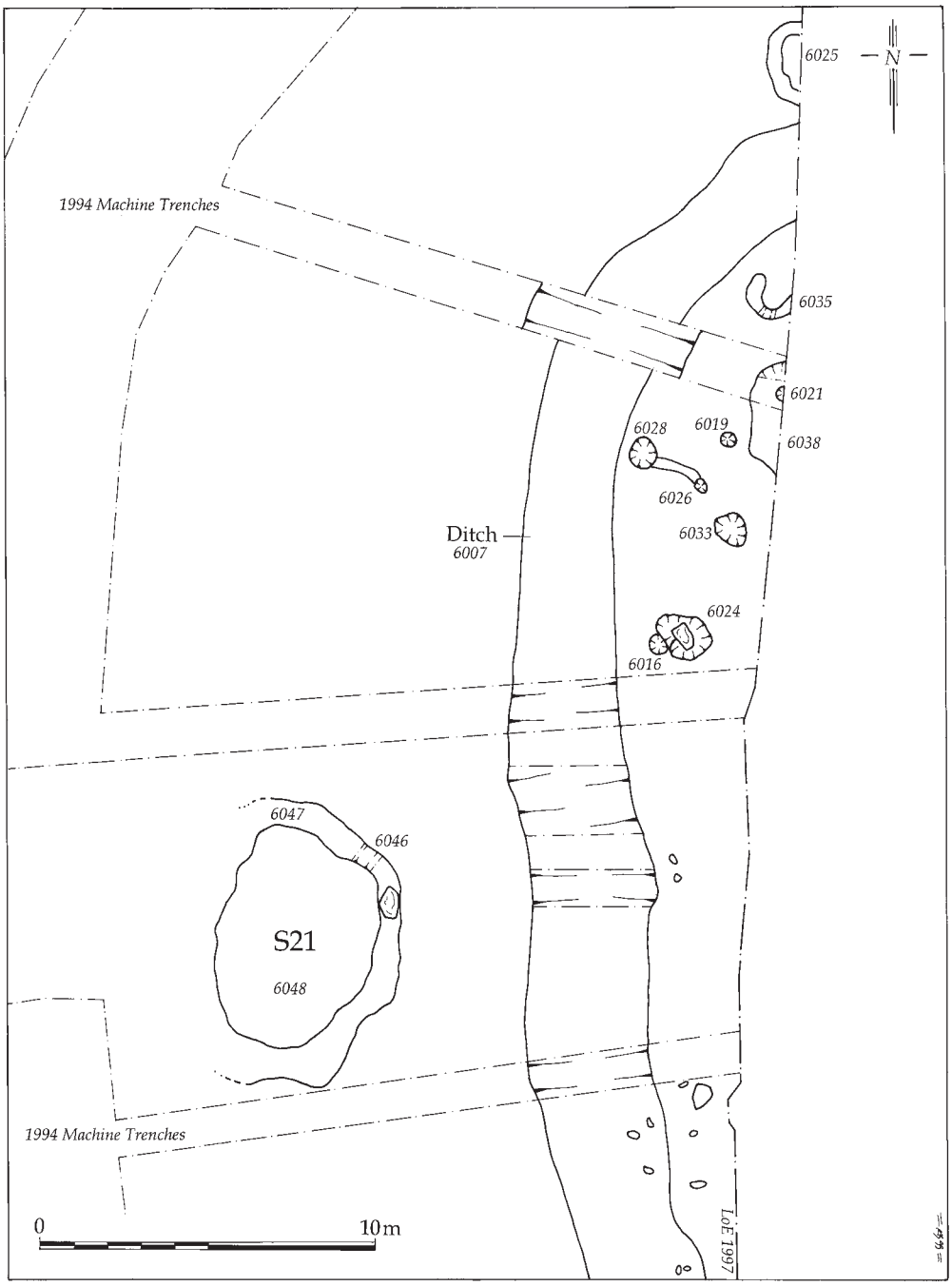
building (6062, 6063, 6064 & 6065). These may have been a part of the building, but their position across the centre of the house makes it unlikely that they were part of the roof, instead forming an internal division.

S21 (6003) lay to the west of the enclosure and almost under the outer bank (illus 11). Section X from 1994 lay little more than a metre to the north of the feature, and it was by chance that the feature was not encountered in the earlier fieldwork. The building was sub-circular in plan, measuring 12 m east/west and 10 m north/south. The encircling trench (6046) varied between 0.4 m and 0.7 m wide, with a maximum depth of 0.25 m. One possible post-hole was recorded in the trench, but there were no features surviving from the interior.

THE BANKS AND DITCH

The enclosure appeared on the surface as two banks heavily denuded through plough action. At various points, the outer bank was almost invisible, in particular on the northern circuit of the enclosure. Three principal sections were machine-cut across the banks, connecting with the outer trench Area C/Area D. Running anti-clockwise from the north, these were Section W (W-W'; illus 12), Section X (X-X'; illus 12) and Section Y (Y-Y'; illus 13); there was also a section (Z; not illus) through the bank to determine whether there had been a palisade.

It would be tedious in the extreme to go through the detail of the different sections, especially as they present essentially similar information. The details can be seen in the section drawings (illus 12 & 13), and instead a summary of the information from the extremely complex sections is presented here.



ILLUS 11 Sub-bank features in the western sector of the excavated areas

Earthwork sections The bank system consisted of an inner bank (Bank 400) ending on the edge of the ditch (Bank 403), with a second bank (Bank 401) starting on the opposite edge; beyond this was a third bank (Bank 402). All consisted of a dump of turf, topsoil and subsoil.

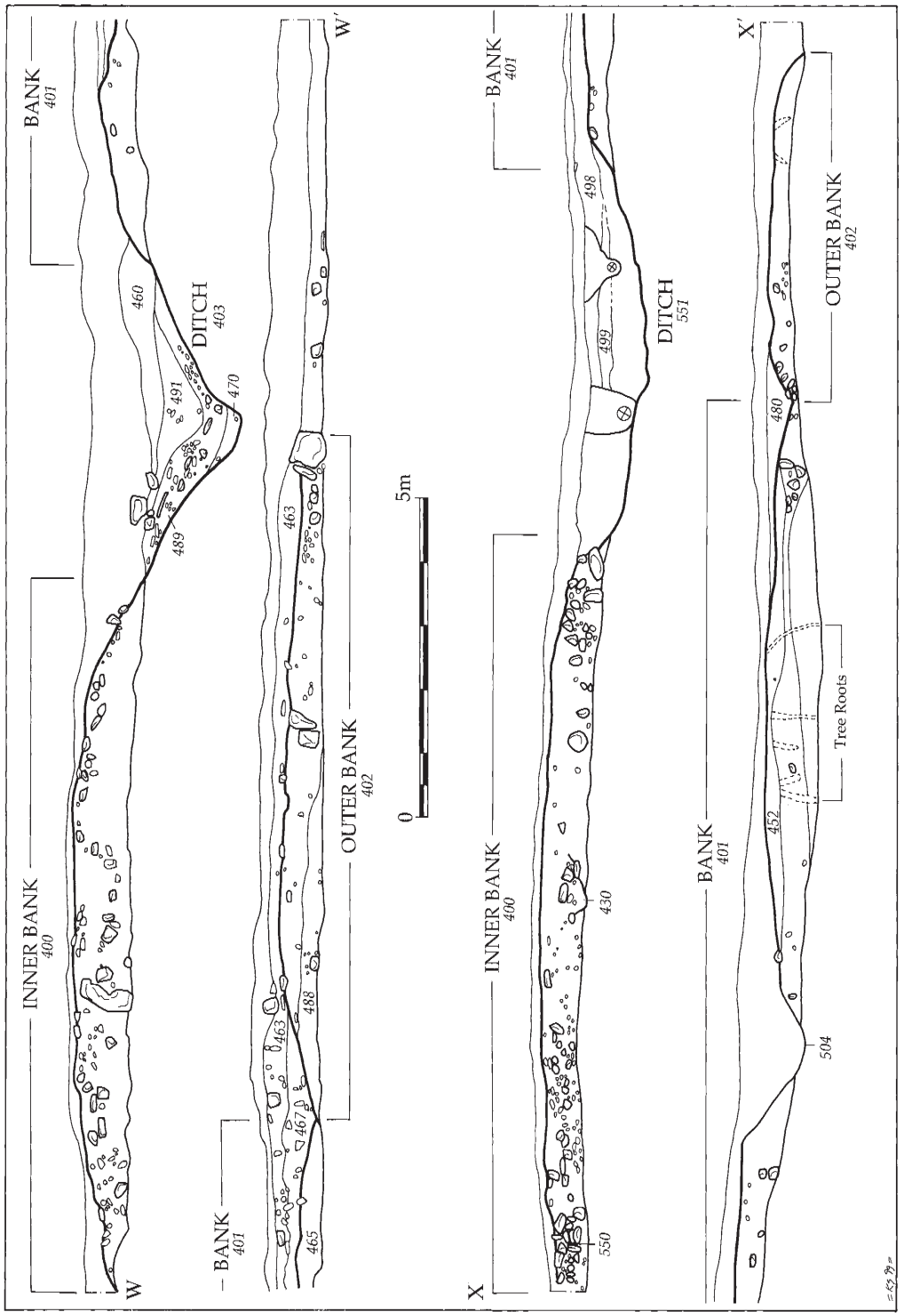
There was substantially more stone in the composition of the inner bank (Bank 400). This included some very large stones, while the primary silt of the ditch was very stony as well. In Section X-X' (illus 12), there appears to be an inner face of stone, a feature not present in the other sections.

The second and third banks (Banks 401 & 402) had been slighted into a single bank, shown by deposit F467 in Section W-W' and deposit F480 in Section X-X' (illus 12); an alternative explanation is that the two banks were always a single bank, and the layers observed in the sections are a result of construction through work-gangs rather than a change in design. Certainly, in Section Y-Y' (illus 13), it is extremely difficult to see two separate banks. At the point where the break might be expected, a modern drain cut straight through the bank material (illus 13). There is a difference in the soils on either side of this modern drain, an upper mottled brown silty clay (F432) and a lower mottled green-yellow clay silt (F434) on one side and a mixture of pink-white clay silts to green-grey silty clays with organic admixtures on the other. This may indicate that the separate sides of the drain cut relate to separate banks. The bank material in this part of the section continues for a great distance, and it is possible that there was a fourth section of bank that did not encircle the enclosure.

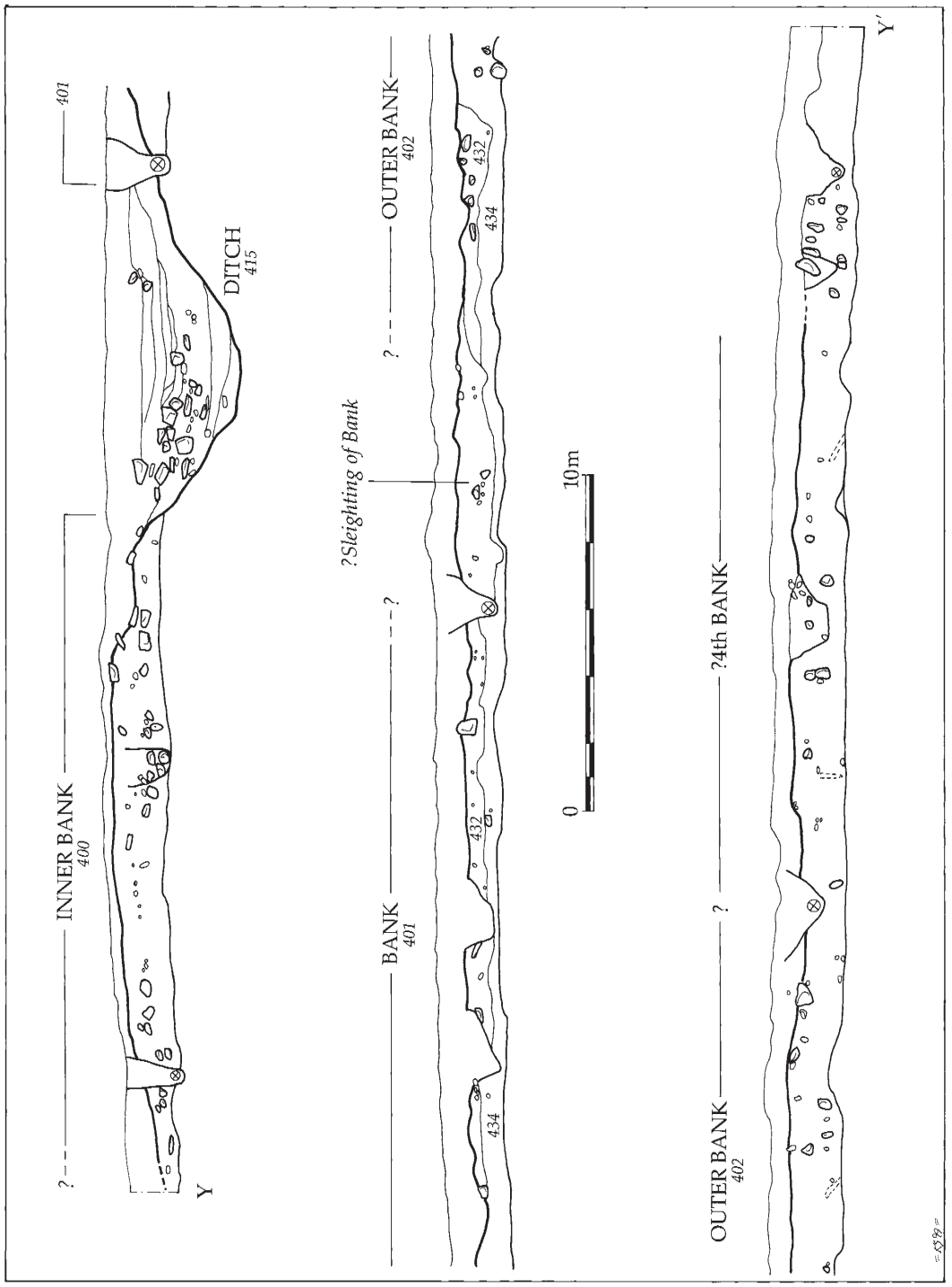
The width of the banks varies greatly from section to section. Bank 400 is around 11 m in all of the sections, but the outer banks vary in width from section to section. In Section W-W', Bank 401 is 6.5 m wide and Bank 402 is roughly 11 m wide. In Section X-X', the respective widths are 14 m and 5.5 m; in Section Y-Y', the widths are estimated at about 23 m and 27 m. This greater width in Y-Y' is probably partly the result of plough action, but the other sections reveal that the banks were not built as uniform features.

The width of the ditch also varied throughout the site, from around 4.5 m to about 9 m. Its depth varied, although by a smaller amount, from 0.6 m to 1.3 m, measuring to the base of the banks. This variation was the result of the ditch being dug in sections, presumably by work-gangs. In Section X-X', a depth of only 0.4 m is shown, but the ditch deepened in the middle of the trench and was roughly 0.7 m deep on the opposite, south-facing section (not illus), suggesting the ditch had been dug in segments; Section X-X' had fallen on the butt-end of one of the segments. Six further sections were dug across the banks by machine and the ditch excavated by hand (illus 4). The section faces were not recorded, but the dimensions were logged by EDM. This confirmed the variations in depth and width of the ditch around the site. In several instances, the butt-end of a segment of ditch was located within the area exposed, proving the segmented nature of the ditch. These extra sections also answered a suggestion made by Waugh (1932), of a second entrance on the north-east side of the site. The projected line of the ditch following these ditch sections appeared either to take a sharp bend or to terminate at an entrance. However, the 1997 topsoil clearance removed the western edge of the banks, showing that the ditch in fact took a sharp bend and there was no second entrance. The sharp bend also suggests that the ditch may have been excavated without a marked-out route; the work-gangs did not manage a smooth curve and had to make a sharp bend to complete the circuit of the ditch.

The sections of the ditch were fairly similar in each trench. The first layer in each case was a basal deposit of primary silting that was largely stone-free. Overlying this was another layer of silting revealing periodic slippage (see Simpson, below); this layer also contained a large number of stones of different sizes in Sections W-W' and Y-Y'. These were predominantly on the side next to the inner bank and inclined at an angle, indicating that they had fallen or been pushed into the ditch. This further indicates that the inner bank was originally covered with stone. This stony deposit was overlain by noticeably less stony layers, indicating the consolidation of the bank deposits with only silt washing down the bank. The silt layers were then sealed by a layer of peat. This layer could only have formed once the ditch area was stable and undisturbed. At this stage, the ditch itself probably contained standing water. The soils became wetter over time (see Simpson, below), while the botanical remains trapped in the silts of the ditch reveal a marshy environment (see Alldritt, below). Finally, there is some suggestion of ploughing, with the re-appearance of stones in the material overlying the ditch fills; this certainly dates long after the abandonment of the site.



ILLUS 12 Bank and ditch sections W-W′ and X-X′



ILLUS 13 Bank and ditch section Y-Y'

Interpreting the bank and ditch sections

A date of 2050 ± 40 BP (Beta-129444) was obtained from waterlogged small roundwood oak recovered from the ditch in Section X. The sample came from the primary silt deposits at the base of the ditch, but it provides only a marker for when the ditch was already in existence. However, taken with the S13 date, this date from the ditch section makes it likely that the enclosure was built before the arrival of the Romans, although the construction may not have been much earlier than the Agricolan advance. None the less, the bulk of the occupation was in the Romano-British period.

The different banks all consisted of dumps of turf, topsoil and subsoil, with the different deposits easily visible in the sections. The micromorphological analysis confirmed this, showing a mixture of turf and substantial amounts of mineral soil. The turf included indications of grasses, and thus may have included turf from the interior of the site. However, there was greater evidence for the use of heath turf, brought in to the site from rough pasture elsewhere (see Simpson, below). This might have been an attempt at managing resources and avoiding the loss of good-quality grazing around the site, but it also indicates the amount of effort that the builders were prepared to expend in the construction of the earthwork. The site was cleared down to subsoil, as the lack of an old ground surface indicates, while considerable amounts of material were brought to the site from elsewhere to construct the banks.

Bank 400 had a high concentration of stone visible in the upper bank material in all three sections, far more than in the other banks. There is a hint of an internal stone face to the bank in Section X-X', but it also seems likely that the high level of stone was a result of the original bank having been capped with stone. An apparently stone bank would have been more visible and striking than earthen banks covered with turf, and would make a stronger delineation between the interior and the exterior of the site. This is not a unique occurrence; the site of Halmie, a Bronze Age ritual centre in Dunbeath, Caithness has a similar phenomenon. The site appeared on the surface as a stone cairn, similar to the Clava cairns, but in fact had earthen walls with a thin layer of stone giving the impression of stone walls (Morrison *et al* forthcoming). This may also partly explain the unnatural amounts of stone across the site, as the remains of the capping which had been dragged across the site by ploughing. However, the amount of stone across the site is too much to have derived from the inner bank alone.

An important point is that the ditch was not a quarry ditch to provide bank material, since the banks are far more extensive than the depth of the ditch could provide; it was created for its own merits. This is emphasized by the evidence of the micromorphological analysis that the bulk of the bank material was brought in from elsewhere. The micromorphological evidence also suggests that the soils of the site were relatively dry when the ditch was created, and thus that its purpose was not primarily for drainage (see Simpson, below). Perhaps its function was to emphasize the banks it divided, although there was no attempt to do the same for the third bank. Its value may have been symbolic rather than practical, a way of emphasizing the exclusivity of the social space.

The micromorphology of the ditch material was very illuminating. In addition to the evidence of periodic slippage in the ditch fills, and of organic accumulation in the earliest fills, the analysis supported the field observations of wetter conditions in the final phase of the ditch fill. This means that the remains of the ditch had pooled water. Furthermore, the diatom evidence indicated that conditions had become increasingly damp over time. Finally, it is possible to say from the evidence of both the micromorphological analysis and the field observations that the ditch was not maintained and was allowed to fill up over time. There was no evidence for re-cuts in

any of the sections, while the microscopic analysis indicated an uninterrupted process of accumulation.

EXTERIOR

The final element of the excavation was the external 'halo', named Area C to the north and Area D to the south. The original intention had been to clean the full extent of the trench, but this was not possible. However, the machining had been sufficiently careful to reveal the subsoil surface relatively clearly, together with features cutting into the subsoil. A sample of these was tested in the course of the excavation, proving to have fills of loose black and highly organic soil in shallow scoops. At the bottom of these were root-holes which preserved organic material in the waterlogged conditions; there was also root material in parts of the fills of the features. Also noted were a series of root-holes cutting into the clay subsoil, initially thought to be stake-holes. The evidence suggests that the area had been wooded, with the black patches of soil being the remains of tree boles. This would match the evidence of Section X, where root-holes cut through the bank material.

TABLE 1
Radiocarbon dates

Lab code	Context		Sample Material	Yrs BP	*d* C13	Calibrated to one sigma
AA-24949	Block 1	S4	*Hordeum sp, H vulgare*, Indet	1865 ± 45	$\delta^{13}C = -23.1‰$	cal AD 82–215
AA-24950	Block 3	S11	*Alnus, Pomoideae, Corylus*	1740 ± 40	$\delta^{13}C = -27.1‰$	cal AD 238–344
AA-24951	Block 4	S12	*Alnus*, Indet	1840 ± 40	$\delta^{13}C = -27.1‰$	cal AD 117–228
AA-24952	Block 1	S1	*Cf Hordeum, Hordeum* sp, *H vulgare, H vulgare* (twisted)	1935 ± 40	$\delta^{13}C = -22.7‰$	cal AD 18–111
AA-24953	Block 6	S14	*Alnus*, Indet	1825 ± 40	$\delta^{13}C = -26.0‰$	cal AD 125–237
AA-24954	Block 8	S17/S18	Indet	2175 ± 45	$\delta^{13}C = -26.0‰$	cal BC 362–176
AA-24955	Block 7	S15	*Corylus*, Indet	1825 ± 45	$\delta^{13}C = -27.7‰$	cal AD 122–240
Beta-129443	Block 5	S13	*Sorbus*	2000 ± 40	$\delta^{13}C = -27.3‰$	cal BC 45–55 AD
Beta-129444	Block 403	Section X-X′	*Quercus*	2050 ± 40	$\delta^{13}C = -29.0‰$	cal BC 100–5

PALAEOBOTANY

Diane M Alldritt

METHODOLOGY

Bulk sieving of 114 soil samples was carried out with a modified Sirâf tank. All subsequent flots and residues were dried and then sorted by hand in order to extract carbonized plant macrofossils and charcoal. The >1 mm and >250 μm flots were sorted with the aid of a binocular microscope. Carbonized seeds were classified following the nomenclature of Stace (1997). All charcoal was sectioned and examined using a Zenith high-power metallurgical microscope and identified

following the descriptions of Schweingruber (1982) and Jane (1970). Individual charcoal species were then bagged and labelled separately in preparation for radiocarbon dating.

A single waterlogged ditch sample consisting of approximately 0.5 litre of detritus was also taken during the excavation. This was sieved under lab conditions to >250μm and stored wet with the addition of thymol crystals to delay the onset of decay. Waterlogged plant remains were extracted and identified using a binocular microscope, then stored in alcohol-glycerine-formalin solution in glass tubes.

RESULTS

Charcoal

From the 114 flots analysed, 82 samples contained charcoal but only 20 of these had identifiable pieces present. Identifiable charcoal pieces ranged in size from 7 mm by 8 mm, with the occasional piece up to 33 mm by 20 mm. Weights of individual species varied from 0.1 g of *Alnus* (alder) in Sample 003 (F208) to 7.8 g of *Corylus* (hazel) in Sample 053 (F022). Other species identified included *Quercus* (oak), *Betula* (birch), cf *Sorbus* (rowan) and cf *Salix* (willow), although never in any great abundance. Three pieces of *Corylus* (hazel) roundwood were found, with the following measurements: one 20 mm diameter piece with six growth rings, one 12 mm diameter piece with seven growth rings, and one 10 mm diameter with nine growth rings.

The residues from flotation were also sorted for charcoal. Most of the residues contained some very tiny fragments of charcoal that had failed to float, with occasional hazelnut shell fragments and barley cereal grains. Most of the unfloated charcoal was too small for accurate identification, measuring typically <4 mm, with some pieces only 1 mm, and generally weighing from 0.1 g to 1.05 g. The residue from Sample 116 (F164) produced a large quantity of unfloated material (c 190 g). The majority was unidentifiable due to its poor state of preservation and the presence of ironpan in the vessels. However, 4.9 g were identified as *Alnus* (alder), and 0.3 g as belonging to *Pomoideae* (rose family). Also notable were Sample 143 (F106), which produced 0.4 g of *Corylus* (hazel), and Sample 138 (F194), with 0.5 g of *Quercus* (oak), but it was unusual to find large amounts of identifiable material from the residues.

Plant macrofossils

Charred plant macrofossils were in 71 of the flots, although again in very low numbers. Weeds of cultivated land and waste ground were the most common species, with the presence of *Persicaria maculosa* (redshank) and *Stellaria media* (chickweed) in most samples. *Carex* spp (sedges) were present in 18 of the samples, indicating some damp ground in the area. Cultivated species were represented by *Hordeum* sp (barley) in 14 samples. Samples 051 (F013), 052 (F015), 073 (F010) and 143 (F106) were notable for the presence of one or two grains of *Hordeum vulgare* var *vulgare* (six-row hulled barley). Unfortunately, no cereals other than barley were recovered.

Waterlogged sample

The waterlogged ditch sample contained a few fragments of soft, heavily waterlogged and degraded wood; both *Alnus* and *Corylus* were present. The macrofossil assemblage consisted of a large number of grasses and wetland species (Table 2), the relevance of which will be discussed further below.

TABLE 2
Plant remains from waterlogged ditch fill

	No. of Fossils
Plant macrofossils	
Potentilla erecta	20
Glyceria flutans	29
Small Poaceae	10
Stellaria media	5
Polytricum sp.	85
Sonchus asper	1
Lapsana communis	1
Rumex acetosella	2
Chenopodium album	4
Montia fontana	5
Ranunculus acris	1
Ranunculus sp.	2
Persicaria maculosa	1
Lamiaceae	1
Urtica dioica	1
Juncus sp.	51
Luzula sp.	20
Aphanes arvensis	2
Carex sp.	3
Sphagnum leaves	14
Other Moss Fragments	4
Calluna leaves	2
Waterlogged wood	
Alnus	1
cf. Alnus	1
Corylus	1
Other remains	
Modern seeds	1
Daphne pulex egg capsules	46
Earth Worm egg capsules	2
Fungal spores	present
Beetle remains	4
Insect eggs	present

DISCUSSION

Very small quantities of identifiable charcoal were recovered from the samples. Typically, the majority of charcoal came from post-hole contexts, eg 7.8 g of *Corylus* from Sample 053 (F022). Some of the roundwood hazel pieces from the site may have originated from coppiced woodland, but as only three pieces were found (six, seven and nine years old when felled) no definite conclusions can be made.

The carbonized weed flora identified from Woodend were almost exclusively species associated with cultivated land and waste ground. The presence of *Hordeum* sp (barley) in some samples, particularly in the sample from the pit in S19 containing 179 cereal grains, also indicated some degree of cultivation occurring in the area. Wet meadows, and/or damp ground, in the vicinity are suggested by the various *Carex* sp (sedges) recovered in low numbers from the samples. Large quantities of modern contaminants were present in some samples. In particular, Sample 149 (F320) contained abundant modern *Ranunculaceae* (buttercup) seeds, some of which were germinating (probably as a result of water immersion during flotation); these probably represent a modern seed bank. The presence of modern seeds and earthworm egg capsules

throughout the samples may bring the stratigraphic integrity of the charred macrofossils into question. It is probable that some degree of 'mixing' was occurring on the site, perhaps because of earthworm action, or fluctuations in the local water table. Care must therefore be taken in any interpretation of the charred remains from this site.

The waterlogged ditch deposit produced approximately 240 macrofossils, mostly identifiable to species. Wetland species such as *Juncus* sp (rushes) and *Carex* sp (sedges) indicate some marshland or damp ground in the area. Fossils of *Glyceria flutans* (floating sweet-grass) were also in abundance. This species is known to inhabit muddy ponds and shallow water in ditches. Evidence of damp grassland in the vicinity of the site was provided by *Ranunculus acris* (meadow buttercup) and *Montia fontana* (blinks). Interestingly, the ditch deposit also contained a variety of other macrofossils commonly found on grassland and cultivated ground. These included *Rumex acetosella* (sheep's sorrel), *Persicaria maculosa* (redshank), and numerous small *Poaceae* sp (grasses), together with *Aphanes arvensis* (parsley piert) which prefers well-drained soils.

By examining a combination of the carbonized and waterlogged elements of the site, a picture of the local environment around the time of human occupation emerges. Barley was cultivated near the site, although no chaff was preserved to indicate processing activity taking place on site. This could mean poor preservation, or that the processing took place at another location. Cultivation was by no means a monoculture, and weeds of *Ranunculus* sp (buttercups), *Persicaria maculosa* (redshank), *Rumex* sp (docks), *Chenopodium album* (fat hen) and *Stellaria media* (chickweed) would have happily coexisted within a field of barley cereal. Upon harvesting, these weeds could have found their way into the habitation areas of the site where cereal processing activities such as sieving and winnowing were occurring. However, as the ecology of these weeds also includes waste ground and disturbed areas, these plant remains may represent the uncultivated areas around the site.

The presence of numerous wet meadow species (*Montia fontana*, *R. acris*) suggests some areas around the site may have been permanently damp. Indeed, the commonest charred wood found in the samples was *Alnus* (alder), which favours wet areas by streams and bogs. The alder was probably brought up from the Annan, which flows along the bottom of the valley, east of the enclosure. Animal husbandry was probably as important as cultivation at this time, with perhaps some of the wetter areas being used as pasture land as suggested by the presence of *Potentilla erecta* (tormentil) and *Urtica dioica* (common nettle). The ditch may have become permanently waterlogged, allowing the growth of rushes, and its gradual infilling with silt and mud was accompanied by the arrival of marsh-loving species. Abandonment of the site would have allowed the uninterrupted growth of marsh and reed swamp plants within the enclosure ditch.

SOIL MICROMORPHOLOGY

Ian A Simpson

Analysis of archaeological soils and sediments of the Woodend enclosure offered the opportunity to establish aspects of site formation and to contribute to the understanding of the site and its environmental context. The excavation revealed areas of surface deposits within and between structures as well as sediment stratigraphy in the remains of the banks and in the ditch. In this study, the technique of soil thin section micromorphology was used to describe and interpret the properties of the Woodend archaeological soils and sediments.

Sixteen undisturbed samples were collected in 80 x 50 x 40 mm Kubiena tins during the course of the excavation. Nine of the samples came from surface deposits associated with the

settlement and seven came from the inner bank and the ditch. Sampling was designed to ensure the maximum range of deposit types across the site. Thin sections were prepared at the Micromorphology Laboratory, University of Stirling, following the procedures of Murphy (1986). Thin sections were described using an Olympus BH-2 petrological microscope and following procedures described in Bullock *et al* (1985). This allowed the systematic description of soil microstructure, basic mineral components, basic organic components, groundmass and pedofeatures. A range of magnification (x1–x400) and light sources (plane polarized, circular polarized, cross-polarized and oblique incident) were used to obtain detailed descriptions, recorded in standard summary tables (in archive). Interpretation of the observed features rests upon the accumulated evidence of a number of workers in this field (eg Courty *et al* 1989; Fitzpatrick 1993).

RESULTS AND DISCUSSION

Surface deposits associated with the structures (Table 3)

All the samples have a similar coarse mineral suite with frequent to common quartz as the major component, together with compound quartz grains and siltstones. This is typical of the Ettrick Association and indicates that no exotic material had been introduced by human activity. The samples also exhibit varying degrees of gleying including distinct juxtapositioning of brown organo-mineral fine material and grey mineral fine material, and the occurrence of amorphous iron crypto-crystalline accumulations. The gley features do not, however, cross micro-structural boundaries within the thin sections and can be regarded as forming later in the history of these soils.

Functional differentiation between and within the buildings can be recognized through differences in micro-structural attributes, which vary from compacted platy with porphyric related distributions to uncompacted sub-angular blocky and crumb with enaulic/porphyric related distributions. Associated with the first category are infrequent fine organic material and excremental pedofeatures, while the second category is associated with a greater frequency of excremental pedofeatures, of fine organic material and of charcoals with frequencies varying in the different samples. Interpretation of the first category is as substantially trampled floor surfaces; the second category suggests a greater degree of organic material and waste material addition in comparison with the first category.

Two samples from within the multi-phase structure are characterized by platy micro-structures (Samples W40.5/57 and W40/60, both from within Block 1). In both cases these samples can be interpreted as part of a compacted floor layer featuring substantial human activity. The nature of that activity cannot be ascertained from the remaining evidence. The lack of biological remains or increased biological activity in the deposit due to organic amendment indicates that it was not an area used for processing organic materials. Similar micromorphological characteristics are evident in Sample W45/75.7 from the single-phase structure (S14). Here, however, the occurrence of amorphous reddish-brown fine organic material located in void space between the platy peds suggests that this floor layer was deliberately constructed by alternately depositing soil and vegetative material.

The two remaining samples from Block 1 are characterized by predominantly sub-angular block micro-structures. Sample W40/55 contains platy micro-structural elements but lacks the compacted nature of the samples described above. These observations suggest that this area of the structure was less frequently used and the occurrence of opaque organic fine material and slightly enhanced biological activity hints at accumulation of organic materials in this area of the structure. The nature of the organic material cannot be ascertained from the micromorphological evidence. This sample came from a floor area relating only to S1 and S5, unlike the two previous samples from areas of the floor layers used by all of the phases of building. The remaining sample characterized by sub-angular blocky micro-structures from this block also contains very few charcoals with few heated stones observed under oblique incident light (Sample W43.2/56.9),

TABLE 3

Micromorphology of surface deposits associated with structures

SECTION	COARSE MINERAL MATERIAL (>10μm)											FINE MINERAL MATERIAL (>10μm)	COARSE ORGANIC MATERIAL (>5 cells)			FINE ORGANIC MATERIAL (>5 cells)						PEDO FEATURES								
	QUARTZ	FELDSPAR	BIOTITE	GARNET	HORNBLENDE	COMPOUND QUARTZ GRAINS	SILTSTONES	PHYTOLITHS	DIATOMS	BONE	HEATED STONE		FUNGAL SPORES	LIGNIFIED TISSUE	PARENCHYMATIC TISSUE	AMORPHOUS (BLACK)	AMORPHOUS (BROWN)	AMORPHOUS (REDDISH BROWN)	CELL RESIDUE	CHARCOALS	POLLEN	TEXTURAL (SILTY CLAY)	TEXTURAL (CLAY COATINGS)	TEXTURAL (LIMPID CLAY)	AMORPHOUS & CRYPTO CRYSTALLINE NODULE	AMORPHOUS AND CRYPTO CRYSTALLINE INFILLS + COATINGS	EXCREMENTAL (MAMILLATE)	EXCREMENTAL (SPHEROIDAL)	DEPLETION
W40/60	●●●	●				●●	●	●	●		●	BROWN; ORGANO-MINERAL;SPECKLED LIMPIDITY GREY; MINERAL; SPECKLED LIMPIDITY				●		●●	●						●●			●●		●●
W43.2/56.9	●●●	●				●●	●	●	●		●	BROWN; ORGANO-MINERAL; SPECKLED LIMPIDITY							●	●●		●			●				●●
W40.5/57	●●●	●				●	●●	●	●			BROWN; ORGANO-MINERAL; SPECKLED LIMPIDITY	●			●		●	●						●●			●		●●
W40/55	●●●	●				●●	●	●	●			BROWN; ORGANO-MINERAL; SPECKLED LIMPIDITY	●			●		●●	●						●			●		●●
W35/65	●●●	●				●●	●	●	●	●		BROWN; ORGANO- MINERAL; SPECKLED LIMPIDITY GREY; MINERAL; SPECKLED LIMPIDITY	●			●		●	●						●		●	●		●●
W45/55	●●●	●				●●	●	●	●		●	BROWN; ORGANO-MINERAL; SPECKLED LIMPIDITY	●			●		●	●	●					●		●	●●		●●
W45/75.7	●●●	●			●	●●	●		●			GREY; MINERAL;SPECKLED LIMPIDITY BROWN; ORGANO- MINERAL; SPECKLED LIMPIDITY				●		●	●									●		●
W40/70	●●●	●				●●	●	●	●			BROWN; ORGANO-MINERAL; SPECKLED LIMPIDITY	●			●		●●				●						●●	●	●●
W46.4/67.25	●●●	●				●●	●	●	●			RED BROWN-BROWN; ORGANO-MINERAL; SPECKLED LIMPIDITY				●		●	●						●			●●		●●

SECTION	MICROSTRUCTURE	COARSE MATERIAL ARRANGEMENT	GROUNDMASS B FABRIC	RELATED DISTRIBUTION
W40/60	PLATY	RANDOM	STIPPLE SPECKLED	ENAULIC
W43.2/56.9	SUBANGULAR BLOCKY	RANDOM	STIPPLE SPECKLED	ENAULIC - PORPHYRIC
W40.5/57	PLATY	RANDOM	STIPPLE SPECKLED	ENAULIC
W40/55	PLATY TO SUBANGULAR BLOCKY	RANDOM	STIPPLE SPECKLED	ENAULIC
W35/65	SUBANGULAR BLOCKY	RANDOM	STIPPLE SPECKLED	ENAULIC - PORPHYRIC
W45/55	CRUMB & SUBANGULAR BLOCKY	RANDOM	STIPPLE SPECKLED	PENAULIC - ORPHYRIC
W45/75.7	PLATY	RANDOM	STIPPLE SPECKLED	PORPHYRIC
W40/70	SUBANGULAR BLOCKY	RANDOM	STIPPLE SPECKLED	PORPHYRIC
W46.4/67.25	SUBANGULAR BLOCKY TO PLATY	RANDOM	STIPPLE SPECKLED	PORPHYRIC

Frequency class refers to the appropriate area of section (Bullock et al 1985)

- ● *Very few*
- ●● *Few*
- ●●● *Frequent / common*
- ●●●● *Dominant / very dominant*

Frequency class for textural pedofeatures (Bullock et al 1985)

- ● *Rare*
- ●● *Occasional*
- ●●● *Many*

characteristics indicative of a hearth area. These four micromorphological samples support the interpretation that this was a house.

The two samples from S13 (Samples W46.4/67.25 & W40/70) are both characterized by sub-angular blocky structures with enhanced biological remains and biological activity. The samples also contain enhanced frequencies of depletion pedo-features and accumulation of reddish-brown fine mineral material. These characteristics indicate an open structure not subject to persistent trampling. Taken with an increased organic input, this suggests an area where livestock may have been held intermittently.

Samples external to the buildings are characterized by sub-angular blocky and crumb structures. In addition, evidence of high biological activity, bone fragments and increased occurrence of charcoals in Sample W45/55 indicates that this area may have served as a midden deposit. Given the highly decomposed nature of the organic material, the source of the midden material is difficult to ascertain from the micromorphological evidence alone; nevertheless, the occurrence of phytoliths in thin section indicates a grassy input, and fungal spores indicate an animal manure input. Sample W35/65 lacks evidence of charcoals or enhanced biological activity, although there is still the occurrence of excremental pedofeatures and a range of fine organic materials, suggesting that this area was simply open space between the structures. Again, the occurrence of phytoliths suggests that the open space was grass dominated with fungal spores perhaps indicating a level of livestock grazing.

Ditch and bank deposits (Table 4)

In thin section, the ditch and bank deposits demonstrate a similar coarse mineral material suite throughout, with channel and chamber micro-structures. However, differences in the occurrence of fine organic materials, inorganic materials of biological origin, coarse material arrangement and excremental pedo-features contrast with the topsoil, with sub-angular blocky structure overlying the ditch deposits (Sample W22–30), and indicate variation in sediment accumulation.

The bottom of the ditch (Sample W105–113) is characterized by many excremental pedo-features, indicating high biological activity where organic debris accumulated. Part of that organic debris included grassy material, as evidenced by the occurrence of phytoliths, and woody material as indicated by the occurrence of lignified wood tissue at the base of the ditch. The source of this wood is not known. Sequences of clustered and banded mineral material and opaque organic debris make up the remainder of the ditch fill material, representing periodic collapse of the bank with additional organic material being deposited (Samples W81–89; W57–65; W48–56). The final phase of ditch fill is characterized by *in situ* organic material accumulation resulting from wetter soil conditions (Sample W35–43). Although the occurrence of phytoliths remains constant throughout the ditch fill material, the incidence of diatoms in thin section is more frequent with proximity to the surface. This suggests wetter soil conditions as the ditch developed, with the implied earlier drier conditions clearly indicating that the ditch was to delineate the extent of the settlement rather than for drainage.

The bank material is also characterized by channel and chamber micro-structures, but with a double-spaced porphyric related distribution (Sample WE 29–37). Observations in thin section indicate a turf-based bank with substantial mineral material attached to the bank. The occurrence of phytoliths indicates a grassy component, but the occurrence of ericoid pollen grains and large fragments of black amorphous fine organic material indicate a grassy heath turf as the most likely material used to construct the bank. Exploitation of heath turf for construction indicates a deliberate policy of avoiding what is likely to have been more local grass turf, implying the maintenance of grassy areas for livestock production.

CONCLUSIONS

Observation based on thin section micromorphology suggests functional differentiation within and between buildings. Such differentiation is in part attributable to the need to hold livestock within the settlement area and may suggest livestock was at least a significant part of the economy.

This view is supported by the use of heath turf to construct the banks rather than more productive grass turf. The infilling of the ditch indicates that it was not maintained, but the ditch infill took place against a backdrop of increasing soil wetness.

PHOSPHATE ANALYSIS

John S Duncan

The practice of using the variation of the phosphate content of soil at archaeological sites as an indicator of the nature and degree of occupation is well established, especially in Scandinavia (Provan 1971). The basic principle is that detritus of human activity will greatly enhance the soil phosphate levels of settlement sites. Humans lived in the midst of both rubbish and livestock until quite recently, sharing their living space with animals and creating piles of rubbish, or middens, in the general habitation area. The bulk of occupation debris is organic, or at least organic in origin (eg food scraps, cloth, burials, wood, excreta and ash). Over time these may have decayed entirely, but a chemical component of them will persist in the soil as phosphates. The retention of these phosphates within the soil involves various mechanisms including chemical bonding, ion exchange and adsorption processes (Wild 1988). Phosphates are the most diagnostic and easily determined of all the macro-nutrients in the soil (Craddock *et al* 1985).

METHODOLOGY

Samples were taken on the 5 m grid. This was a coarse sampling interval, but the intention was to derive a general impression of the phosphate distributions across the site. (A finer sampling strategy would have been much more expensive and potentially no more rewarding.) The samples were collected at the interface between the topsoil and subsoil, reducing the chance of recent additions from fertilizers or from the effects of cattle grazing. Finally, three background samples were taken from topsoil away from the enclosure itself to provide a control for the analysis.

The samples were analysed in the Archaeology Laboratory at the University of Glasgow following the ignition-hydrochloric total phosphate extraction procedure (Andersen 1976). This procedure produces values for the total phosphate content, the inorganic phosphate content and the organic phosphate content. Measurement of the antimony-phosphomolybdate complex was made on a colorimeter at 680 nm. Details of the procedure, analytical values and the standards used are described in a longer version of this report, in the project archive. Precision of the analysis, calculated using the formula described in Vermeulen (1953), was found to be $\pm$ 33 mg P/kg soil.

RESULTS

Overall, the values were relatively low, although differences between the samples can be seen as relating to archaeological activities.

The ratio of inorganic:total P provides some information concerning the nature of the original form (Table 4). A low inorganic:total ratio would suggest a relatively recent addition to the soil of some form of organic P-rich substance (such as manure). The background (topsoil) samples show this configuration, with a mean value of 9.97%. This was expected as it is known that recent land-use will have produced non-anthropogenic soil enhancement. However, nearly all the other samples show a significantly higher ratio of inorganic to total phosphorus (a mean of 50.57%), which provides evidence that the samples related to an anthrosol and a degree of mineralization has occurred. No contamination of the ancient distribution of phosphate deposits has occurred from the recent addition of organic waste.

DISCUSSION

The relatively large sampling interval limits the interpretation of the results. However, some patterns of phosphate distribution emerge from the data, allowing some conclusions to be drawn.

It is tentatively proposed that higher levels of phosphates immediately outside the buildings indicate where domestic detritus was dumped. This was suggested by the increased inorganic phosphate concentration situated to the east of the possible entrance to S14, the single-phase house on the north of the site (50E/75N). Similar results were recorded at Ullandhaug farm in the Stavanger district of south-west Norway. High phosphate levels, associated with numerous finds, were located just outside House 1, and were interpreted as indicating the dumping of refuse from within the house (Myhre 1969, reported in Provan 1971). From the results in the present analysis, it is suggested that the inhabitants of the Woodend houses were relatively tidy and did not allow large quantities of waste to accumulate inside their dwellings.

A high inorganic value was also recorded at 45E/60N, immediately adjacent to Block 1. Its location supports the picture of waste material dumped outside the houses, but it is impossible to determine which phases produced the enhancement and it may be a sum of all the phases. There are similar problems in interpreting several of the phosphate values relating to buildings because of the replacement of one by another in every case apart from S14. It is noticeable, however, that in every case, high phosphate values are found adjacent to the buildings but rarely within them. The exception to this is S13. Two samples from the interior (40E/65N & 40E/70N) indicated phosphate enhancement with high inorganic levels. This would suggest that the function of S13 differed from the other buildings, and, taken with the evidence of the micromorphological analysis (see Simpson, above), S13 can be interpreted as an animal pen. The antiquity of the enhancement is indicated by the substantial mineralization of the phosphates; the micromorphological evidence of the presence of faecal matter and organic waste in the samples (see Simpson, above) indicates that mineralization has been the factor here.

COARSE STONE TOOLS

Kevin J Taylor & Biddy Simpson

During the excavation, numerous coarse stone tools were recovered. These include a variety of forms, some indicating pastoral activities while others point towards arable. Unfortunately, very few of the tools come from specific contexts; the majority came from the loose stone across the site presumed to have been largely re-deposited from the inner bank by ploughing. Thus, although the tools were undoubtedly from the occupation of the site, most were not found in their original positions of loss or dicard. There were a few notable exceptions, including a quern fragment within S13/S16 (254AA) and a series of artefacts from the midden deposit F066.

The coarse stone tools can be divided into a series of different functional types: querns, butchering implements, hammerstones, rubbers, cup-marked stones, anvils, chisels and miscellaneous tools.

DESCRIPTIONS

Querns (illus 14)

Four fragments of querns were recovered from the site, together with a possible roughout. Two of the fragments and the possible roughout were found in the loose stone across the site and thus

have no known primary context. The other two fragments came from firm contexts: one (016AA) came from a post-hole in Block 1, the other (254AA) from a layer within S13/S16.

001EG (14.3) is a fragment of the upper part of a particularly fine beehive quern, shaped by pecking. It has a large hopper or receptacle for grain, with an accentuated lip partly designed to increase the capacity of the hopper. The base is slightly concave, allowing flour to pour from the sides of the quern as it was ground. The hopper bears regular horizontal grooving from preparation by drilling. The under-surface, which would have rested at a slight angle, is pecked with no evidence of grinding. The horizontal handle socket is partly preserved. It bears a general similarity to an example recovered from Newstead, dated to the late first or mid second century AD (Curwen 1937) and belongs typologically to Curwen's flat 'beehive'-type quern.

001EO (14.4) is a fragment of a trough quern typical of the later prehistoric period (Close-Brooks 1983) and representing the simplest technology. The trough in the lower stone would have been formed by the repetitive unilateral rubbing of an upper, hand-held stone across its surface, the grain being ground between the two surfaces. On the underside is a ground flat surface with an ovoid depression, perhaps resulting from its use as an anvil.

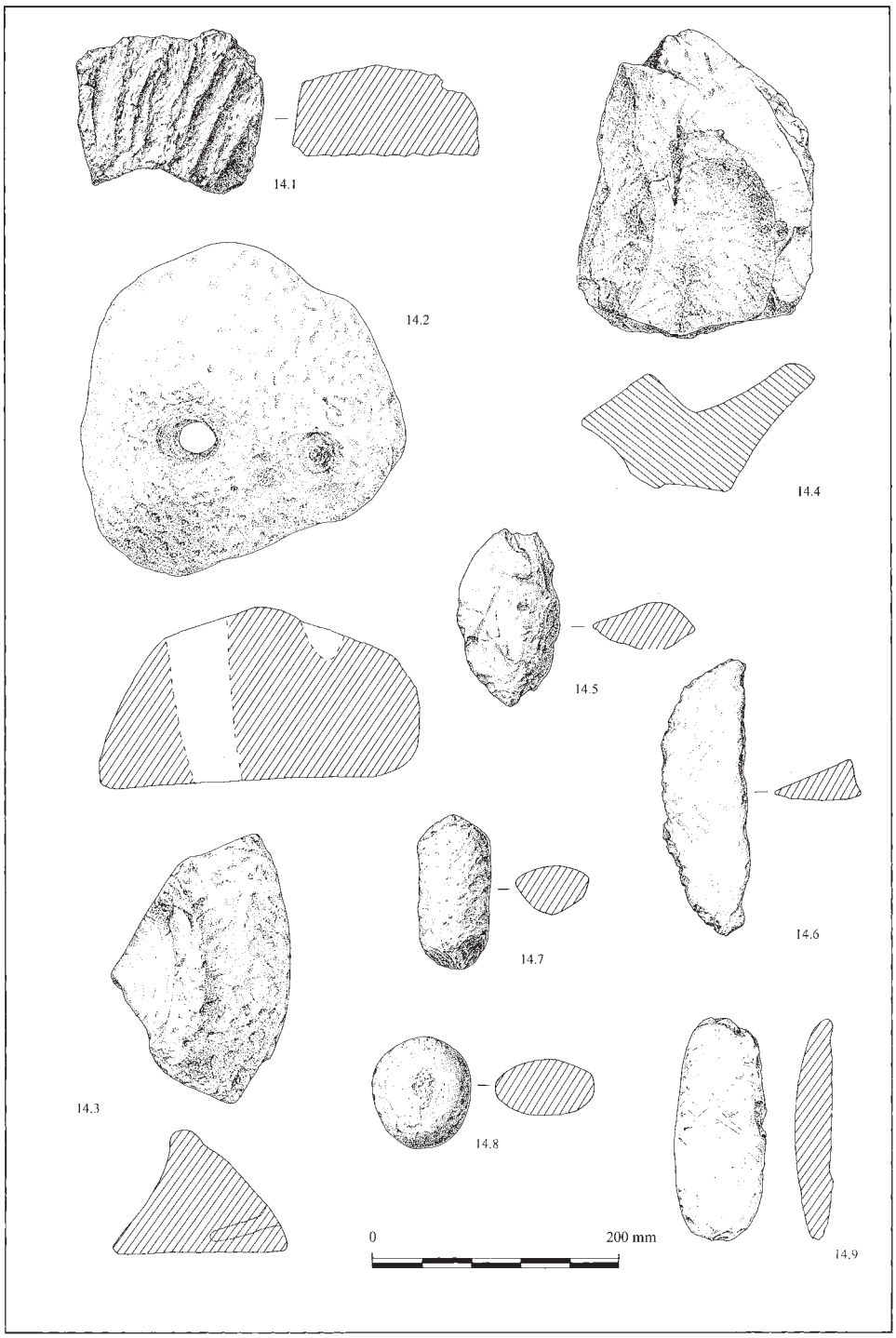
254AA (14.2) was recovered from what appears to have been a floor level of S16 but also within S13, the putative livestock enclosure. It is a Scottish derivative of the flat beehive form (Curwen 1937). In contrast to 001EG, the grinding surface is flat, there is no hopper, it is asymmetrical and has a vertical handle socket. The stone was dressed by packing on all its surfaces including the flat grinding surface. To one side of the handle socket, there is a much shallower pecked depression, although of similar dimensions, suggesting that the first attempt to create the handle socket was a failure. The axial perforation, the handle socket and the quern base are all rough and do not appear ground or polished as would be expected after use. It would thus appear that the quern was never actually used. The dating of this type of quern is very broad, Curwen (1934) suggesting a range from the first century AD to the fifth. The vertical handle socket is particularly associated with the brochs of northern and western Scotland.

Fragment 016AA (14.1) features grooving on its lower surface to facilitate the grinding of grain. It dates roughly to the later part of the Roman occupation of Britain (Curwen 1937).

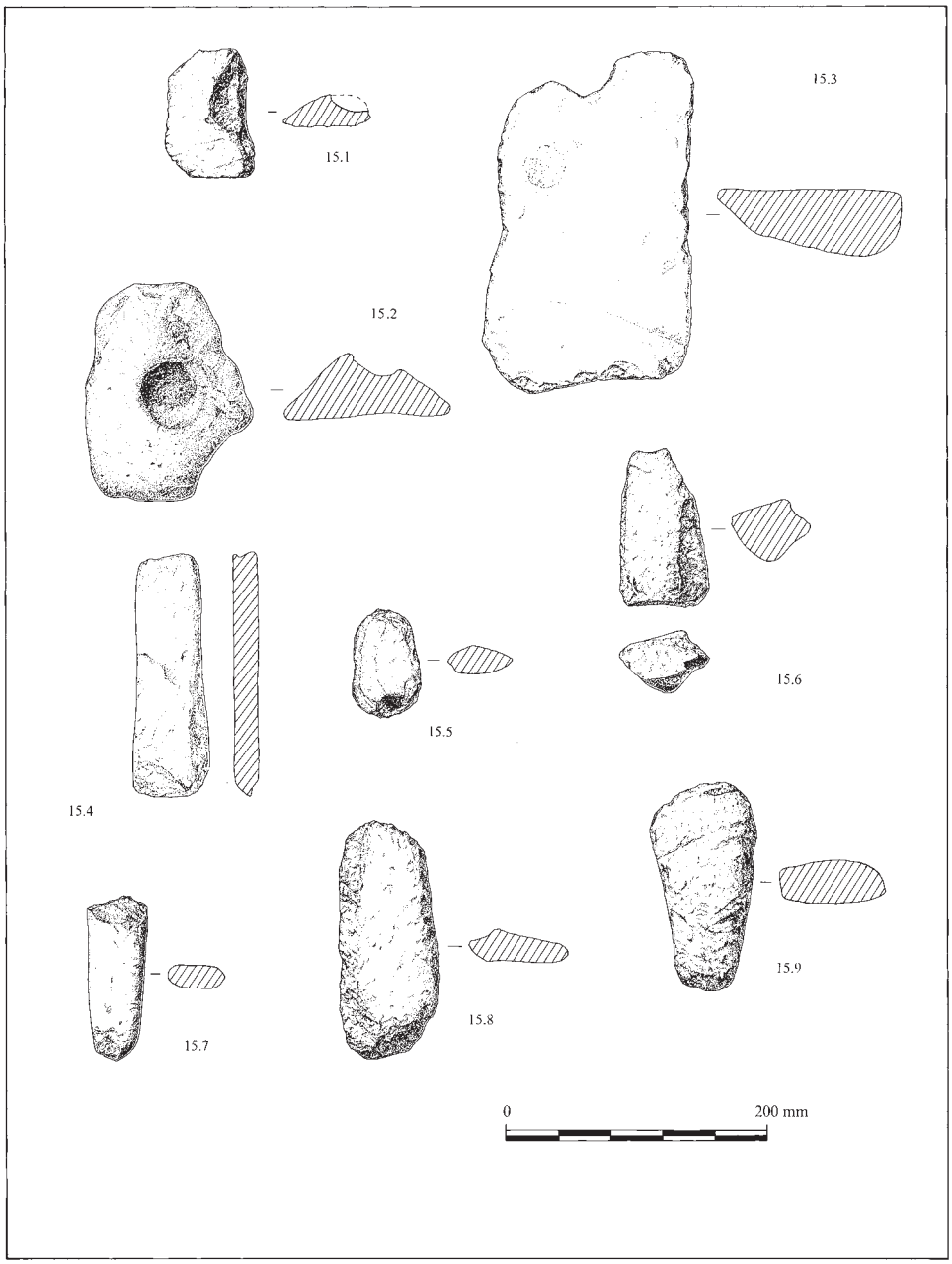
001DM (not illus) was a large cobble of similar dimensions to 254AA. Three large flakes have been removed from its edges, suggesting an attempt to prepare the stone for use as a quernstone. This is supported by the presence of grooves on the flatter face, appearing to delineate the intended shape. On this face, corresponding to a natural hollow on the opposing face, a circular hollow had been pecked, perhaps as the beginnings of an axial perforation.

Butchering implements (illus 14)

These come in a range of shapes and sizes, but generally were produced from decortical stone flakes similar to Skaill knives recovered on Orkney (Clarke, forthcoming). They are usually semicircular in plan with crescentic blades, some of which are serrated; whether this is by design or attributable to use-wear in uncertain. Two pieces are illustrated as particular fine examples of the material. 001BA (14.5) was produced from a large decortical flake and is wedge-shaped with a curving blade. It bears considerable traces of use. 001EV (14.6) was similarly produced from a large decortical flake and shows considerable evidence of use damage.



ILLUS 14 Quern fragments, butchering implements, hammerstones and rubber



ILLUS 15 Cup-marked stones, anvil, chisel and miscellaneous tools

TABLE 5
Coarse stone tools (illustrated)

Finds No	Context	Dimensions L (mm)	Th (mm)	Description
001BA	001	142	40	Butchering implement
001DA	001	63	46	Hammerstone
001DO	001	85	48	Miniature axe
001EE	001	71	63	Cup-marked stone
001EG	001	143	100	Rotary quern (frag)
001EH	001	165	131	Cup-marked stone
001EK	001	120	182	Borer
001EO	001	256	194	Trough quern
001ER	001	128	43	Hone
001EV	001	228	74	Butchering implement
001EZ	001	182	34	Rubber
016AA	016	148	131	Rotary quern (frag)
066AW	066	251	154	Anvil
066AX	066	189	17	Chisel
254AA	254	274	148	Rotary quern
000AA	Surface	182	68	Stone bar
000AB	Surface	125	57	Hammerstone
000AC	Surface	160	80	Adze

Hammerstones (illus 14)

These range from cobbles bearing small areas of pecking, probably used on an *ad hoc* basis, to very fine examples bearing patterned markings indicative of consistent and repetitive use. Two examples of the latter type — surface find AB (14.7) and 001DA (14.8) — are illustrated.

Rubbers (illus 14)

This term has been used with reference to those implements bearing regular and/or numerous striae caused by the implements' abrasion against another surface. Also included in this category are implements bearing ground facets from similar activities. None of the rubbers can be described as having been used with a trough or saddle quern, representing instead implements used in other activities, such as the preparation of stone, wood and leather. One example, 001EZ (14.9), had a smooth convex surface on one face suggesting its use in the beating of textiles (Ramsey 1995).

Cup-marked stones (illus 15)

Several objects were recovered bearing broadly hemispherical depressions on one of their surfaces. Only two can clearly be identified as artificially produced. 001EE (15.1) was a small tabular flake with a ground upper surface and a pecked depression. These elements are particularly reminiscent of a trough quern, albeit in miniature, and it may have been used as a mortar from grinding pigments or herbs (not illus). The other example, 001EH (15.2), was a large flat cobble with a sub-circular depression pecked on one face. The only other point of interest is that 001BM (not illus), a cobble fragment, was blackened and reddened as though through exposure to heating.

Anvils (illus 15)

This term refers to objects that bear evidence of use as a working surface. One example, 066AW (15.3), had a working surface prepared by grinding, while the other had been prepared by pecking.

Chisels (illus 15)

Three pieces resembled modern chisels in shape and were probably used for similar tasks. Two were fragments, but 066AX (15.4) was intact and shows evidence of use on the chisel edge.

Miscellaneous tools (illus 15)

A number of other stones appeared to have been used as tools. Surface find AA (15.8) appeared to be a stone bar of a type used in tillage and well known from northern Scotland (eg Orkney or St Kilda), while surface find AC (15.9) was probably used as an adze. 001DO (15.5) was a small stone in the shape of a miniature axe; similar miniature axes were recovered at Stoneyburn Cairns and from Cloburn (Banks 1995b, illus 9.11, 314; Lelong & Pollard 1998). 001EK (15.6) was a borer with the pointed end pecked to a concave depression; 001ER (15.7) was an exceptionally smooth polished stone bearing irregular striae and seems to have been a hone. 085AA was a pounder (not illus), with a hole possibly drilled or pecked in one end and one edge hammered to a concave surface. The hole appeared to have been lined with a fine grey clay and seems to have been a lining for a thumb-grip. There were a further 64 pieces of stone recovered either for which it was impossible to determine a particular function or which proved unlikely to be artefactual.

DISCUSSION

Very few of the items described have been recovered from firm contexts, but all relate to the occupation of the site. The assemblage overall points to both pastoral activity with the possible butchering implements and to arable agriculture with the querns and the possible tillage tool (surface find AA). Whether these are from different phases of occupation cannot be known; thus, from these tools it is not possible to determine whether the site economy was mixed or whether the emphasis changed over time.

The study of the coarse stone tools does reveal interesting information, however. The condition of the querns indicates that they may have been manufactured on site. The intact beehive quern (254AA) bears no sign of use either in the form of wear on the flat grinding surface or in the form of use-wear in the handle socket or in the axial perforation. The possible roughout (001DM) supports this suggestion as it is both similar in dimensions to the intact beehive quern (254AA) and has evidence of preliminary flaking and the beginnings of a perforation for the central rotary axis.

The dating of the querns is quite loose and all the types represented could easily have been in use at the same time. The trough quern fragment (001EO) is the least datable, being broadly later prehistoric, while the beehive quern fragment (001EG) is tentatively dated to the first to second centuries AD. Fragment 016AA is of a type dated to the later part of the Roman occupation, while the intact flat beehive quern (254AA) has been dated very broadly to the first to fifth centuries AD (Curwen 1934). It is unusual to find a beehive quern with vertical handle in southern Scotland, so the lack of a secure date for the piece is to be regretted, particularly as the piece appears never to have been used and was probably manufactured on the site.

The distribution of the rubbers, hammerstones and butchering implements indicates a significant spatial separation of certain activities and the associated depositional practices. Both the rubbers and the hammerstones are relatively frequent within the midden deposit (F066), which lay adjacent to structure S5 in Block 1, roughly a third coming from that context. In contrast, there was only one butchering implement in the midden deposit of nine recovered. The midden deposit contained large quantities of fire-cracked stone and charcoal, suggesting that it represents the waste material from hearths and from cooking in general. The distribution of the

butchering implements, particularly when considered with the greater abundance of other tool types, suggests that butchering probably occurred outwith the domestic/cooking areas.

INDUSTRIAL MATERIAL

Effie Photos-Jones

In the course of the flotation of the soil samples for environmental remains, material broadly classified as 'industrial waste' (IW) was recovered. On close optical examination much of this material proved to be natural. Chemical and mineralogical analysis was subsequently undertaken on the remaining samples, with the aim of establishing (a) which of the materials were indeed natural as against man-made, and (b) which of the samples within the latter group derived from domestic as opposed to industrial activities.

In addition to these 'industrial' materials, an iron bar, recovered from ditch fills, was also examined.

METHODOLOGY

The samples were examined using a stereo microscope at low magnification. Most of the material, originally identified as slag or cinder, proved to be fragments of raw or heated coal (coke). As a result the original categories were redefined. Samples, identified as 'lead and lead slag', 'mortar' and 'industrial', were subjected to further examination and chemical and mineralogical analyses. Specimens were prepared as polished blocks, mounted in cold-setting resin, then ground and polished with 6 and 3 micron diamond pastes. Technical characterization was based on reflecting light microscopy followed by examination and chemical analysis with scanning electron microscope with energy dispersive X-ray analyser (SEM-EDAX) and X-ray diffraction (XRD) analysis for mineral phase identification. Prior to examination with the SEM, each polished block was carbon-coated. Conventional SEM-EDAX analysis methodology consists of a) area analyses over different sections of the polished block with the aim of producing a 'bulk' chemical composition followed by b) spot analyses of distinct mineralogical phases (angular or needle-like grains, glassy matrix etc) with the aim of characterizing each one.

RESULTS

A full report on the analytical results is held in the project archive. The results presented here are for the samples that demonstrated an anthropic rather than a geological origin and derived for the most part from secure contexts (Table 6).

WE2: WE 94 013/051 construction trench of the roundhouse

Description Siliceous rock-type material; on section, it is grey, compact and lacking porosity; small quartz inclusions are embedded on its surface.

SEM-EDAX examination and analysis Two area analyses over two different sections of the polished block revealed a mean composition consisting of an alumino-silicate with varying amounts of iron, potassium, sodium and magnesium. A number of inclusions of different composition were detected: a titanium oxide-rich spot, a feldspar and numerous quartz grains.

TABLE 6

SEM-EDAX analyses of industrial waste and iron bar: composition in weight percent; nm = not measured; results are normalised to 100%

	Na_2O	MgO	Al_2O_3	SiO_2	SO_3	P_2O_5	K_2O	CaO	TiO_2	MnO	FeO	BaO	CuO	Total
Industrial waste														
WE2 area analysis 1	2.3	1.17	11.94	73.41	0	0.25	3.91	1.07	0.85	0.09	4.77	0.25	nm	100.01
WE2 area analysis 2	1.02	4.91	13.62	54.48	0.17	0.19	1.6	2.36	2.95	0.31	18.18	0.21	nm	100
WE2 Ti-rich grains	0	0	0	0.24	0	0	0	0	95.59	0	0.43	3.58	nm	100.01
WE2 feldspathic grains	0.16	0	17.07	63.45	0	0	17.13	0	0	0	0	0	nm	99.84
WE4 area analysis	0.22	2.25	12.97	33.68	0.09	0	4.72	39.94	0.72	0.21	4.1	0.91	nm	99.81
WE4 grains of gehlenite	0.24	4.49	16.89	31.03	0.05	0.09	1.04	43.52	0.18	0.05	2.88	0	nm	100.46
WE4 spot analysis 3	0	0.07	8.92	34.09	0	0.27	8.09	34.35	4.94	0.03	8.01	0.63	nm	99.4
WE4 spot analysis 4	0.04	0.23	10.56	34.03	0.09	0.24	9.31	27.39	4.82	0.24	11.57	1.5	nm	100.02
WE4 spot analysis 5	0	0	2.89	36.95	0.12	0.27	3.09	54.92	0.17	0.22	0.93	0.44	nm	100
WE4 spot analysis 6	0	0	4.48	37.67	0.03	0.22	5.03	52.11	0.11	0.06	0.99	0.27	nm	100.97
WE5 area analysis 1	0.84	3.06	14.45	68.2	0	0.08	3.83	0.14	0.87	0.11	8.35	0.07	nm	100
WE5 area analysis 2	0.73	4.9	19.08	58.36	0	0.18	3.17	0.19	1.23	0.08	11.93	0.07	nm	99.92
WE5 area analysis 3	0.89	2.93	14.69	69.59	0	0	3.99	0.1	0.93	0.12	7.48	0.26	nm	100.98
Iron bar														
WE18.1 slag inclusion 1	0.03	0.12	1.16	20.61	0.02	3.42	0	0.12	0	2.95	71.39	0.01	nm	99.83
WE18.1 slag inclusion 2	0	0	0.15	21.13	0	2.14	0.02	0.01	0	3.45	73.03	0.06	0.01	100
WE18.1 slag inclusion 3	0	0.25	4.69	25.07	0.32	0.94	0.03	0.22	0.42	7.53	60.26	0.11	0.13	99.97
WE18.1 slag inclusion 4	0.09	0.02	1.6	14.92	0.1	6.24	0.06	0.02	0.14	2.4	74.34	0	0.07	100
WE18.1 slag inclusion 5	0	0.08	4.6	34.79	0.34	1.29	0.24	0.33	0.42	4.36	53.42	0.12	0	99.99
WE18.1 slag inclusion 6	0.06	0.05	3.33	20.84	0.49	5.5	0.23	0.25	0.18	3.33	65.42	0.28	0.02	99.98
WE18.2 slag inclusion 1	0	0.06	0.07	0.46	35.4	0.11	0	0.06	0.29	47.53	15.98	0.06	nm	100.02
WE18.2 slag inclusion 2	0.02	0.12	2.15	17.96	0.42	5.69	0.14	0.23	0.21	2.67	70.39	0	0	100
WE18.2 slag inclusion 3	0	0.02	0	0.08	26.9	0.09	0.03	0.03	0.03	31.85	39.25	0.07	1.66	100.01
WE18.2 slag inclusion 4	0	0.143	0.06	0.163	13.17	0.17	0.02	0	0.06	11.67	67.12	0	7.43	100.01
WE18.2 slag inclusion 5	0.27	0.22	4.43	34.72	0.32	0.5	0.21	0.32	0.47	4.36	54.18	0	0	100
WE18.2 slag inclusion 6	0.2	0.8	1.56	4.95	0.73	0.1	0.19	1.73	0	0.06	89.43	0.19	0.07	100
WE18.2 slag inclusion 7	0	0.08	0.05	0.15	24.06	0.27	0.02	0	0.05	26.86	48.04	0	0.41	100

Conclusions On the basis of phase characterization, this sample is most likely to be a fragment of rock.

WE3: WE 94 surface find 001 DY (Site ID: 'lead slag')

This sample was an amorphous piece of metallic lead (rather than 'lead slag') with a thin layer of lead carbonate weathering on the surface. It was identified as scrap metal, possibly dropped from a crucible while still hot, or discarded after use, perhaps while soldering.

WE4: WE 94 surface find 001 BP (Site ID: 'slag')

Description Amorphous lump of siliceous grey-white material, with 'ropey' top surface reminiscent of tapped slag and smooth, bottom surface, presumably man-made; on sectioning, it revealed a grey core with a thin outer layer (off-white) due to weathering.

SEM-EDAX examination and analysis Area analyses over two different sections showed a calcium alumino-silicate with only small quantities of iron. In detail, dark angular grains of gehlenite are seen in a two phase matrix consisting of a) bright Fe-Ti-rich calcium alumino-silicate (spot analyses 3 and 4, Table 6); and b) a potassium-rich calcium alunimo-silicate (spot analyses 5 and 6, Table 6, illus 16a).

X-ray diffraction The diffraction pattern showed primarily gehlenite, a high temperature forming calcium alumino-silicate.

Conclusions The sample appears to be a slag fragment consisting of gehlenite, which is a mineral rarely encountered in nature but quite common in iron or steel making furnace slags (Photos-Jones 2000). Since the sample was a surface find, it is most likely that it has been brought to the site from elsewhere.

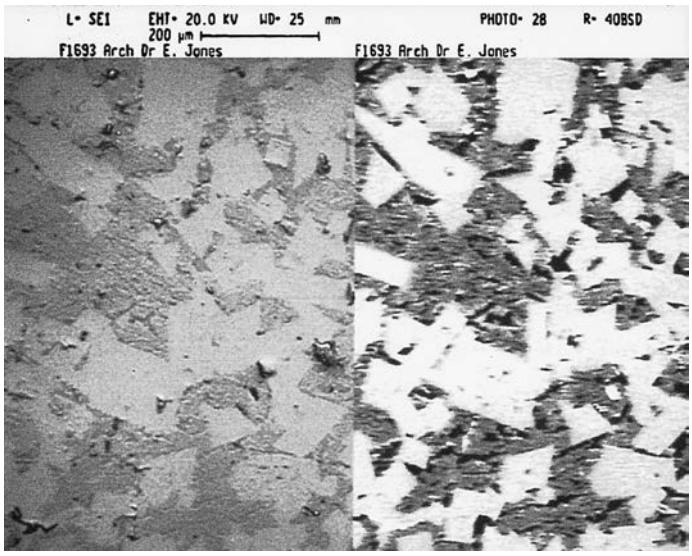
Description Greenish-grey light amorphous lump of highly vitrified material with small quartz inclusions adhering to the surface but showing no reaction with it. In section, it is black and very porous (variable size from very small to large, 1 mm across). Small fragments of carbonaceous material trapped within a pore on the surface of the sample were also revealed.

SEM-EDAX examination and analysis Area analyses at both low and high magnification revealed a uniform composition throughout. The glass composition consists of alumino-silicates with c 8–10% FeO and a small amount of magnesium and potassium ($K_2O + MgO$ = c 7%; see illus 16b and Table 6).

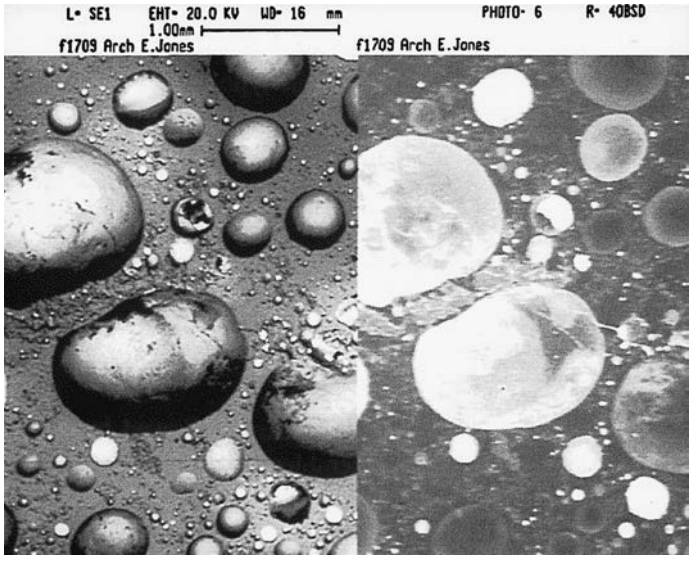
Conclusions This is a highly fired, vitrified material normally identified as vitrified fuel ash (VFA). There are no metallic inclusions or elements within the glassy phase that would have characterized the sample as metallurgical. VFA is known to have occurred within a domestic context like a hearth. The charcoal, trapped within one of the pores on the surface of the sample, might repay further investigation to establish the type of wood.

WE12: WE 94 249/016 (Site ID: 'industrial waste')

Description Fragments of material resembling coal or coke but with a highly vitrified surface.



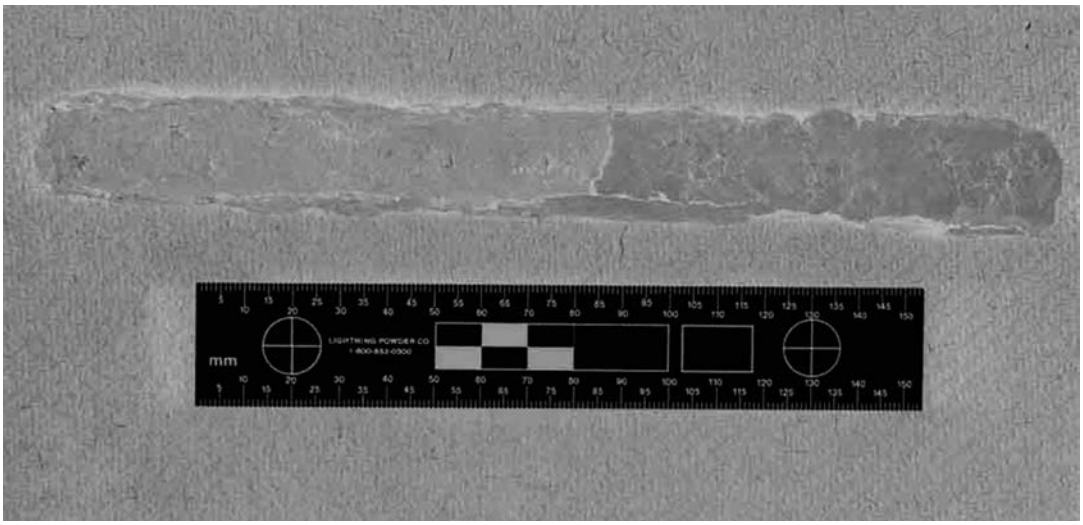
ILLUS 16a WE4-area photograph of the section of both SE (left) and BS (right): angular grains of gehlenite within a crystalline matrix consisting of two phases, a) iron-titanium rich calcium alumino-silicate and b) potassium-rich calcium alumino-silicate (bar = 200 microns)



ILLUS 16b WE5-area photograph of part of the section at both SE (left) and BS (right): round inclusions are pores; the matrix is non-crystalline sample of VFA (bar = 1 mm)

X-ray diffraction The diffraction pattern shows a single quartz peak followed by a minor peak of feldspar. Overall, the diffraction pattern resembles that of coke or charred coal (A J Hall, pers comm).

Conclusions The sample is likely to be coal or coke. Strictly speaking coke derives from the heating of coal in a reducing environment within coking furnaces. However, a fragment of coal that was heated within a furnace might produce the same porous structure. Unfortunately, the provenance of this sample is problematic; it derived from a post-hole in Block 7 which could not be confidently assigned to either of the structures, S15 or S16.



ILLUS 17 WE18: iron bar recovered from the ditch

WE18: WE97 600/6007 (403) (Site ID: iron 'currency bar')

Description An iron bar (210 mm long, 7 mm thick — metal only — 20–22 mm wide; illus 17). Weight was 185 g. Recovered from ditch fill.

Sample preparation A section (c 3 mm thick) was cut transversely from the end of the bar and was made ready for mounting in a cold-setting resin. However, at the point of cutting, the core of the section came loose and had to be mounted separately. Thus, two sub-samples were prepared as polished blocks, WEB18.1 and WEB18.2. Both blocks were ground and polished with 6 and 3 micron diamond pastes.

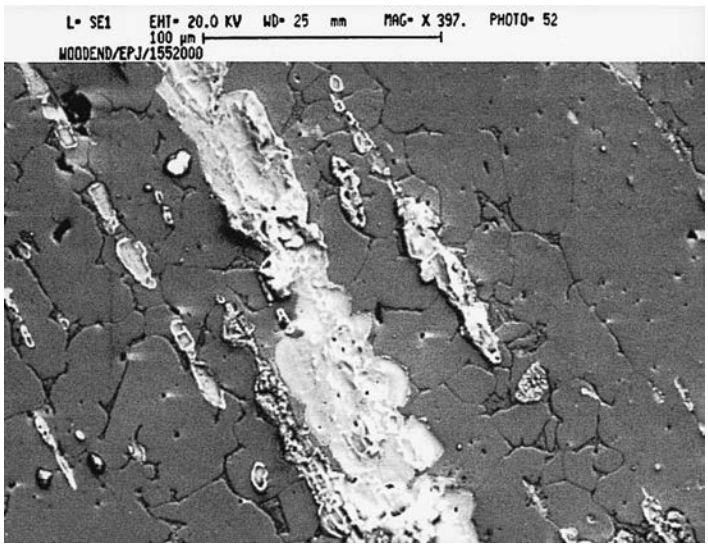
Analytical data Illustration 18a presents a composite SEM photograph of sub-sample WEB18.1 collated from four separate SEM photographs (scale = 2 mm). What is immediately obvious is that on cross-section the bar is horseshoe-shaped rather than oval-shaped, as would have been expected, pointing to a bar in the making rather than a finished one. WE18.1 is a composite of at least two if not more strips of metal, forge-welded together, a layer of corrosion having pushed the two strips apart. The composite strip (WE18.1) is folded over but not bonded with the core (WE18.2), which consists of a thin, flat strip of iron enveloped in a layer of iron oxide (see illus 18b).

Metallographic observations Metallographically, the two sub-samples were unexpectedly different. WEB18.1 consists of ferrite (pure iron) with small amounts of pearlite (a composite phase consisting of plates of ferrite and iron carbide, cementite) forming at the ferrite grain boundaries (illus 19a). It is characterized as a low carbon steel (c 0.2%C), both strips made of low carbon iron. On the other hand, WEB18.2 is a steel with a higher carbon content (c 0.8%C) which has been heat treated, ie heated above its critical point and rapidly cooled by quenching in water. The ensuing phase is martensite (illus 19b).

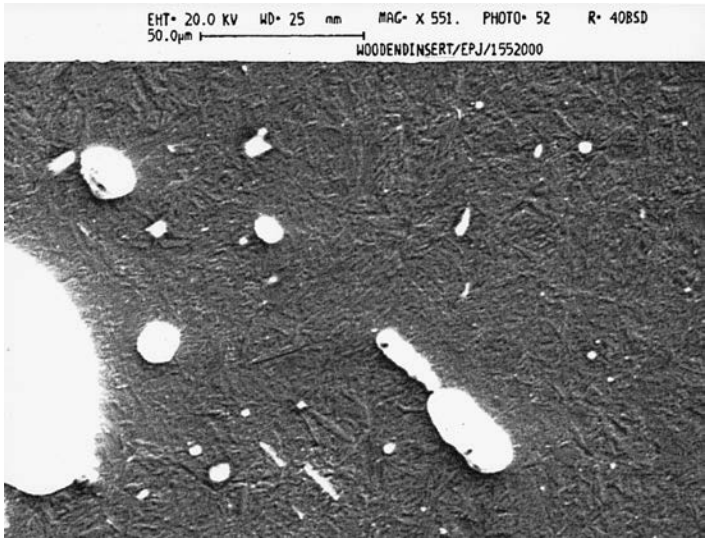
Chemical and metallographic analyses SEM-EDAX analysis of the slag inclusions in both WE18.1 and WE18.2 was aimed at establishing the type of ore used in the making of the bar. Slag inclusions derive from both the smelting and the smithing cycle but it is primarily the former that are suggestive of ore typology.

ILLUS 18a SEM-BS composite image of WE18.1 showing point of cracking and layer of corrosion between the two low carbon iron strips (bar = 2 mm)

ILLUS 18b SEM-BS image of WE18.2 showing steel 'insert' within low carbon envelope (WE18.1): layer of iron oxide surrounds remaining metal core (bar = 2 mm)



ILLUS 19a SEM-BS image of WE18.1 showing 'thread-like' pearlite along the ferritic grain boundaries, denoting a low carbon iron (c 0.1–0.2%C): glassy slag inclusions are elongated along the line of working and the large number thereof has contributed to the failure of this object (bar = 100 microns)



ILLUS 19b SEM-BS image of WE18.2 showing accicular structure of martensitic steel with c 0.8% C and large (black) pores: long and thin dark inclusions are Mn-Fe-sulphides (bar = 50 microns)

Table 6 presents the results of the analyses of six slag inclusions taken across sample WE18.1. They are manganese-rich iron inclusions with considerable amounts of phosphorus, small quantities of alumina reflecting the commonly available type of bog iron ore used in Highland bloomeries (Photos-Jones *et al* 1998). In contrast to WE18.1, WE18.2 is relatively free of slag inclusions. Of those analysed, only one or two are similar in composition to those of WE18.1, the majority being manganese-iron sulphides (Table 6).

Manganese sulphide inclusions are common in steel produced from pig iron. In the context of 19th-century practice manganese was added to iron in the blast furnace to act as a de-sulphurizer. Thus it appears that while the iron enveloping WE18.1 could have been and probably was produced by the local smith from raw materials available locally, the core was brought in or 'bought from a tinker'.

The forge-welding of low and high carbon iron strips has been common practice since very early times. Martensite is a hard phase necessary for a cutting edge but on its own it is very brittle. It therefore needs to be forge-welded to a soft (ferritic) envelope or core, thus ensuring that the object will not fail.

DISCUSSION

Miscellaneous samples

The chemical and mineralogical examination of the samples indicated that only a small percentage derived from human activity, particularly of the period of the site. Of the materials presented here and deriving from sound contexts, WE2 is a natural rock, WE12 is a fragment of coal/coke and only WE5 (classified as vitrified fuel ash) could have been produced within a domestic hearth environment. Of clearly metallurgical origin are the lead fragment (WE3) and the sample of gehlenite slag (WE4) as well as a second fragment of slag (WE16) consisting of mullite, another high-temperature phase. All three were surface finds.

Thus, the majority of the industrial waste proper recovered from the site seems to belong to the activities of a later period, and appear to have been brought in. The presence of coal/coke on the surface as well as in context (WE12) suggests that this material was present and possibly available for use at a domestic level, even at a pre-medieval period.

Iron bar

The Woodend bar consists of two types of metal, a core of heat-treated steel (WE18.2) and a low-carbon (WE18.1) iron enveloping the core. Given the relative absence of bloomery type or slag inclusions and the presence of manganese sulphide ones, it is unlikely that this piece of steel was produced by the carburization of a piece of low carbon iron made in the bloomery. It was most likely produced from pig iron in a blast furnace.

From the Iron Age to the post-medieval period, the bloomery was the only type of process used in iron-making. In this process, bog iron ore (or iron oxy-hydroxides) was reduced in the presence of charcoal within low-shafted furnaces or hearths (Photos-Jones *et al* 1998). Fuel varied according to regional availability, with the Highlands relying on charcoal and the Lowlands perhaps on coal as well as charcoal. Bog iron ore, whether on its own or mixed with mineral ore haematite or siderite, ranged in iron content from 30% to 70% FeO. Varying amounts of manganese and phosphorus were always present and these two elements although not exceptional form the 'fingerprints' for the ore of Highland bloomeries.

In the bloomery furnace, iron metal is never molten; it is simply reduced from the ore while still in the solid state. As a result, the slag never separates efficiently from the rest of the metal but needs to be squeezed out of it in the process of billet-making and metal-smithing. The slag inclusions acquired during the smelting cycle carry the fingerprint of the ore used. They normally consist of a glassy phase with iron oxides. Not all mineral phases present in the smelting slag are found within the slag inclusions, having been removed in the process of bloom smithing. Additional slag inclusions are introduced in the process of smithing. These are primarily iron oxides (FeO) with some scales of magnetite and haematite often referred to as hammer scale, as well as fayalite-type slag inclusions ($FeO\text{-}2SiO_2$). The latter are introduced in the process of sprinkling silica sand on the surface of the hot iron to remove the iron oxide films formed on the surface.

There are two different methods of welding two pieces of metal: a) fusion welding and b) forge welding. In the case of fusion welding, the metal has to be molten or liquid. In the latter case, the metal has to be in a semi-liquid or paste-like form. In both cases, after the welding has taken place no seam is obvious. Oxide films form on the surface as the metal is heated. Silica sand is a particularly good oxide film remover since it combines with the iron oxide film to make a fayalite slag as mentioned above.

With regard to items of everyday use such as tools and weapons, a composite material consisting of low- and high-carbon strips would be most useful since it would impart both strength and flexibility to the artefact. A hardened-steel would break upon impact while a mainly ferritic (low-carbon iron) would be too soft and would bend.

The Woodend bar was in the process of being made. Two separate strips of low-carbon iron were welded together to a single piece and subsequently folded over a core of steel. However, after folding, and while worked a crack developed (illus 18a), which must be the reason why the bar was put aside in the first place. Mechanically, the bar failed because of the plethora of slag inclusions acting as small pieces of glass breaking up the continuity of the metal matrix and creating weak points along the structure.

The sequence of events in the manufacture of the Woodend bar could be roughly summarised as follows:

i) welding of at least two strips of low-carbon iron; bonding by hot hammering
ii) folding without bonding
iii) insertion of a thin strip of hardened steel within the folded composite strip
iv) cracking of the combined material
v) bonding of the iron and steel strips; this stage did not take place in the Woodend bar.

The bar recovered was an artefact in the process of being made rather than an item of trade or currency bar as originally thought. Therefore, a smithy must have been operating in the vicinity of the excavated site, although there is no evidence for smithing slag amongst the finds. If the steel core was indeed 'imported' into the site as explained above, then the smith, who was 'interrupted' in his job by unknown circumstances, may have lived and worked at Woodend many centuries later than the period investigated in this report.

INTERPRETATION

The enclosure at Woodend Farm was built shortly before the Roman invasion, continuing in use as a farming community of the Romano-British period, somewhat later than had been expected. The economy of the settlement was mixed, with evidence of both cultivation and livestock. The palaeobotanical evidence indicated that cereal crops were being grown around the settlement, while the fragments of querns indicated that the cereals were probably processed on the site. There was no evidence of animal bones, but this is scarcely a surprise in south-west Scotland where acid soils make faunal remains a rare discovery on prehistoric sites.

Cattle appear to have been penned on the site, although this may have been intermittent. The large pen may have been very important in the settlement while it was in use. Society would have been based upon cattle, going on the literary evidence available from Irish and Classical sources, and the large animal pen may have been the focal point of the settlement at the time. Cattle would have been gathered for slaughter at the appropriate times of the year, while renders will also have been paid in cattle. The *taurchrec*, a system of combined patronage and investment

(Ó Corráin 1972, 43; MacNiocaill 1981, 7), required the repayment of cattle gifts within a seven-year period, again producing a need to gather cattle. Finally, feasting was an important part of social interaction, with specially raised cattle used for high status feasts.

Grazing would have been on the surrounding grasslands and on water meadows down by the Annan, with the higher ground to the west probably used in summer. At least part of the function of the livestock was meat production, indicated by the presence of butchering tools in the coarse stone tool assemblage. Whether there was a dairying element cannot be known, nor is there evidence for the production of leather. Both are likely from the evidence of literary sources from the post-Roman period, but the physical evidence does not survive here. It is also probable that traction was a reason for the presence of livestock on the site.

The structures appear largely to represent domestic buildings. The micromorphological analysis of samples from Block 1 and from S14 indicated floors and hearths, while the phosphate analysis strongly suggested the interiors of all the structures except S13 were kept relatively clean. It is unfortunate that none of the hearths was preserved and that truncation of the site removed most of the evidence for superstructures.

The one exception to this domestic pattern, S13, was a large enclosure which seems to have accommodated livestock at times. The structure was unroofed but displayed a more complex entrance than the other buildings, having a central division. The radiocarbon date for S13 was the earliest for the buildings, and it is not possible to link any of the others to this phase. However, there must have been houses within the enclosure contemporary with S13, or there would have been little reason to construct a separate pen for livestock. Fencing off part of the internal space of the enclosure must have been to separate the penned livestock from other areas of use. Accordingly, some of the buildings must have been occupied at this time.

There was little evidence to reveal the activities of the occupants of the enclosure other than the evidence for farming. One exception was provided by the quern fragments. At least one of these had not been used and thus was probably made on the site. This does not indicate industrial processes, merely the sort of craft production that could be expected for a farming community. It suggests a degree of self-sufficiency at this basic level that should not be surprising. The evidence for industrial activities on site is very slight, although the presence of fragments of coke in one or two contexts is interesting and a discarded iron bar suggests smithying on site or nearby. There is evidence for industrial activity on the site in terms of unstratified material; the lack of context for this material makes it impossible to determine whether this was contemporary with the occupation or whether it marks a later reuse of the site.

The results of the excavation provide little help in evaluating the status of the inhabitants of the site. High social status is suggested by the scale of the enclosure itself, which indicates considerable effort in its construction. That the inhabitants were involved in agriculture means little; agriculture was fundamental to society in the first millennia BC and AD. The only suggestion of active involvement in the tilling of fields is provided by a stone bar from the midden deposit adjacent to Block 1, although there is no proof that the inhabitants used it. Thus, the inhabitants may have been the farmers themselves; they may have enjoyed the products of the efforts of other, politically dependent communities; or the settlement may have comprised a mixture of both lords and farmers.

The multi-vallation itself might be considered as an indication of social rank (see below), and it had no obvious practical purpose. Furthermore, these banks were constructed from material brought to the site from the surrounding landscape, denoting both control of labour and resources and a strategy based upon social or ideological reasons rather than a practical approach — which would have been to use the soils from the field through quarry ditches. The

ditch itself was created as part of the enclosure rather than as a quarry or a drain. The inner bank appears to have been stone-capped, while none of the banks would have been particularly effective defensively. The intent seems to have been to create a wide band of enclosure that was a very visible monument. An alternative explanation is that the banks were important in emphasizing the identity of the community, as the physical expression of a distinction between those who lived inside and those living outside. This may be of particular importance in view of the radiocarbon evidence for the site operating within the period of the Roman occupation.

Unfortunately, there is no support to be gained from the artefactual material which consists almost entirely of coarse stone tools. The houses vary in size, but there is no indication of difference in status or indeed in function. The radiocarbon dates indicate that several of the structures may have been in use at roughly the same time.

The site has proved to be essentially a Romano-British settlement, occupied both in the period of the Agricolan advance and of the Antonine conquest, but which was probably built in the pre-Roman Iron Age. The evidence for this includes the date for the construction of the ditch (first centuries BC to AD and probably pre-Roman); the similar date for S13; and the fact that S13 is later than S5 and perhaps some of the other, more ephemeral remains in Block 1. The date of construction may not have been long before the Roman period, but a change in the form of the earliest structures may indicate a greater chronological variation.

Still earlier activity is suggested by the date from a post-hole within Block 8, although it could be unconnected with the enclosure itself. This early phase may have included the features on the north-western side of the enclosure, including those which underlay the bank. However, the date of these features is impossible to assess, and they could be seen as much earlier than the enclosure.

DISCUSSION

One aim of the excavation was to examine the value of the model of settlement development in south-east Scotland for south-west Scotland. The developmental sequences recovered from sites such as Hayhope Knowe in Roxburgh (Piggott 1949) and Saint Germains (Watkins 1982) and Dryburn Bridge (Triscott 1982) in East Lothian have been used to create a model for south-eastern Scotland. This is a development from open settlement to palisaded enclosures, the replacement of the palisaded enclosure by a bank, and then a final phase of open settlement involving the construction of buildings over the earlier defences.

This model does not perfectly fit conditions in the south-east. In the discussion following a 1981 conference on later prehistoric settlement in south-east Scotland (Harding 1982, 189–94), several of the contributors noted substantial differences between individual sites in the area and it was concluded that a generalized sequence had yet to be proved. Previous excavations in the south-west have not supported the south-eastern model, with palisades absent and several having no evidence for open settlement. At Woodend, the enclosure provided no evidence for a development of the defences, apart perhaps from the indication that the second and third banks may have been amalgamated after construction. There is certainly no evidence for an earlier palisaded enclosure.

An unenclosed phase is more likely, since there are features and one building (S21) that underlie the banks of the enclosure. However, with no dates for these earlier features, it is impossible to know whether there was any direct relationship to the enclosure. Thus there are not clear grounds to claim a replacement of unenclosed settlement by enclosed settlement. The

conclusion must be that the south-eastern model of settlements in the Iron Age cannot be proven at Woodend.

With the chronology of the enclosure established, it is possible to compare this site to others in south-west Scotland. The past quarter of a century has seen a series of excavations relating to other enclosures in this part of the country.

The first significant excavation was George Jobey's work at Boonies, Westerkirk (Jobey 1975). The site was somewhat smaller than Woodend, but with banks surviving to a height of up to 2 m. The enclosure was formed from a single bank, built onto the old ground surface within a stone facing. The original width was up to 6 m with a ditch c 1.5 m deep. The entrance to the site revealed a hard-core roadway and gate structure. Internally, there was a similar sequence of roundhouses to that of Woodend, with some stances showing a drift off-centre and others showing differences in size. Preservation was better, with hearths and paving preserved. In the area excavated, Jobey found five stances, and the general level of settlement seems equivalent to that of Woodend. The recovery of artefacts was greater than at Woodend: in addition to a similar coarse stone tool assemblage, seven sherds of local pottery and three of Roman pottery were recovered, together with a fragment of a glass bracelet and a bronze penannular brooch. None the less, this is a low incidence of artefactual material for a domestic site and indicates that the general recovery of artefacts from these enclosures will be low. This is significant as this site seems to have suffered less from ploughing than Woodend.

Jobey obtained a single radiocarbon date from charcoal from beneath bank material, providing a *terminus post quem* for the construction of the bank, if not of the internal buildings. The date was 1842 ± 47 BP (AD 129–238 at the one sigma level or AD 77–325 at the two sigma level) and places the site in the Roman period. Certainly, the date concurs with the artefactual evidence. However, a recent interpretation of the Boonies site considered that the radiocarbon date came from a late context and argues that 'it would be legitimate to suggest that the enclosing earthwork was only constructed at a relatively late stage in the sequence of occupation, representing an addition to a previously unenclosed settlement' (RCAHMS 1997, 147). The radiocarbon dates from Woodend suggest that the Boonies date is likely to represent the main phase of settlement, whether or not there was an earlier phase. The strong similarities in the internal structures of the two sites suggest that they would have had similar chronologies; the Woodend dates from buildings very similar to the undated examples at the Boonies suggest that it was also occupied during the Roman period.

Long Knowe in Eskdale, east of Moffat, had a single stone-faced rampart like Boonies (Mercer 1981) that the excavator felt could have achieved a maximum height of 1.5 m originally. Internally, there were 10 house stances with evidence of some single-phase structures, a few two-phase buildings and three or more phases in one case. The radiocarbon dates were 2535 ± 135 BP (calibrating to 803–421 BC at the one sigma level or 982–260 BC at the two sigma level) and 2240 ± 60 BP (373–204 BC at the one sigma level or 399–125 BC at the two sigma level). Both samples were from the primary fill of the ditch and provide only a *terminus post quem* for the internal structures.

Rispain Camp, near Whithorn in Galloway (Haggarty & Haggarty 1983), stands out from the other examples considered in this discussion. Unlike the standard sub-oval form normally found across south-west Scotland, Rispain Camp is one of the few rectilinear examples known. While certainly not unique, and there are several examples from northern England, it is sufficiently different in a Scottish context to invite comment. The enclosure consisted of a double bank and a ditch of considerable size, with an outer ditch system that may have been part of a field system (ibid, 40). The defences were very substantial, very different to Woodend where the defences were

extensive rather than substantial. Little of the interior was excavated, but the interior of one complete house and part of a second was recorded. Both structures were probably destroyed by fire (ibid, 41). Artefact recovery was again low, albeit better than at Woodend. The primary fill of the ditch produced a date of 1990 ± 80 BP (62 BC to AD 124 at the one sigma level, and 175 BC to AD 218 at the two sigma level).

These dates mean that the shape of the enclosure might have been copied from Roman military examples. However, the vagaries of radiocarbon dates mean that it is as possible for the ditch to have been excavated prior to the Romans as after them. The rectilinear form is well known from northern England, and it might be argued that Rispain Camp indicates population movement, or the influence of a population group, rather than a response to the Romans. The radiocarbon dates from the excavated building could indicate pre-Roman activity; charcoal from the ring-groove gave a date of 2085 ± 80 BP (190 BC to AD 7 at the one sigma level or 360 BC to AD 78 at the two sigma level), but derives from oak charcoal and therefore could be giving an artificially early date. Ash charcoal from the same context provided a date of 1830 ± 90 BP (AD 84–327 at the one sigma level or AD 13–412 at the two sigma level). The radiocarbon dates cannot determine whether the site was pre-Roman or Romano-British. The other radiocarbon dates were also either oak or assorted charcoal, all materials with their inherent problems in providing accurate dates (Ashmore 1999). However, the balance of probabilities is that the site dates to the Romano-British period. The origin of the form of Rispain remains obscure, especially since many of the rectilinear enclosures of northern England are Romano-British in date.

The site of Uppercleuch in Annandale, excavated by GUARD in 1990, was the most recent excavation of an enclosure in south-west Scotland prior to the Woodend Farm excavation (Terry 1993b). There was sparse evidence of phasing from the internal features, but there was certainly no indication of phasing of the enclosure itself. The site had a single ditch surviving, with residual evidence of a bank; it is impossible to know how substantial the original defences were. Only around 50% of the interior was excavated as this, like Woodend, was a rescue project arising from the M74. Within the interior, only one building was recorded, although there were other slots present. The radiocarbon dates were again suspect, with a possibility of contamination of the samples. The samples gave a post-Roman date for the building and a medieval date for one of the slots.

The site of Candyburn, just north of Biggar (Lane 1986), resembles the Boonies and Long Knowe examples in shape. A single bank enclosed the site; however, there was no evidence for a ditch. The interior had been severely truncated and only one house was recognizable (ibid, 51). The dates are 2305 ± 65 BP (404–207 BC at the one sigma level or 752–182 BC at the two sigma level) and 2060 ± 90 BP (175 BC to AD 56 at the one sigma level or 360 BC to AD 128 at the two sigma level). These dates rely upon mixed samples, and therefore must be considered with some care (Ashmore 1999).

Unlike the other sites considered here, there is some indication of a palisade pre-dating the bank. This probably reflects the location of the site, suggesting that it relates more to the south-eastern sites than the south-western and that there is a genuine division between the south-east and the south-west in the Iron Age. It is tempting to see this division in ethnic terms, but the imprecise dating and low level of evidence from material culture makes this a dubious approach.

The comparison of the sites indicates that there is enough evidence to say that the south-eastern model of the development of Iron Age settlement does not apply in the south-west. It also shows there is little cohesion in the south-western sites in general. The nature and scale of the defences vary widely, as do the altitudes of the sites: Boonies was at about 150 m OD, Long

Knowe was at 343 m OD, Rispain Camp was about 95 m OD, Candyburn was at 245 m OD and Uppercleugh was at 77 m OD. There seems to have been little difference in the material culture between the sites located in the low-lying areas and those in the uplands (possibly because there is virtually none from any of the sites); the economy (all seem to have followed a mixed agricultural regime, with the possible exception of Long Knowe); or the levels of occupation (where sufficient evidence survives to make a judgement).

The enclosures themselves constitute the main differences: the number of banks, the dimensions of those banks and the presence or absence of a ditch. The main alternatives seem to have been between high banks and low banks. Boonies and Rispain Camp appear to have had banks originally in excess of 2 m, as does the unexcavated enclosure at Warden's Dykes (Banks 1992 & in press); Long Knowe, Candyburn and Woodend had much lower banks. At Woodend, the relatively low height of the bank was off-set by the overall scale of the enclosure. Woodend seems to have had at least three banks, the outer of which was either inordinately broad in places or perhaps included a fourth bank. While none was particularly high, the innermost was probably stone-capped to mark it more clearly.

The fact that the main variation is the form of the enclosure suggests that it is in this respect that any differences between the communities was expressed. These may have been differences in status, or differences in ethnic or tribal affiliation.

Despite the many internal similarities, the Woodend enclosure clearly differs from Boonies. Boonies had a single bank, built onto the old ground surface without significant site preparation (Jobey 1975). The facing of the inner bank at Boonies denotes considerable labour input to the construction, but is still on a different level to the combined elements at Woodend: the ground clearance of the site, the work-gangs' excavation of the ditch, the construction of three wide banks (and possibly a fourth), and the stone capping of the inner bank. This contrast could be treated with indifference, as uniformity of design is scarcely to be sought in prehistoric construction. However, literary texts concerning later, post-Roman societies suggest that considerable importance was attached to physical indicators of status at that time (Bowden & McOmish 1987; Banks 1996). In Irish mid first-millennium AD texts such as the *Críth Gablach*, extra ramparting was the right of a king and some nobles (Kelly 1988, 30; MacNeill 1923) and it is likely that the native British societies of the Roman period were similar. It could thus be argued that the differences in the construction of enclosures were of socio-political significance and that Woodend may have been a site of some importance.

The difference between settlements such as Boonies and Woodend could reflect a completely different perception of the enclosure. The height of the banks at Boonies would provide a practical wall against the outside world, especially if topped with a timber palisade. Not only would it prevent access to the interior, it would also make the interior of the site invisible. The banks at Woodend would have hindered access to the site, but would have allowed the interior to be viewed from without. Another difference would be in the physical distance at which the outside world was kept, far greater at Woodend than Boonies. There is support for the social significance of ramparts in texts such as the *Críth Gablach* and the Irish myths and legends of the period, such as the *Fled Bricriu* (Bricriu's Feast). This has a description of the champions' wives hurrying past the three 'ridges' of the fort in a race to be first into the interior (Henderson 1899). Archaeological evidence from Ireland also supports this linkage between status and ramparts: Edwards (1990, 33) notes that the material culture from the multi-vallate raths in Ireland is much higher than for the simple univallate examples, the former producing fine metalwork and imported pottery and glassware. A note of caution is that the relevant texts and archaeological evidence from Ireland

all post-date the Romans. None the less, there is reasonable evidence that ramparts indicated the status of the inhabitants.

The proposition that the banks of Woodend reflected a particular level of social status is undermined, however, by the general lack of artefacts, and particularly of Roman artefacts, on the site. A settlement in occupation during the Roman period, lying close to the Roman road and the concentration of Roman military sites at the foot of the Lowther Hills, might be expected to produce Roman artefacts, particularly if it had a high social status. Woodend was extant during the Roman occupation, and near to a permanent military structure at Milton, yet there were no Roman artefacts recovered in either 1994 or 1997. The Boonies enclosure, which is strikingly similar to Woodend, produced some Roman artefacts despite being much further from any Roman sites. Similarly, the site of Uppercleugh near Lockerbie, 8 km to the south of Woodend, produced a fragment of a Roman bangle from a ditch terminal (Terry 1993b, 61) despite the very low level of artefact recovery. Although it is not unknown for Romano-British sites to lack Roman artefacts — other southern Scottish examples include the Dod, Selkirkshire, and Brixwold, Midlothian (Smith 1992; Crone & O'Sullivan 1997) — it is unusual and such circumstances require explanation.

The enclosure would have been familiar to the Romans, with the smoke from fires often visible from the Roman road in the valley. There was no attempt to destroy the site, so it must have been accepted by the Romans. It is therefore surprising that there is no evidence for any interaction between the inhabitants and the Roman sites some 7 km to the north.

If Woodend had been an important settlement, it could be expected that some Roman material would have been found on site. The lack of any Roman artefacts suggests that the Romans felt no need to cultivate the inhabitants of the enclosure, and thus suggests that they had no political importance. This does not accord with the implications of the scale of the construction, which suggests a site with political status. Two hypotheses might explain these circumstances. The lack of artefacts might reflect post-depositional attrition and not the contemporary status of the site. The absence of hearth deposits, despite the micromorphological evidence, is explicable through later ploughing entirely removing the traces. Heavy ploughing might also have destroyed much of the artefactual material. (The only artefactual material recovered on site was a coarse stone assemblage that would have been less prone to disturbance.) The lack of Roman material is then as much due to mischance as the presence of the glass bangle at Uppercleugh is due to good fortune. However, it might then be expected that at least some of the artefacts would have been trapped against the inner bank or in a deposit such as the midden in Block 1.

The other hypothesis relates to the longevity of the site. It appears to have been built in the period before the Roman occupation, and it is possible that the construction of the banks reflects that pre-Roman period and the status of the occupants at that stage. The Romano-British occupation of the enclosure, the best surviving aspect of the site's history, would then have been at a period when the social status of the inhabitants had been eroded. Local political circumstances may have changed, with the inhabitants having lost status, or it might reflect the upheavals of the Roman conquest. The *Críth Gablach* makes it clear that status could be lost over generations as well as gained, while Roman occupation would overturn as many social structures as it would maintain.

The enclosure may have been accepted by the Romans as a concentration of settlement, nucleation of the local population being a way of controlling the countryside. It is noticeable that the densest occupation of the site was in the Romano-British period, and perhaps the Romans encouraged multiple occupancy rather than single farms. The inhabitants of Woodend would

then be local farmers, with the social status of a subject population in occupied territory. The site would therefore have had little political importance and would have been largely ignored by the Roman military.

It would also be tempting to discuss the site of Woodend Farm and its differences to other enclosures of the period in terms of the tribal names provided by Ptolemy and attested by Roman sources as the enemies against whom they fought. Woodend Farm lies in an area between the locations given for the Novantae in the west and the Selgovae in the east, and it may be suggested that the enclosure was Selgovan. However, understanding of the territories and nature of the tribal groups identified by these names is too coarse to assign the site confidently to either group. The paucity of artefacts noted in all the enclosure sites discussed indicates that such an approach is unlikely to be successful. It is difficult to explain the differences between Woodend and Candyburn in ethnic terms, since neither has survived sufficiently well for differences to emerge. Furthermore, we have no idea whether the differences between the Novantae and the Selgovae were expressed at the level of material culture or whether it was a purely political difference between groups of warriors.

In conclusion, it seems likely that the settlement was originally of relatively high status, but declined in importance over the centuries of occupation. There is no evidence of interaction with the Romans, and the site appears to have been abandoned by the time of the Roman withdrawal from Scotland. The economy was mixed. Crops grew nearby, while the quernstones suggest that flour was made on site, even though none of the botanical evidence for this survives. The quernstones also reveal some level of craft production, some having been unfinished examples. There was a seasonal element to the livestock regime, either being overwintered in the enclosure, or being gathered in the enclosure at particular times of the year for slaughter, payment of renders and so forth. The attitude to livestock changed over the centuries, with the large animal pen disappearing, and some indication of animals grazing between the later houses across the interior of the site. This may relate to a period of lower status when the settlement had fewer beasts and fewer resources to tend the herds.

The excavation of the enclosure at Woodend Farm has provided some insight into the Iron Age of south-western Scotland. Unfortunately, this site, like so many others in south-west Scotland, has been severely truncated by ploughing, leaving much conjectural and uncertain. As the number of excavated enclosures rises, some of the uncertainties will be removed, but some problems, such as low levels of material culture, are intractable. Consequently, there is much that we will never know about this period of Scotland's history.

ACKNOWLEDGEMENTS

Thanks are due to Mr Sloan of Woodend Farm for his help and forbearance in allowing the excavation to go ahead considerably in advance of the road-building programme. Funding was provided by the National Roads Directorate of the Scottish Office and the project was managed by Historic Scotland. Muriel MacLeod prepared the soil thin sections and Bill Jamieson and David Aitchison the tables of micromorphological results. Dave Sneddon prepared the samples for the metallurgical analyses, while IT assistance on the metallurgy report was provided by Serena D'Alessandro. Thanks to Lesley Farrell, Paul Johnston and Kenny Dunlop for technical assistance during the phosphate analysis. The finds illustrations are by Jill Sievewright and the site illustrations by Keith Speller. Special thanks go to Patrick Ashmore and Gordon Barclay of

Historic Scotland and Bill Hanson of Glasgow University Department of Archaeology for commenting on earlier drafts of this report; the remaining mistakes are in spite of their efforts.

REFERENCES

Alcock, L 1961 'Castell Odo: an embanked settlement on Mynydd Ystum, near Aberdaron, Caernarvonshire', *Archaeol Cambrensis*, 109 (1960), 78–135.

Andersen, J M 1976 'An ignition method for determination of total phosphorus in lake sediments', *Water Res*, 10 (1976), 329–31.

Ashmore, P J 1999 'Radiocarbon dating: avoiding errors by avoiding mixed samples', *Antiquity*, 73 (1999), 124–30.

Banks, I 1992 *Warden's Dykes*. GUARD unpubl rep, 58. Glasgow.

Banks, I 1995a *Woodend Farm, Annandale*. GUARD unpubl rep, 193.2. Glasgow.

Banks, I 1995b 'The excavation of three cairns at Stoneyburn Farm, Crawford, Lanarkshire, 1991', *Proc Soc Antiq Scot*, 125 (1995), 289–343.

Banks, I 1996 'Rural society and settlement: isolated monuments and farming communities in northern and western Scotland in the late Atlantic Iron Age', PhD thesis, University of Glasgow.

Banks, I in press 'The excavation of multi-period remains adjacent to the banked enclosure of Warden's Dykes, Gretna; Neolithic, Bronze Age and Early Historic evidence from the M74', *Trans Dumfriesshire & Galloway Natur Hist Antiq Soc.*

Bowden, M & McOmish, D 1987 'The required barrier', *Scott Archaeol Rev*, 4 (1986), 76–84.

Boyd, W E 1988 'Cereals in Scottish Antiquity', *Circaea*, 5 (1988), 101–10.

Bullock, P, Federoff, N, Jongerius, A, Stoops, G, Tursine, T & Babel, U 1985 *Handbook for Soil Thin Section Description*. Wolverhampton.

Clarke, A forthcoming *Artefacts of Coarse Stone from Neolithic Orkney*.

Close-Brooks, J 1983 'Some early querns', *Proc Soc Antiq Scot*, 113 (1983), 282–9.

Courty, M A, Goldberg, P & MacPhail, R I 1989 *Soils and Micromorphology in Archaeology*. Cambridge.

Craddock, P T, Gurney, D, Pryor, F & Hughes, M J 1985 'The application of phosphate analysis to the location and interpretation of archaeological sites', *Archaeol J*, 142 (1985), 361–76.

Crone, A & O'Sullivan, J 1997 'Excavation of a cropmark enclosure at Brixwold, Dalhousie Mains, Bonnyrigg, Midlothian', *Proc Soc Antiq Scot*, 127 (1997), 387–406.

Curwen, E C 1937 'Querns', *Antiquity*, 11 (1937), 133–51.

Dearn, M J & Branigan, K 1995 'The use of coal in Roman Britain', *Antiq J*, 75 (1995), 71–105.

Dickson, J H 1993 'Scottish Woodlands: their ancient past and precarious present', *Scott Forestry*, 47 (1993), 73–8.

Edwards, N 1990 *The Archaeology of Early Medieval Ireland*. London.

Fitzpatrick, E A 1993 *Soil Microscopy and Micromorphology*. Chichester.

Haggarty, A & Haggarty, G 1983 'Excavations at Rispain Camp, Whithorn 1978–1981', *Trans Dumfriesshire & Galloway Natur Hist Antiq Soc*, 58 (1983), 21–51.

Harding, D W (ed) *Later Prehistoric Settlement in South-East Scotland*. Edinburgh (= Univ Edinburgh Dept Archaeol Occas Papers 8).

Henderson, G (ed & trans) 1899 *Fled Bricriu*. London.

Hingley, R 1990 'Boundaries surrounding Iron Age and Romano-British settlements', *Scott Archaeol Rev*, 7 (1990), 96–103.

Jane, F W 1970 *The Structure of Wood* (2nd edn). London.

Jobey, G 1966 'A field survey in Northumberland', *in* Rivet, A L F (ed), *The Iron Age of Northern Britain*, 89–110. Edinburgh.

Jobey, G 1971 'Early settlement in eastern Dumfriesshire', *Trans Dumfriesshire & Galloway Natur Hist Antiq Soc*, 48 (1971), 78–105.

Jobey, G 1975 'Excavations at Boonies, Westerkirk, and the nature of Romano-British settlement in eastern Dumfriesshire', *Proc Soc Antiq Scot*, 105 (1975), 119–40.

Kelly, F 1988 *A Guide to Early Irish Law*. Dublin.

Lane, A 1986 'An Iron Age enclosure at Candyburn, Tweeddale: report of excavation 1979', *Trans Dumfriesshire & Galloway Natur Hist Antiq Soc*, 61 (1986), 41–54.

Lelong, O & Pollard, T 1998 'Excavation of a Bronze Age ring cairn at Cloburn Quarry, Cirngryffe Hill, Lanarkshire', *Proc Soc Antiq Scot*, 128 (1998), 105–42.

McCullagh, R P J & Tipping, R (eds) 1998 *The Lairg Project 1988–1996: The Evolution of an Archaeological Landscape in Northern Scotland*. Edinburgh (= Scott Trust Archaeol Res Mono, 3).

MacKie, E 1972 'Some new quernstones from brochs and duns', *Proc Soc Antiq Scot*, 104 (1972), 137–46.

MacNeill, E (ed & trans) 1923 'Críth Gablach', *Proc Roy Ir Acad*, 36 C (1923), 281–306.

MacNiocaill, G 1981 'Investment in early Irish agriculture', *in* Scott, B G (ed), *Studies on Early Ireland: essays in honour of M V Duignan,* 7–9. Belfast.

Mercer, R 1981 'The excavation of an earthwork enclosure at Long Knowe, Eskdale, Dumfriesshire, 1976', *Trans Dumfriesshire & Galloway Natur Hist Antiq Soc*, 56 (1981), 38–72.

Morrison, A M, Pollard, T & Banks, I forthcoming *Halmie, Dunbeath: a multi-phase ritual centre in Bronze Age Caithness*.

Murphy, C P 1986 *Thin Section Preparation of Soils and Sediments*. Berkhamsted.

Myhre, B 1969 'Gårdsanlegget på Ullandhaug etter to gravningssesonger', *Frá Haug ok Heiðni*, 1 (1969), 201–23.

OSA. Old Statistical Account of Scotland, IV: Dumfriesshire.

Ó Corráin, D 1972 *Ireland Before the Normans*. Dublin.

Photos-Jones, E 2000 *The technical characterization of the Dalmellington Dunaskin industrial waste* (SASAA Rep 50). Glasgow.

Photos-Jones, E, Atkinson, J A, Hall, A J & Banks, I 1998 'The bloomery mounds of the Scottish Highlands; Part 1: The archaeological background', *J Hist Metallurgy Soc*, 32 (1998), 15–31.

Piggott, C M 1949 'The Iron Age settlement at Hayhope Knowe, Roxburghshire: excavations, 1949', *Proc Soc Antiq Scot*, 83 (1948–9), 45–67.

Pollard, T 1997 'Excavation of a Neolithic and ritual complex at Beckton Farm, Lockerbie, Dumfries & Galloway', *Proc Soc Antiq Scot*, 127 (1997), 69–122.

Provan, D M S 1971 'Soil phosphate analysis as a tool in archaeology', *Norwegian Archaeol Revue*, 4 (1971), 37–50.

Ramsey, G 1995 'Rubbing stones, raths and polished stone axes', *Archaeology Ireland*, 9 (1995), 9–10.

RCAHMS 1997 Royal Commission on the Ancient and Historical Monuments of Scotland. *Eastern Dumfriesshire: an archaeological landscape*. Edinburgh.

Rostocker, W & Bennet, B 1990 *Pre-Industrial Iron: its technology and ethnology*. Philadelphia.

Schweingruber, F H 1982 *Microscopic Wood Anatomy* (2nd edn). Birmensdorf, Switzerland.

Soil Survey of Scotland 1982 *South-East Scotland*. The Macaulay Institute for Soil Research, Aberdeen.

Stace, C 1997 *New Flora of the British Isles* (2nd edn). Cambridge.

Terry, J 1993a 'Bodsberry Hill unenclosed platform settlement, near Elvanfoot, Strathclyde', *Glasgow Archaeol J*, 18 (1993), 49–63.

Terry, J 1993b 'Excavation of a farmstead enclosure, Uppercleuch, in Annandale, Dumfries and Galloway', *Trans Dumfriesshire & Galloway Natur Hist Antiq Soc*, 68 (1993), 53–86.

Triscott, J 1982 'Excavation at Dryburn Bridge, East Lothian', *in* Harding (ed), 117–24.

Vermeulen, F H B 1953 'Control of the reproducibility and accuracy of routine analyses at the laboratory for soil and crop testing in the Netherlands', *Plant and Soil*, 4 (1953), 367–75.

Wainwright, G J 1969 'Walesland Rath', *Current Archaeology*, 12 (Jan 1969), 4–7.

Watkins, T 1982 'Saint Germains enclosure, East Lothian', *in* Harding (ed), 106–16.

Waugh, W 1931 'Moats and enclosures in Annandale: Fort, Woodend Farm and Lint Vat, Cleuchhead Farm, Johnston Parish', *Trans Dumfriesshire & Galloway Natur Hist Antiq Soc*, 17 (1930–1), 131–4.

Wild, A 1988 'Plant nutrients in soil: phosphate', *in* Wild, A (ed) *Russell's Soil Conditions and Plant Growth* (11th edn), 696–742.
Williams, B B 1984 'Excavations at Ballyutoag, County Antrim', *Ulster J Archaeol*, 47 (1984), 37–49.

This paper is published with the aid of a grant from Historic Scotland