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THE ROMAN TILERY AND AISLED BUILDING AT CROOKHORN, HANTS, EXCAVATIONS, 1974–5

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ABSTRACT

This report describes the excavation of a Romano-British agricultural settlement and major civilian tilery associated with the Roman villa at Crookhorn, north-east of Portsmouth. The excavation, carried out under difficult conditions during the early stages of modern housing development, revealed an aisled building and an associated double T-shaped corn-drying oven. The main features of the tilery immediately to the north were the tile-kiln within a cover building rebuilt on one occasion, a large rectangular clay pit, and an extensive yard containing waster pits and a possible drying shed. The kiln cover building is a unique discovery in Roman Britain. The site dates from the late third to early fourth century AD.

INTRODUCTION

In January 1974 contractors started work on a new housing estate for Portsmouth City Council at Crookhorn Farm, Purbrook, near Portsmouth. It was well known that the development area encroached onto the course of the Bitterne to Chichester Roman road where some excavation and research had already taken place (Soffe & Johnston 1974). It was also known that the site of a large Roman villa, partially examined in 1926, lay on the north side of the road, just to the east. With these facts in view, members of the South Hampshire Archaeological Rescue Group (SHARG) kept a regular watch on the development area. At the same time the opportunity was taken to record the abandoned buildings of Crookhorn Farm. These stood outside the area of the new housing estate but on a site scheduled for Farthingsgate School (now Morelands First School), to be built for the Hampshire County Council, and were therefore due for demolition. The work was carried out with help from the Royal Commission on the Historical Monuments of England and Dr E M Yates of King's College, London, and will be published separately.

The boundary between the housing estate and the school site ran along the north bank of the farm pond, 50m south-west of the farmhouse. A pipe trench cut 13–15m south of the pond was observed to have sectioned a number of features containing Roman pottery, tiles and flint nodules. In these circumstances a rescue excavation was mounted by SHARG on behalf of DOE, revealing the remains of a Romano-British industrial and agricultural complex consisting of a tile-kiln with associated structures, an aisled building and a corn-drying oven. Evidence was also found to indicate that the pond had originated as the clay quarry for the tilery.

Further work by the contractors in preparation for the school also brought to light evidence of Saxo-Norman and later medieval occupation some 100–130m north and north-west of the Roman site. These features were also excavated in the limited time available, and it was apparent that they formed part of the remains of the deserted medieval settlement of Crookhorn, known from documentary sources. This work will also be the subject of a forthcoming report, as will a reassessment of the 1926 villa excavations, incorporating new information from fieldwork and air photography.

Initially, archaeological excavations took place on three days a week, but were later

reduced to weekends only. In essence, circumstances dictated that excavations were of a salvage nature, taking place for the most part under difficult conditions. They were terminated in July 1975 when the sites were finally required by the contractors. The pond was eventually drained and consolidated. The aisled building, corn-drying oven and tile-kiln complex were destroyed by the subsequent buildings, roads and service trenches. The later medieval site was sealed beneath the school playing fields, whilst the Saxo-Norman features together with the post-holes of unidentified structure were sealed under the school car park and its approach road. Evidence of the kiln survives as a widespread scatter of tile rubble beneath the top-soil to the south-east of the school and at least one waster pit remains almost intact. A large oak growing on the north-east bank of the pond was preserved and is the only part of the pre-1974 landscape to survive the development. With the exception of a few examples of the kiln products on loan to Morelands First School, all finds and excavation records are deposited with Portsmouth City Museums.

SITE LOCATION, GEOLOGY AND GEOMORPHOLOGY (Figs 1 & 2)

Crookhorn is situated at NGR SU 686 074, 50m above OD, on the south facing slope of an almost dry re-entrant valley. The Roman road (Margary's Route 421) runs 80m south of the site. The Roman villa lies 600m to the east.

The valley opens out to the east at Bedhampton into the northern creek of Langstone Harbour, but this water is not visible from Crookhorn owing to the intervening mass of Camp Down, the eastern terminus of the Portsdown chalk ridge. The site also lies on an east-west watershed and provides a spring supplying a tributary of the Pur Brook, which flows west into the River Wallington. All the features described in this report, including the Roman villa, lie on the eastern edge of a patch of the Bagshot Beds, the easternmost of several similar deposits which extend west across the Eocene basin filled with the preceding London Clay and Reading Beds. These strata, of clays, sands and pebbles, occupy a syncline in the Chalk which itself outcrops to the south to form the Portsdown ridge, and to the north to form the South Downs (Fig 2.A). Thus the London Clay and Reading Beds are exposed to north and south of Crookhorn, and the large tract of London Clay to the north has been heavily wooded until recent times. From the Middle Ages, this area has been managed as the Forest of Bere, and settlement on it has been sparse; only since the 19th century have settlements such as Waterlooville developed along important routes across it. The edge of the forest must have come very close to Crookhorn, and today it is represented by Littlepark Wood which is divided from the dwindling pastures of Crookhorn by Scratchface Lane.

During the Roman period and to some extent since, the Bagshot Beds have been important in providing a course for the Roman trunk road (Margary's Route 421) from Bitterne, Winchester and Wickham in the west, to Havant and Chichester in the east (Soffe & Johnston 1974). The sandy acid soils of the Bursledon and Shedfield series produced on the Bagshot Beds (Hodgson 1967, 104–5) give rise to a natural vegetation of heathland (cf. local names: Purbrook Heath, Lye Heath and Broomfield), which would have been relatively passable during the Roman period. Also for much of its length, the road – which passes just north of Crookhorn, was constructed from marine pebbles quarried directly from the Bagshot Beds. It is therefore not surprising that limited Roman settlement has been found along its route at places such as Crookhorn and Southwick. The Crookhorn villa itself is very interesting in being one of the few in central southern Britain situated off, although not far off, the chalk. The reasons for this are clearly complex, but tile-making may have played a very important role in the generally agricultural economy of the villa.

At Crookhorn the local Bagshot Beds consist of bright yellow and white sands, beds of marine pebbles, and lenses of varicoloured

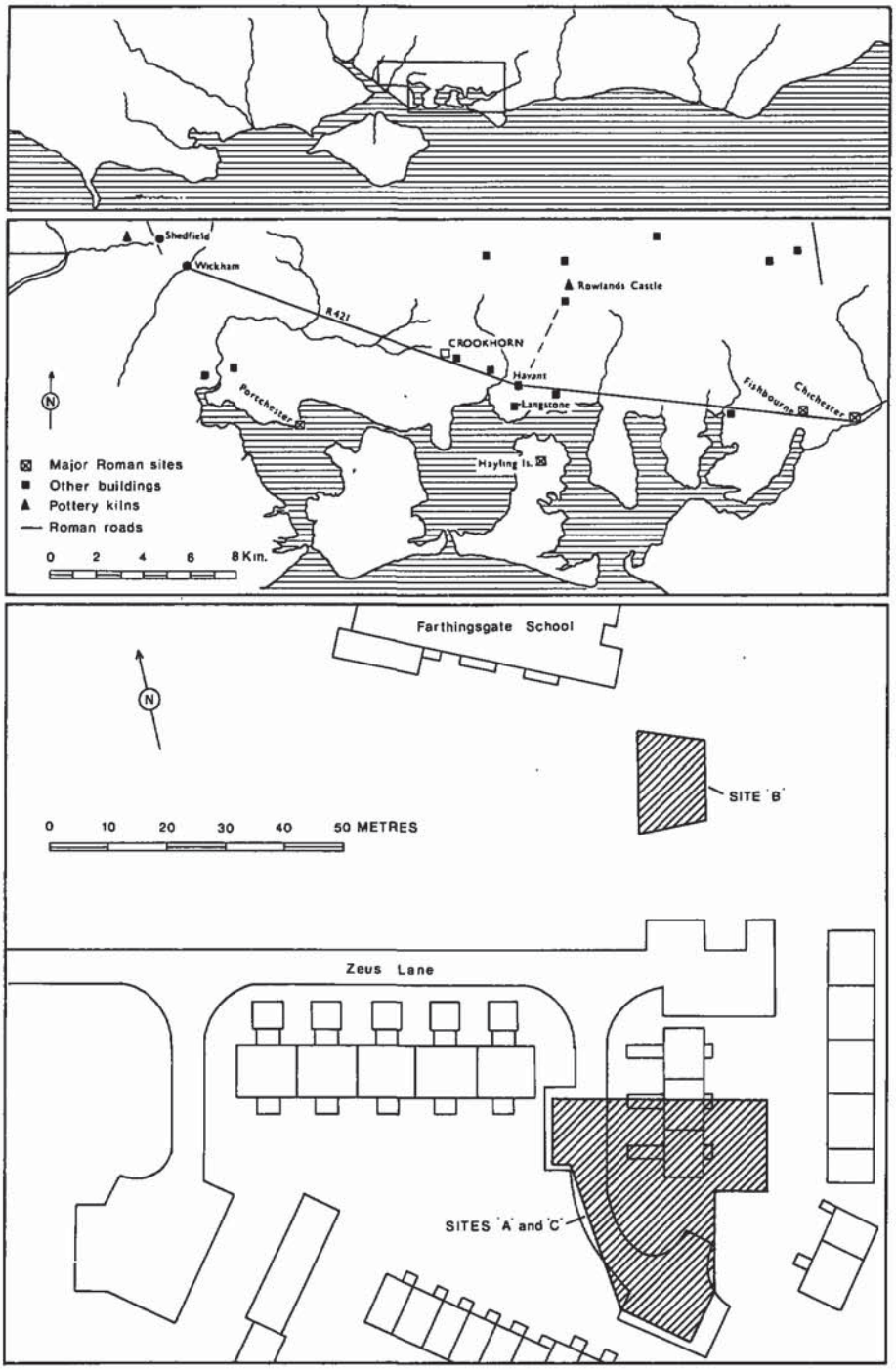
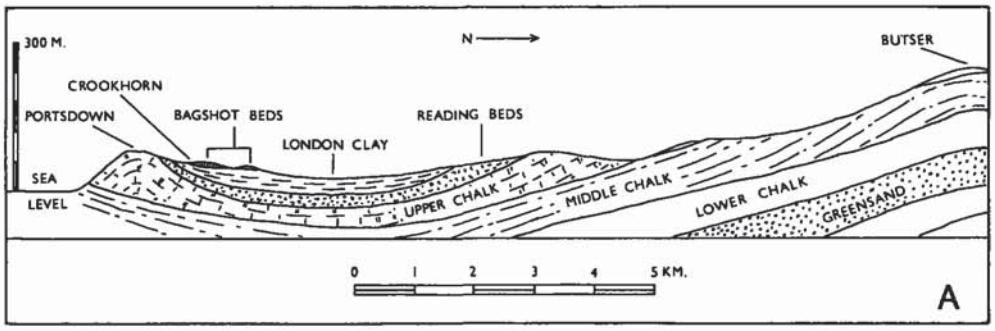


Fig 1. Location Maps and Plan.



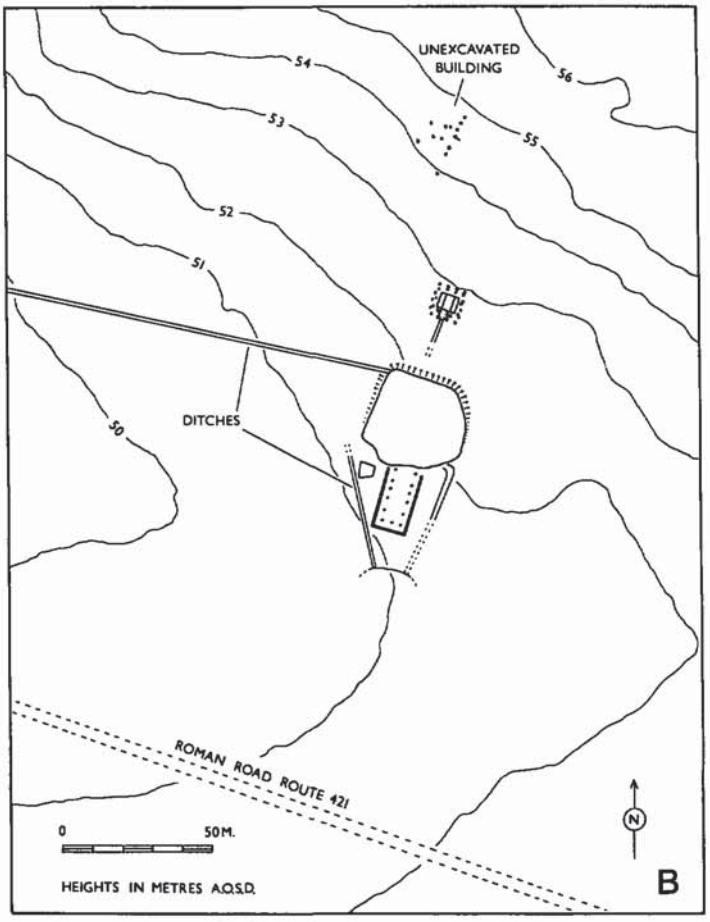


Fig 2. **A** Geological section from Portsdown to Butser Hill. **B** Contour plan of site.

clays. The tile-kiln and clay pit are both cut northward into a slope, the former into a brown clay with sand and pebble lenses and the latter into a pocket of bright blue clay. When exposed to the air the blue oxidises rapidly to a muddy brown colour. However, there is ample evidence in the area of the tile-kiln for the use of a bright red clay in the manufacture of bricks and tiles, and this appears to derive from the local outcrop of the Reading Beds which abut and run along the northern edge of the Portsdown chalk ridge. During the construction of College Road in 1975, these beds were exposed as narrow seams of bright red and white clay. Several small hollows and ponds along this outcrop may suggest some clay working at the time the kiln was in production.

The much more extensive exposure of the Reading Beds to the north was certainly worked during the Roman period, especially at Red Hill, Rowlands Castle. Here, the important potteries supplied basic domestic wares to a wide market and much of the reduced sandy pottery found at Crookhorn, probably came from there. The presence of Roman tile-kilns in that area is more likely, although none has yet been found apart from slight indications on Blendworth Common. Here, during the construction of the A3(M) motorway, several pits of Roman date and quantities of tile were found; these may indicate a kiln. In more recent times there have been large brick and tile works at Padnell, near Cowplain, and Red Hill, Rowlands Castle, utilising red clays from the Reading Beds. The surviving quarry at Red Hill exposes red clay to a depth of *c* 30m. The Reading Beds were also employed at the western end of Portsdown for the production of bricks, tiles and pottery around Fareham and Funtley, at least since the medieval period. The Roman potteries at Shedfield and tile-kilns at Braxells Farm, near Botley, seem to have worked clays and sands from the Bagshot Beds and the Bracklesham Beds which overlie them in this area. Just to the north, at Locks Farm, Bishops Waltham, materials from the Reading Beds and London Clay seem to have been used in making Roman tiles (Cunliffe 1961a).

Thus the situation at the Crookhorn tilery was one where suitable clay, sand, timber and water must have been in plentiful supply during the Roman period.

THE EXCAVATION

The area of excavated Roman features was divided into three units, Sites A, B and C (Fig 3). Throughout the excavation, work was concentrated on one or other site depending on the progress of the developers' building works. This flexible procedure allowed a high return of information within the restrictions imposed by the difficult conditions.

Site A, lying immediately south of the pond, contained the aisled building with ditches running to east and west of it. The building was first located when the contractor's trench cut through it and the pit F1 was sectioned by a manhole. A resistivity survey of the area between the trench and the pond failed to produce useful results and the topsoil was removed mechanically to allow features to be excavated. The north end of the building could only be excavated when the water level of the pond was lowered by partial draining. No trace of a north wall was found but a ramp of flint nodules was discovered leading from the apparent open end of the building down into the pond. The ramp was traced for 5.5m northwards but its extent to east and west could not be determined.

Site B lay in the area scheduled for the school buildings and grounds north of the pond and contained the tile-kiln and its associated structures. Roman pottery was initially observed in contractors' trial bore holes and Roman tile rubble was noted in the north bank of the pond. Trial machine trenching defined an area of scattered Roman tile rubble and a magnetometer survey was carried out (cf report below). This led to the discovery and subsequent excavation of the tile-kiln, the two post-hole structures which had enclosed it, and a number of waster pits and other features surrounding it. The kiln was sampled for archaeomagnetic dating (cf report below), and

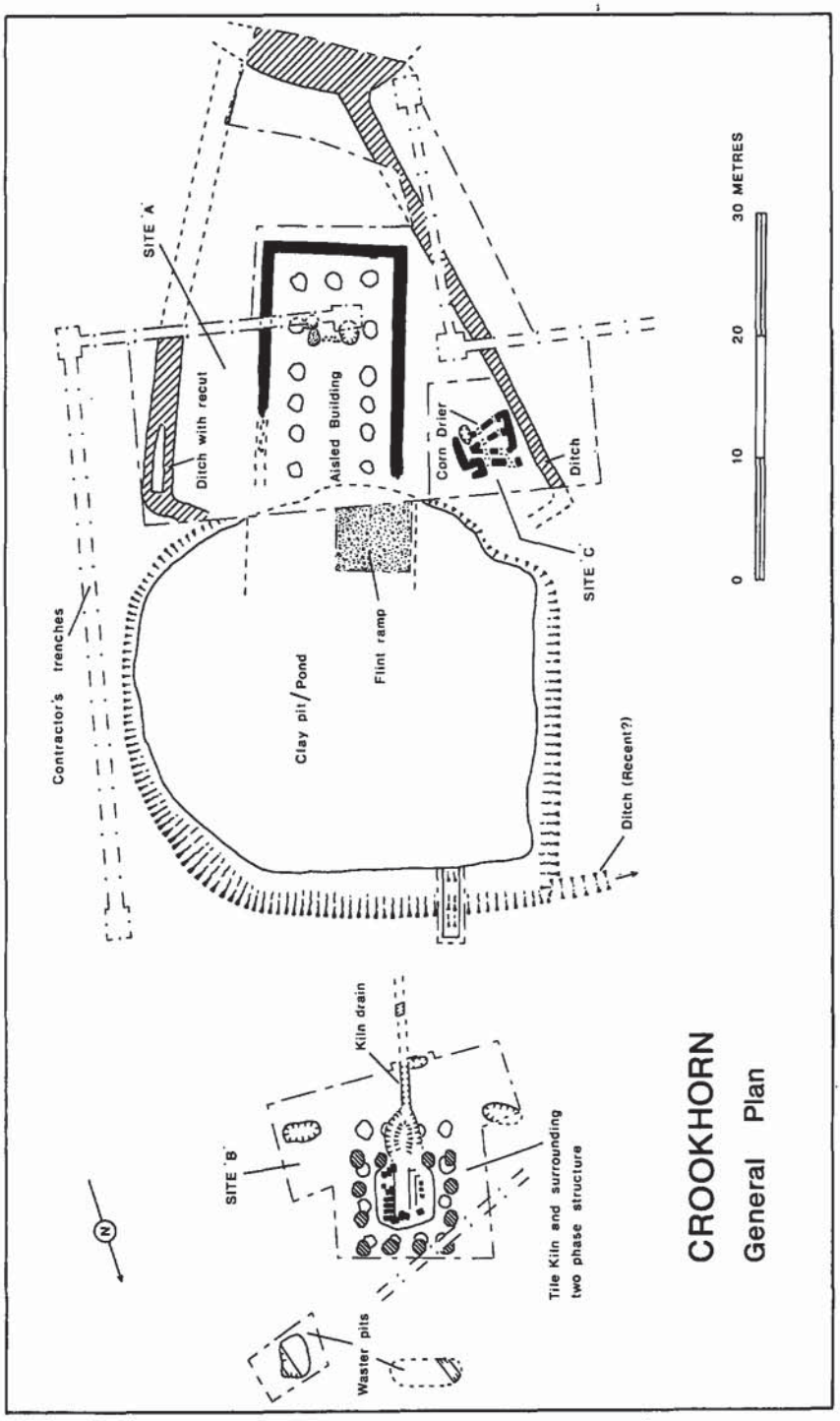


Fig 3. General plan of site.

the feasibility of preserving part of the kiln structure was examined. Unfortunately, its fragility and advanced decomposition ruled out this possibility. A layer of Roman tile rubble was noted in the north bank of the pond where it had been eroded at water level. A trial trench showed this to follow the contour of the bank. The bank was further sectioned back for 6m in order to determine the relationship between the pond and the tilery.

Site C lay immediately west of Site A and contained the corn-drying oven discovered during work on the ditch running to the west of the aisled building. Excavation here was carried out prior to levelling for a service road.

The Magnetic Ground Survey by F V Philpot

The survey was carried out on two occasions, using a differential fluxgate magnetometer and automatic recorder developed by the writer (Philpot 1972/3; Clark & Haddon-Reece 1972/3).

Firstly, a general scan was carried out over the pasture field later occupied by Site B while Site A was being excavated. Two large magnetic anomalies of a confused nature were located east of Site B. The signals were so strong that they could have been caused by buried iron debris relating to the post-medieval farm.

During the 1974 excavation, trial trenches across the field revealed a spread of Roman brick and tile fragments, and a group of pits containing brick and tile wasters. A further magnetometer survey was carried out to locate the tile-kiln. Initially, it was found that the area of brick and tile scatter gave strong magnetic anomalies of very complex 'shape' due to the random orientation of the tile fragments. An area was chosen which was located centrally between exposed pits and surveyed with eight parallel traverses spaced at 1m apart. A very large anomaly of 400 nano Tesla was recorded above the side walls and the back wall of the kiln. Removal of the top-soil then revealed the tile-kiln. A second magnetic anomaly, also of 400 nano Tesla, was located 15m south-east of the tile-kiln (Fig 18). After the area was landscaped, a further scan was carried out in 1987, indicating that the anomalies still remain of this feature and the tile-kiln.

DESCRIPTION OF THE STRUCTURES AND FEATURES

The following is a brief description of all excavated features. A summary list of small finds, pottery by fabric type and weight, and illustrated pottery for each feature or context described, is contained in the microfiche. Where they are of particular relevance to context descriptions, finds are referred to below, and the absence of finds is also noted.

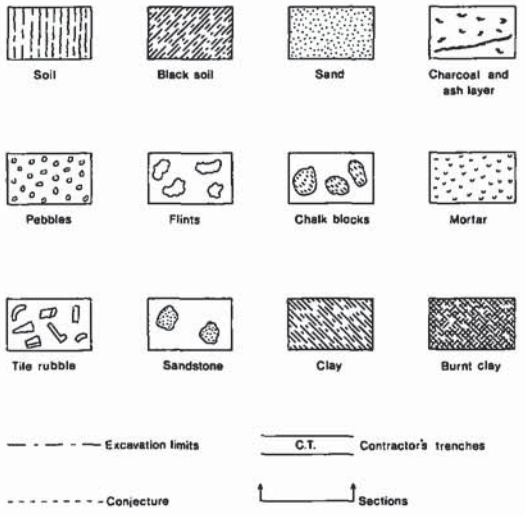


Fig. 4. Key to symbols used in illustrations of excavated features.

Site A
The Aisled Building and Pond/Clay Pit (Figs 5 & 6)

The aisled building was a rectangular structure *c* 19m long and 11.9m wide, with its long axis running approximately north-south. The wall foundations were of flint but no traces of walls or other superstructure survived. The interior was divided by six pairs of large post-holes into a central nave and two side aisles with a central post-hole between the most southerly pair. Seven metres from the southern end of the building the nave area had been filled by several features, the most

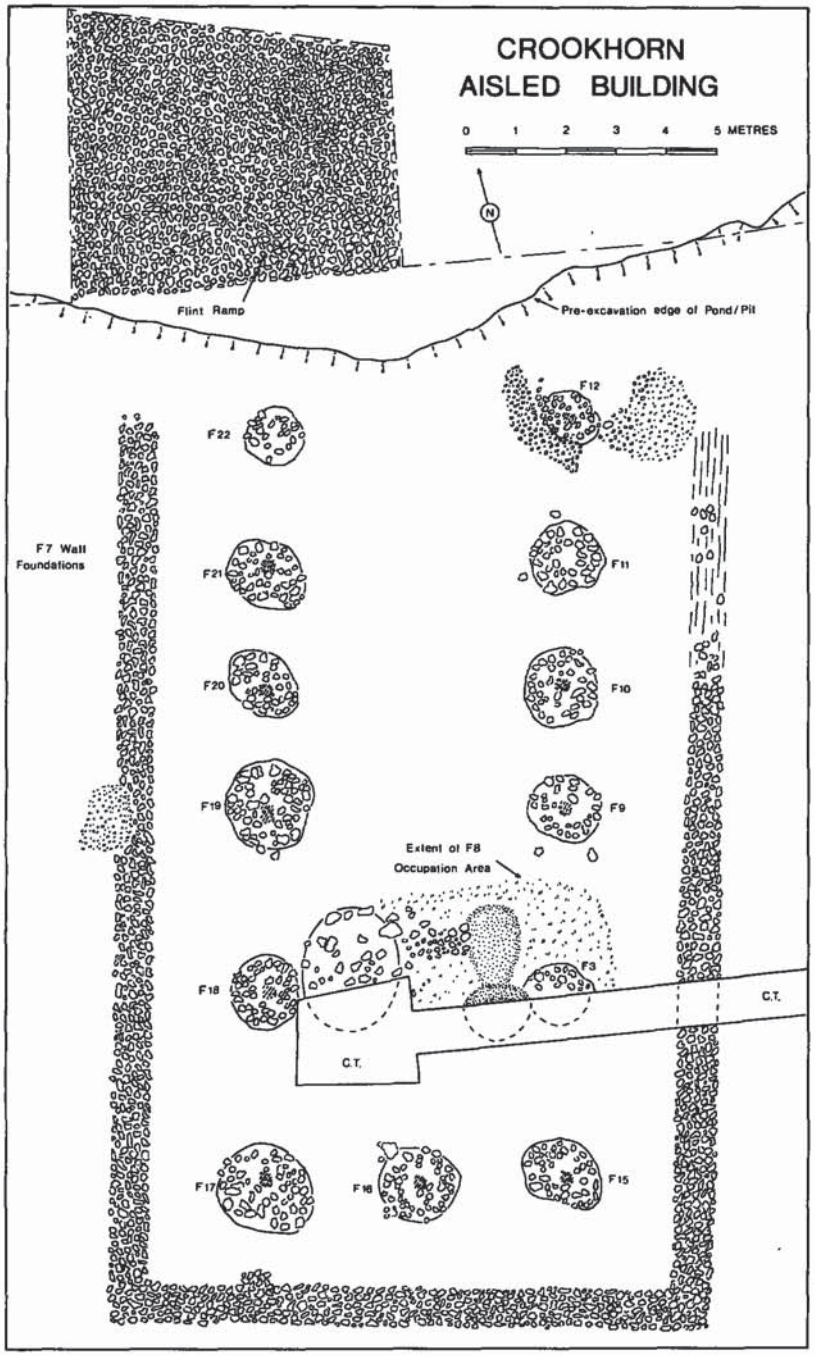


Fig 5. Plan of the Aisled Building.

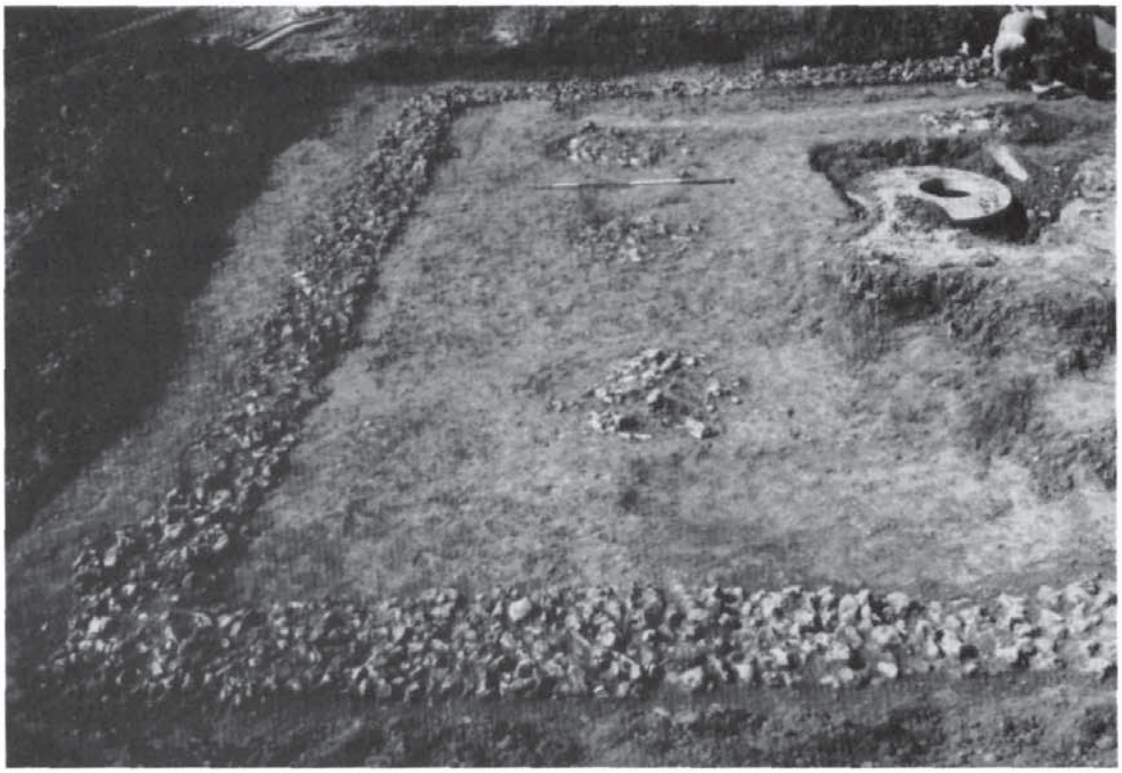


Fig 6. South end of the Aisled Building seen from the east during excavations in 1974.

notable of which was a keyhole-shaped hearth and an oven. To the west of the hearth a small L-shaped platform of undressed chalk blocks had been constructed and nearby a pit was filled with refuse material. A thin scatter of occupation debris surrounded these features and constituted the only such layer within the building.

No traces of a north wall were found, but the partially draining of the pond exposed a ramp running from just beyond the probable north end of the building, down into the pond. The ramp had a gradient of 1:10 and was made up of a uniform layer of flint nodules set into a natural pocket of blue clay. Due to the heavy silting of the pond it was not possible to determine its original dimensions or to prove strategically its precise chronological relationship to the aisled building, tile-kiln and other features on the site. Nevertheless, there is no evidence to indicate that it was not contemporary with these structures and the hypothesis that the pond represented the surviving remains of the clay pit which served the Roman tilery seems to fit well with the other evidence from the site.

If the ramp related directly to a phase in the use of the aisled building, it seems likely that a wide entrance existed at this end. Apart from this there were no signs of entrance-ways or wall sills along the lines of wall foundation. Two small areas of firmly set pebbles, one mid-way along the west wall, the other close to post-hole F12, overlay the structural flints of these features, but there was nothing to show whether they were the remains of a floor or a natural deposit.

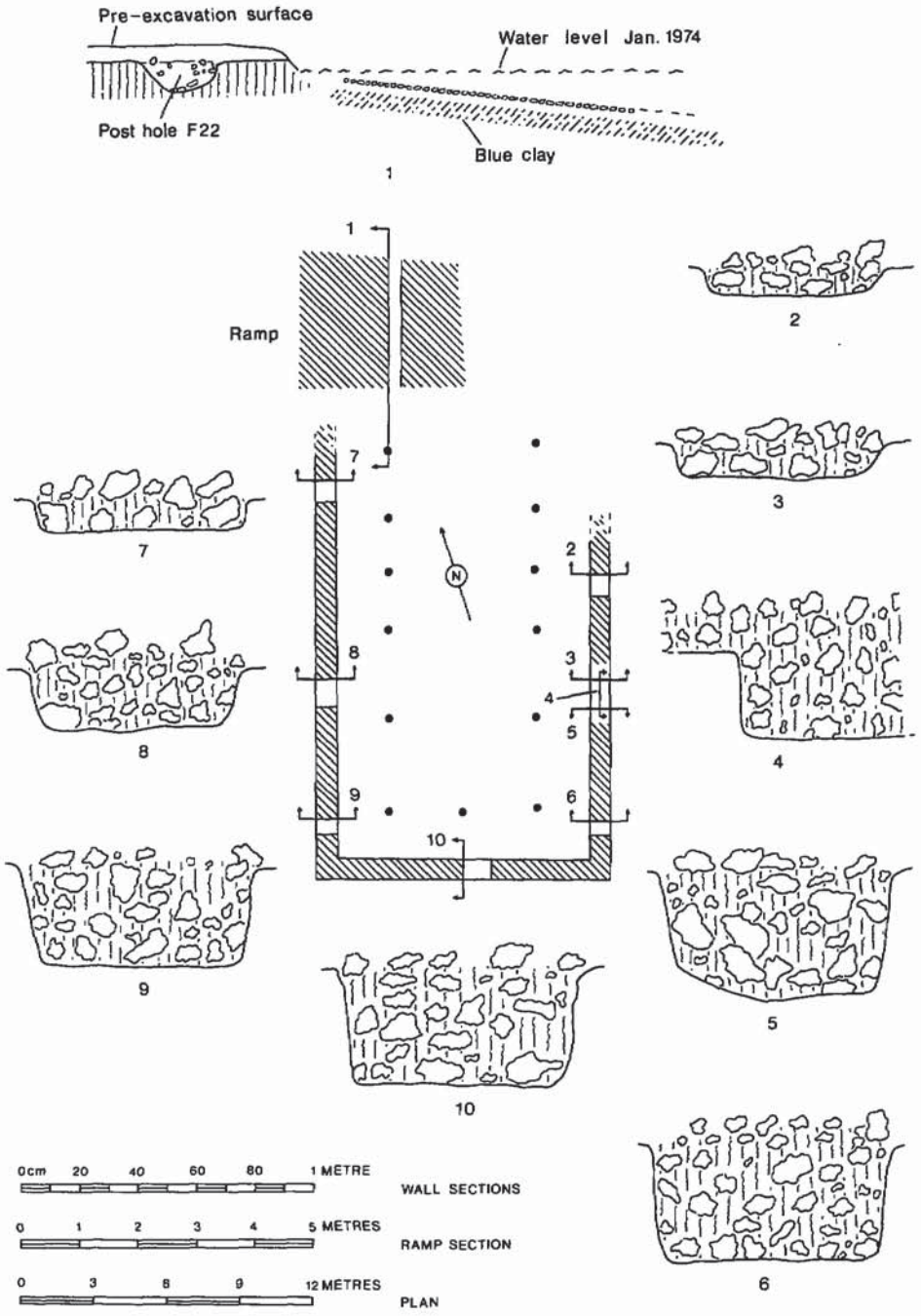


Fig 7. Aisled Building: sections, **1** flint ramp, **2–10** wall foundations.

The wall foundations, F7 (Fig 7)

The wall foundations were of flint nodules bonded in a clayey soil and set in a flat-bottomed trench 70–80cm wide. The depth of the trench was greatest at the southern end of the building. The northern end of the east foundation had not survived but could be traced as a dark stain to a point corresponding to the length of the west side. The bottom of the east foundation was also stepped opposite a point mid-way between post-holes F3 and F9 (Fig 7.4). There was a small internal projection on the south foundation, offset to the west.

Features inside the aisled building (Fig 8)

Pit, F1. Oval plan, 1.8 × 1.6m, depth 0.5m. Partially destroyed by contractor's trench. Compacted fill in 3 layers; the bottom layer 15–20cm thick, consisting of black soil with charcoal flecks and some tile rubble, above this a layer 10–15cm thick, lighter sandy soil with some red clay and small pieces of chalk. The upper layer, 20cm thick, was of brown soil with large flints, chalk and sandstone fragments and tile rubble. The upper two layers contained pottery, including sherds of a storage jar of BB2 ware (fabric J).

Oven, F2. Largely destroyed by contractor's trench. Shallow depression 60cm wide, 12cm deep, filled with soil, having a layer of burnt red clay on the surface surrounding by an area of red clay with chalk granules.

Hearth, F13. 1.5 × 1.0m, adjoining the oven F2. Made up of a layer of burnt soil with fragments of charcoal, chalk and tile, 5cm deep. There were no finds.

Area of Occupation Debris, F8. Partially destroyed by contractor's trench. 4.5 × 2.5m, 5–10cm deep, surrounding the oven, hearth and chalk partition (F2, F13, F14). Large amount of pottery.

Platform or Partition, F14. Partially destroyed by contractor's work, a much disturbed L-shaped feature of undressed chalk blocks, 1.6m long, 0.6m wide and surviving to a height of 10cm. It may originally have been longer, covering pit F1.

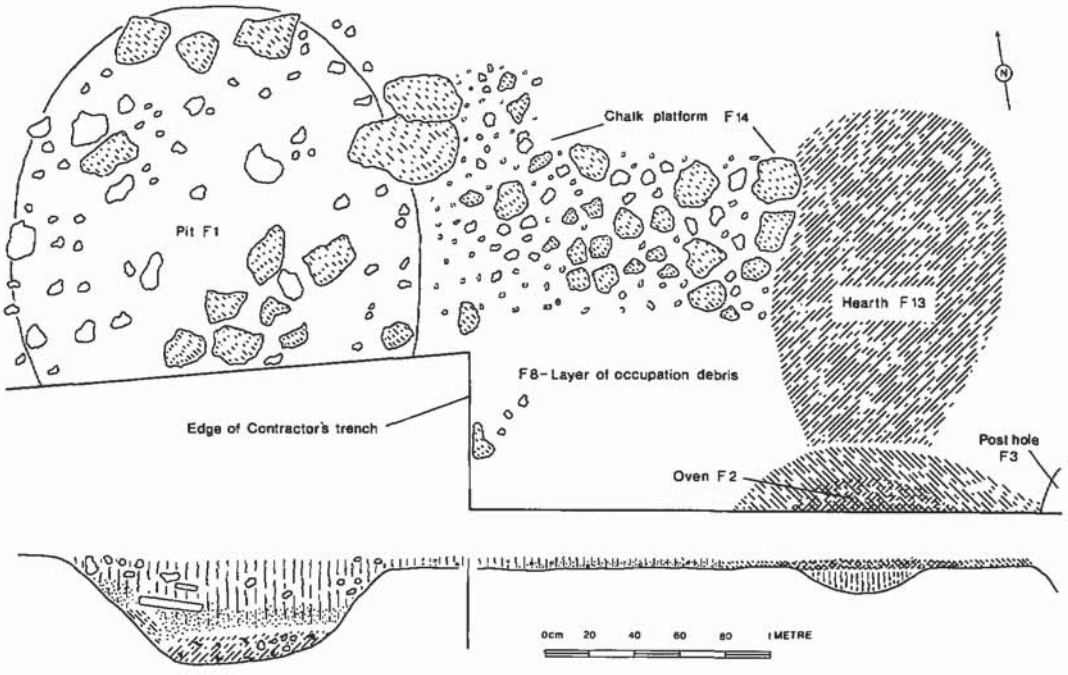


Fig 8. Aisled Building: features inside building partially destroyed by contractor's trench.

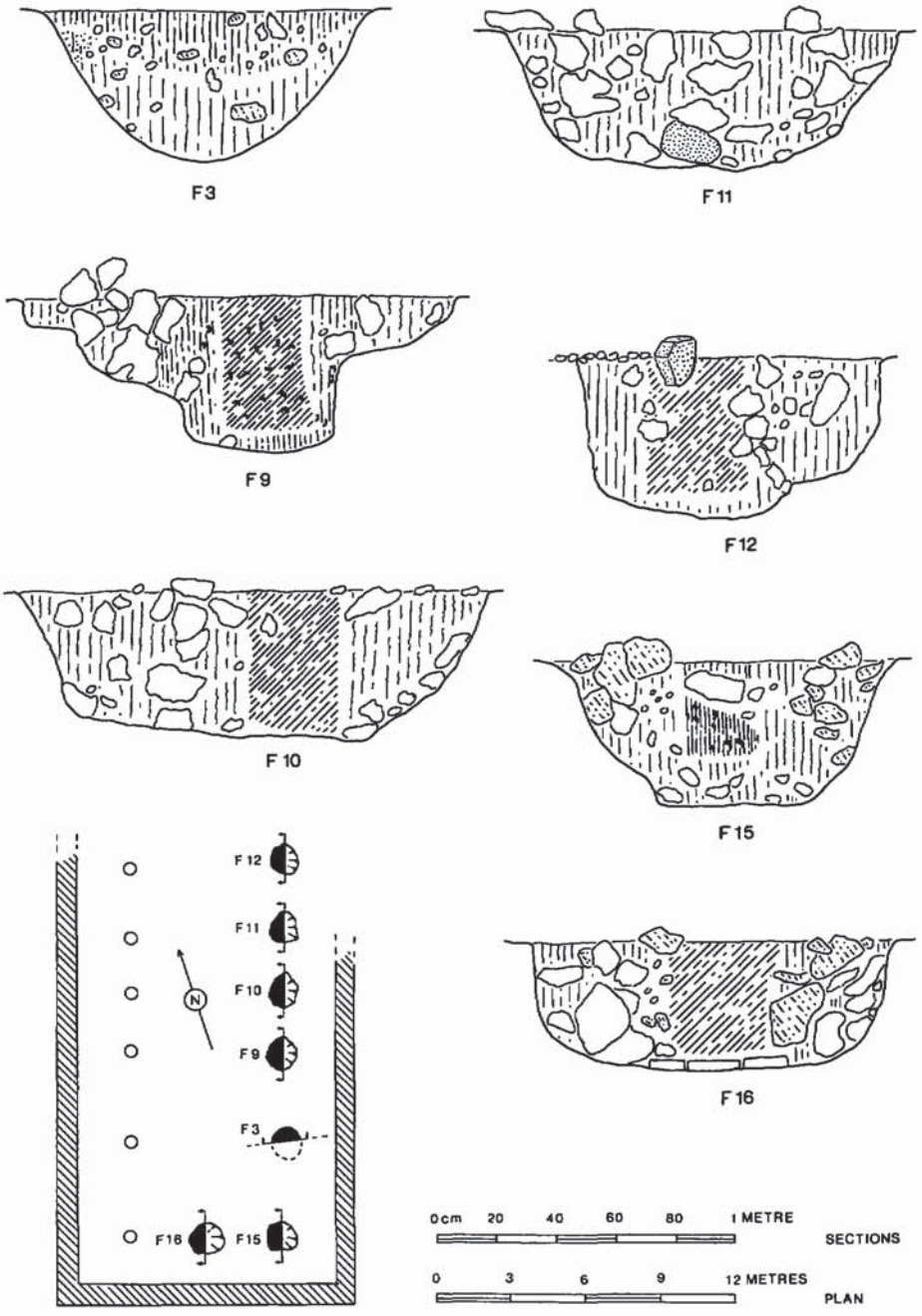


Fig 9. Aisled Building: sections of post holes.

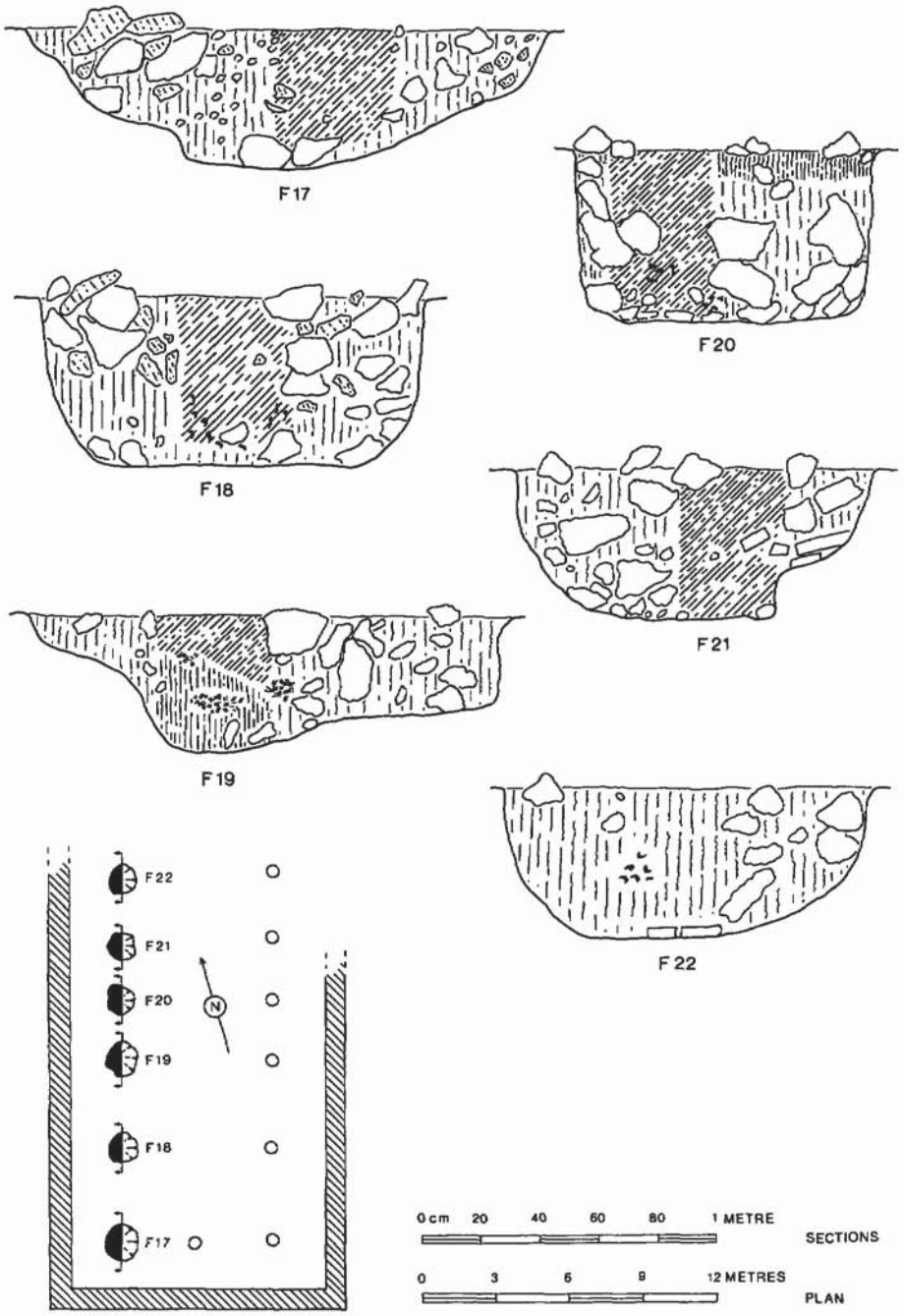


Fig 10. Aisled Building: sections of post holes.

The post holes (Figs 5, 9 & 10)

F3. Diameter 1.1m, depth 0.5m. Partially destroyed by contractor's trench. Fill of brown soil with a darker upper layer. Both layers contained chalk and flint packing. No trace of post position.

F9. Oval, maximum diameter 1.4m, depth 0.6m. A step in the north and south sides. Central post position as a column of black soil with charcoal flecks, 21–25cm square at an angle to the axes of the building. Packing of flints with soil.

F10. Oval, maximum diameter 1.5m, depth 0.55m. Flat bottomed with sloping sides. Post position offset slightly to north showed as a column of black soil *c* 27cm square set at an angle to the axes of the building. Flint and soil packing.

F11. Diameter 1.3m, depth 0.45m. Flat bottom, sloping sides. No trace of post position. Packed with flints, a few fragments of tile and one piece of sandstone, some chalk fragments on surface.

F12. Diameter 1.0m, depth 0.55m. Rounded bottom with step on north side. Post positioned showed as nebulous area of very dark soil. Fill consisted of soil, flints, fragments of tile, chalk and two pieces from a large millstone.

F15. Diameter 1.1m, depth 0.55m. Flat bottom with small step on south side. Post position indicated by dark soil with charcoal flecks halfway down the section. Flint, lump chalk and soil packing.

F16. Diameter 1.2m, depth 0.45m. Flat bottom with rounded sides. Post position showed as black soil with charcoal and chalk fragments. Packing of soil, lump chalk and flints. On the bottom, a broken *pedalis* brick provided a base to the post.

F17. Diameter 1.7m, depth 0.5m. South side had two small steps. Post position showed as column of black soil *c* 40cm across, offset to north. Packed with soil, lump chalk and flints.

F18. Diameter 1.3m, depth 0.65m. Flat bottom with near vertical sides swept in at base. Post position showed as black soil with charcoal at bottom. Packing of soil, lump chalk, flints and tile fragments.

F19. Diameter 1.6m, depth 0.48m. Irregular shaped bottom with large step at south side, wide shallow step on north side. Post position offset to south and showed as black soil at the top and dark brown soil at the bottom. Packing of soil, flints, lumps of yellow clay and fragments of tile.

F20. Diameter 1.0m, depth 0.60m. Flat bottom with vertical sides. Post position offset to south, showed as column of black soil with charcoal. Packed with soil, flints and tile rubble.

F21. Diameter 1.2m, depth 0.60m. Flat bottom with step on north side. Post position offset to north, adjacent to step, showed as column of black soil 35cm across. Packed with soil, flints and tile rubble.

F22. Diameter 1.25m, depth 0.5m. Flat bottom, rounded sides. Packed predominantly with soil, some flints, tile rubble and charcoal. One piece of broken tile laid flat at the base. No trace of post position. No finds.

The Ditches

Two ditches flanked the aisled building, the eastern ditch ran approximately parallel to the long axis of the building, the western at an angle to the axis. Both terminated in a shallow drainage area (F32), 12m south of the building.

East Ditch, F4, F4A, F4B (Fig 11)

This was exposed over a length of 15m between the contractor's pipe trench and the edge of the pond/clay pit. Its western edge was also noted where it entered the drainage area. At its northern end it turned sharply to the west (an important point discussed below), and here it had been recut to leave a spine of earlier fill. The eastern side (F4A) was the later alignment and cut into the earlier ditch (Fig 11.2.3). The depth of this feature was between 0.7m at the south end and 0.25m at the northern end. The fill was of black sandy soil containing large quantities of charcoal. Silting was confined to the bottom and sides in contrast to the fill of the earlier alignment (F4B), which contained lenses of clay silt deposited at regular intervals. It was clear from the stratigraphy that in the last stages of filling the later ditch alignment (F4A) had served as a dump for general site refuse and much ash from the stoke-pits and oven. Flints and tile fragments were also present in quantity together with the pottery and other finds listed in the microfiche.

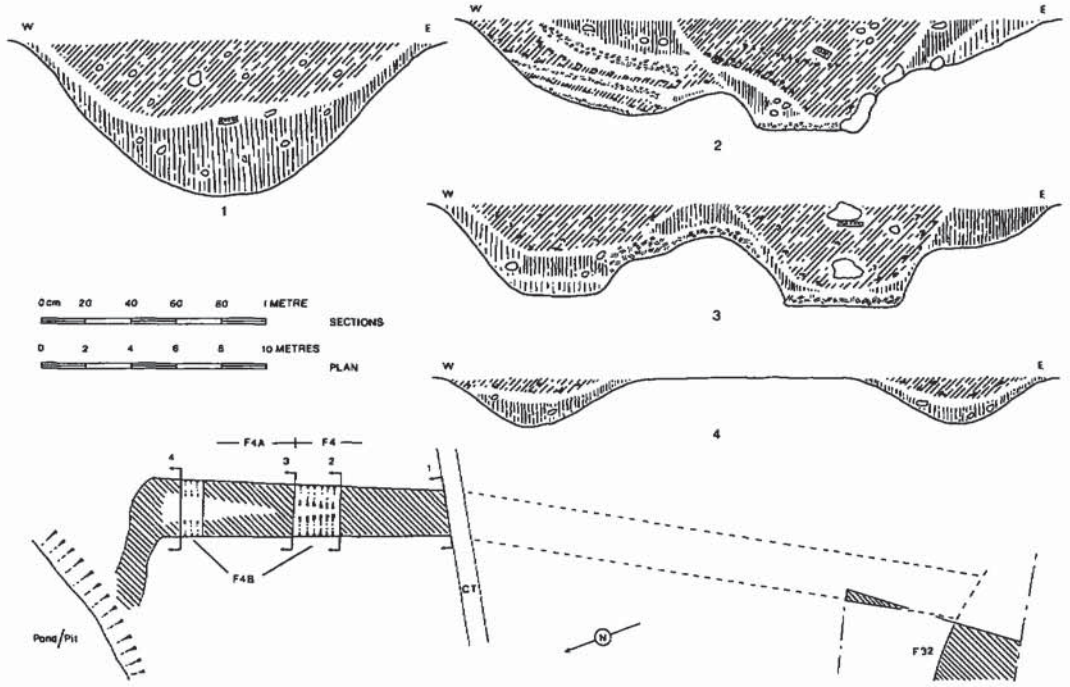


Fig 11. Sections of East Ditch, F4, F4A & F4B.

West Ditch, F5 (Fig 12)

Exposed in plan for a length of 36m, the northern end was unfortunately destroyed before it could be recorded. It was also cut by contractor's pipe trenches in two places. The depth was 0.45m in both excavated sections. The fill differed markedly from that of the east ditch in being predominantly of brown soil containing pebbles and a few flints. At the southern end only, a top layer of black sandy soil, 10cm thick, was observed.

The Pond/Clay Pit (Figs 3 & 13.2)

This feature, measuring a maximum of 30.5m north-south by 33.4m east-west, was cut into the south-facing slope and appeared to allow access to a natural pocket of blue clay. When first observed by the excavators in 1974, it was filled with water to the level of its southern rim and had probably been so for much of the time since its probable abandonment in the 4th century AD. The bottom was covered with a thick layer of black silt, but the circumstances of the excavation prevented samples being collected for analysis, or a determination of its depth, although from general observation it seemed unlikely to have exceeded 2m below the level of the original ground surface. The north and west banks were more or less straight, forming an approximate right angle, and appeared to have retained their original plan. The remainder of the perimeter had been distorted by post-medieval farm activity and the recent dumping of building material. That all four sides were originally straight forming a true rectangle is suggested by the fact that the pond is shown as such on the Tithe Map of 1838 (HRO Tithe Map, Farlington Parish); this being the earliest surviving document showing the site at a usable scale. Aerial photographic cover taken in 1949 (RCHME NMR SU 6807/3/5039 etc) shows a track run-

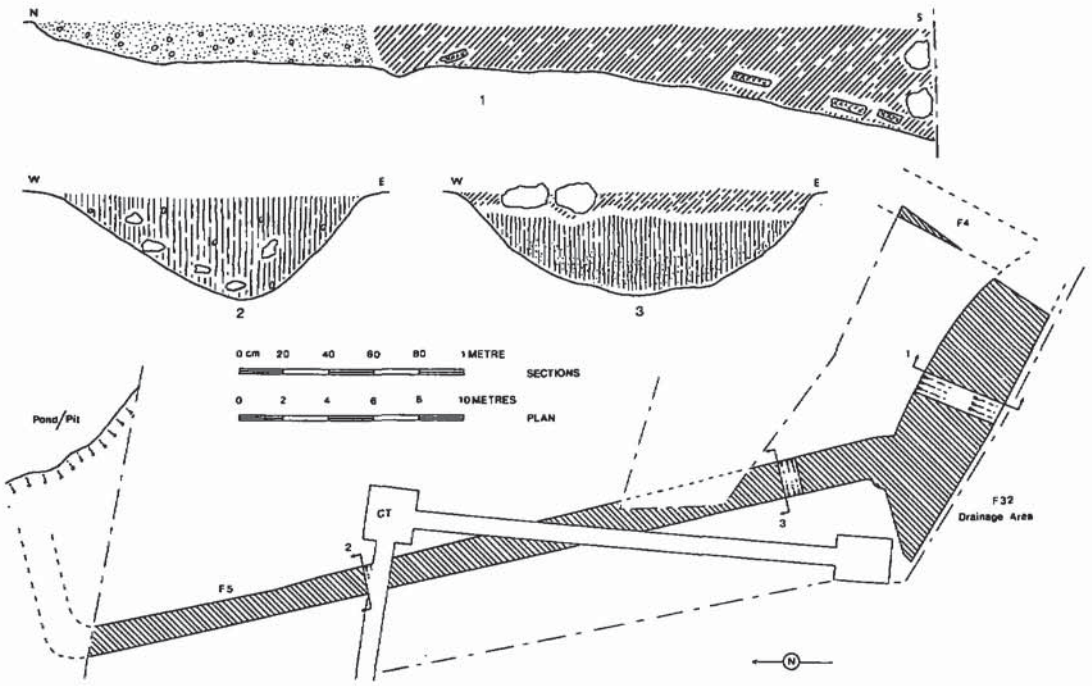


Fig 12. **1** Section across Drainage Area. **2** & **3** Sections across West Ditch.

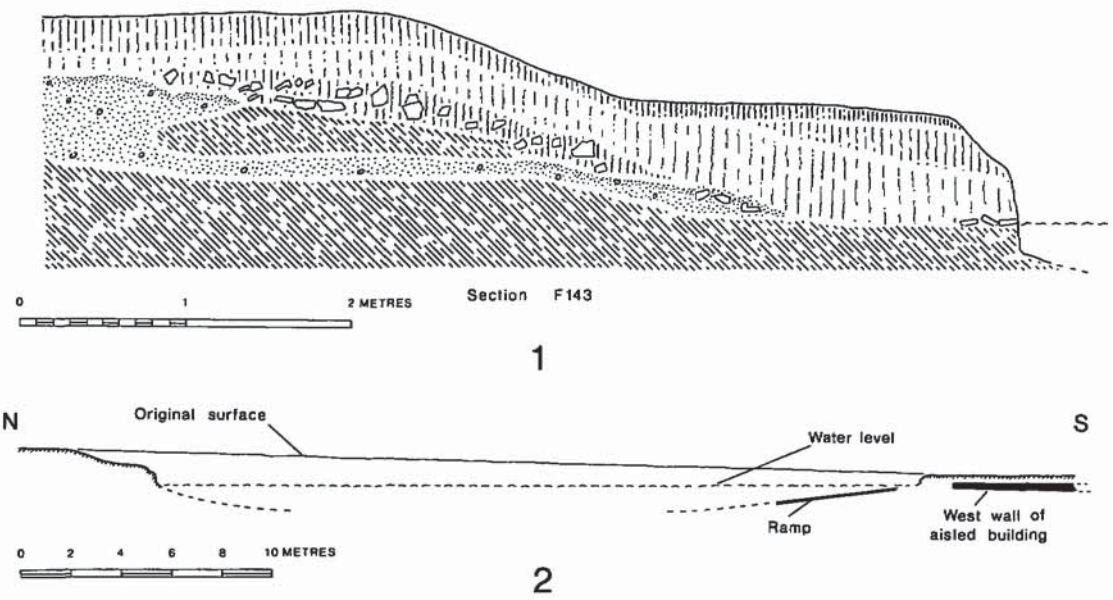


Fig 13. **1** Section through north bank of Pond/Clay Pit. **2** Section across Pond/Clay Pit along projected line of west wall of aisled building.

ning between post-medieval cattle sheds and the south-east corner of the pond/clay pit.

A ditch *c* 130m long, 1m wide and 0.7m deep, which ran westwards from a point on the north-west corner of the pond/clay pit, had been blocked at this point, probably to prevent water draining away. A hawthorn hedge forming a modern field boundary, ran along the north sides of the pond/clay pit and the ditch, and followed the ditch to its western extremity on Crookhorn Lane. The modern surface height fell gradually by a total of 2m east to west over the length of ditch and hedge.

Section through the north bank of the pond/clay pit, F143 (Fig 13.1)

It was only possible to excavate one section through the edge of the pond/clay pit. This demonstrated that the levels of natural clay and sand had been artificially cut down in a series of at least two shallow steps. This evidence suggests organised digging and removal of clay and possibly sand, although no marks of spades or other tools were observed. Before any natural accumulation of soil had taken place, a layer of Roman tile rubble and a few sherds of Roman pottery had accumulated or been tipped over the worked surface. Although the possibility that this layer could have been redeposited should not be disregarded, the absence of a soil horizon beneath it or any contamination from the medieval and post-medieval activity on the site, strongly argues for the original excavation of the pit and the deposition of this layer during the working life of the tilery.

Site B

Site B comprised the areas excavated north of the pond/clay pit, embracing the tile-kiln and all associated features. The depth of top-soil varied between 10 and 40cm, being generally deeper at the lower, southern end of the site.

The Tile-Kiln (Figs 14–24)

The excavated substructure or combustion chamber of the tile-kiln showed it to have been of rectangular up-draught type, aligned with its long axis running approximately north-south. Along this axis ran the main flue from which cross flues ran at right angles on either side. The cross flues were separated by cross walls resting on the side walls of the main flue, which had originally been carried over the main flue as arches. The springers of the arches had survived on the east side. These structures made up the combustion chamber of the tile-kiln. The firing chamber or oven floor which would have rested on the arches of the main flue and cross walls, together with the superstructure of the firing chamber, did not survive. This was because, as in most other cases, these parts would have originally stood above ground level and have subsequently been swept away. The probable position of the oven or firing chamber walls and the oven floor resting upon the reconstructed arch elevation of the main flue is shown in Fig 16.2. The oven floor would have been pierced with a pattern of circular holes corresponding with the positions of the flues beneath. These would have allowed the passage of hot gasses into the firing chamber where the bricks and tiles would have been carefully stacked on their edges. The kiln combustion chamber was constructed within a pit dug deep into the clay-sand subsoil with the stoke pit at its southern end; the main flue projected beyond the south face of the kiln into the stoke pit. This part of the main flue is usually referred to as the fire tunnel or *praefurnium*.

The side walls of the main flue were solidly built of square and rectangular bricks (*bessales* and *lydion* bricks) bonded with mortar (Fig 27.2.4), which rested on two courses of *tegulae*. These projected beyond the rear wall of the combustion chamber where they supported a stack of three more *tegulae*, forming a step which at some stage in the life of the kiln may have been part of a damping arrangement. The space between the kiln structure and the inside face of the enclosing pit had been filled with fired tile rubble, red unfired tiles, red clay and sand. This must have formed the foundation for the walls of the kiln superstructure, comprising the oven or firing chamber (cf McWhirr 1979, and reconstructed in Fig 16.2). Two points emerge here. The red unfired tiles and clay must have derived from a Reading

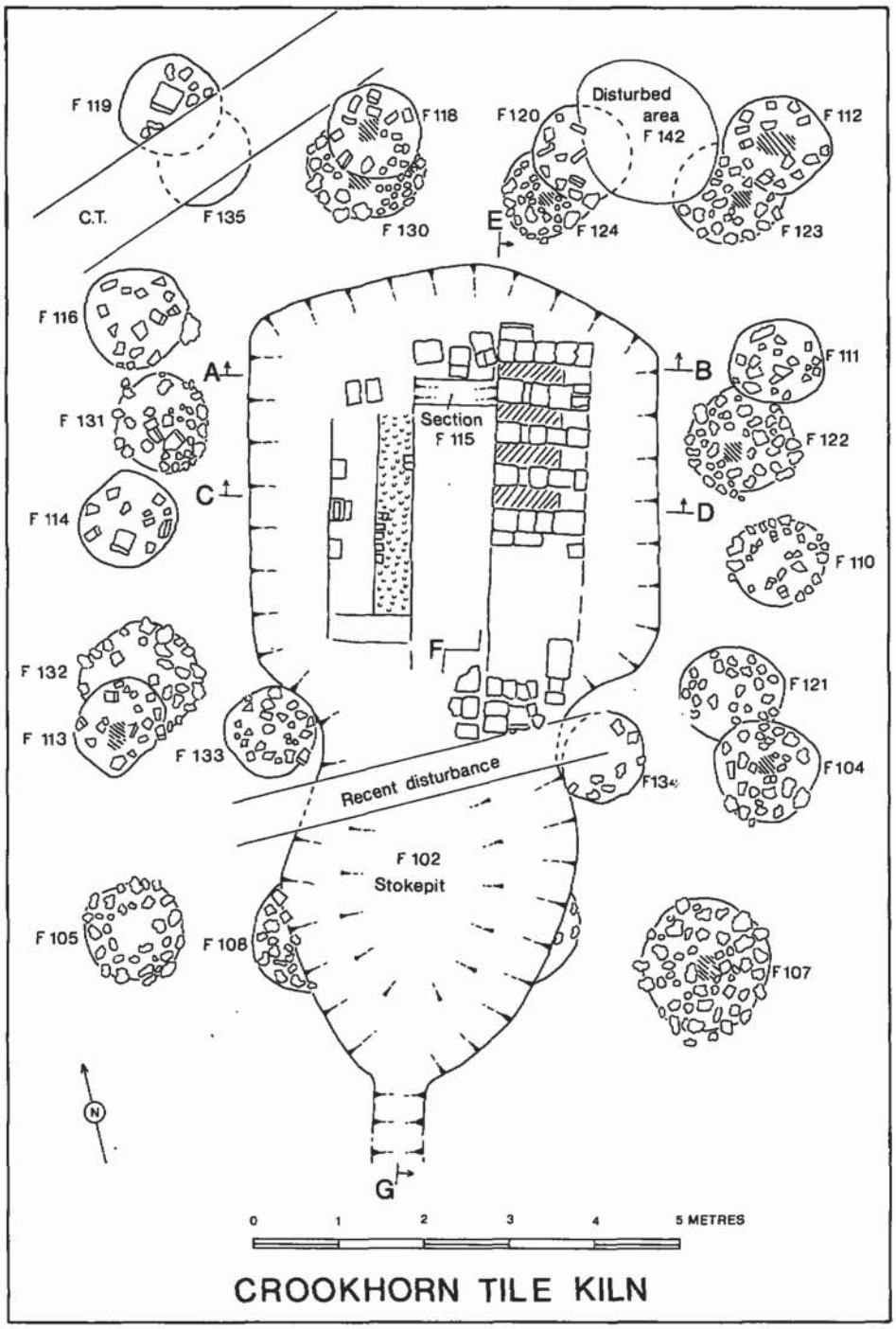


Fig 14. Tile-Kiln: plan of kiln and post holes of cover building.

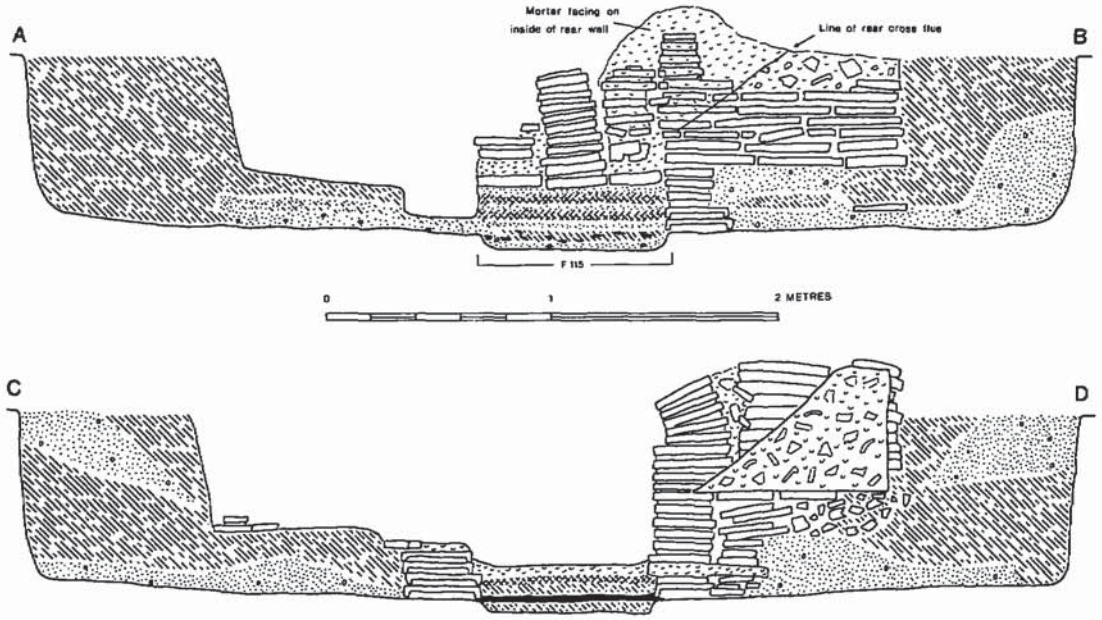


Fig 15. Tile-Kiln: cross sections (see Fig 14).

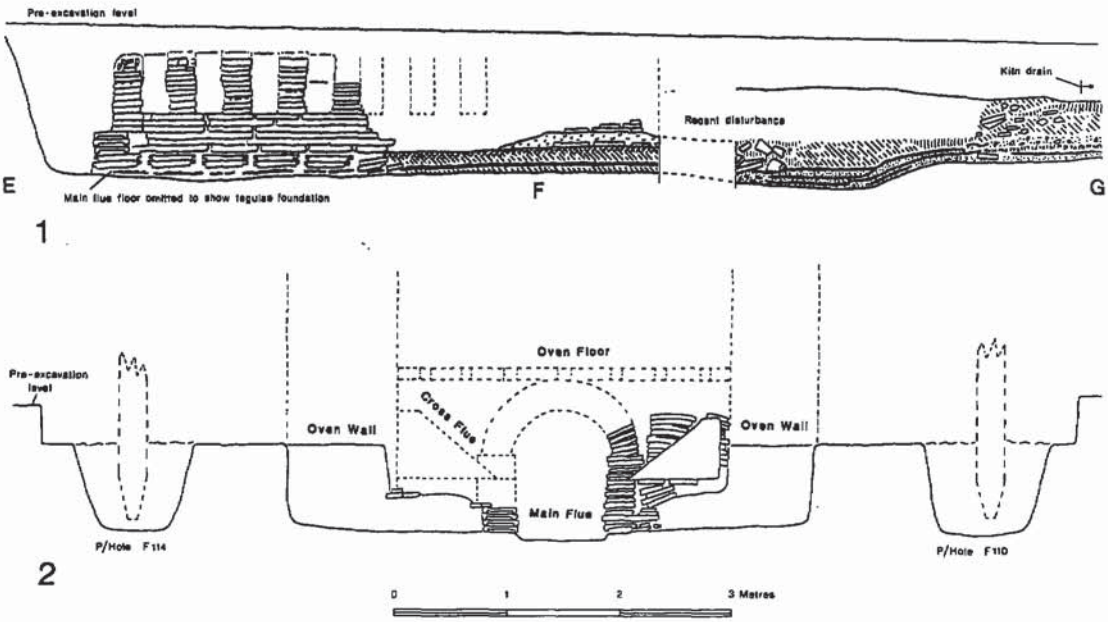


Fig 16. Tile-Kiln: **1** elevation of east side of main flue and cross flues and longitudinal section through main flue and stoke pit (see Fig 14). **2** reconstruction of main flue arch and oven floor in relation to the second phase post holes of the cover building (F114 & F110).

Beds deposit probably south of the site and not from the clay pit. Secondly, they indicate the probability of another earlier tile-kiln perhaps situated on the Reading Beds clays, or reconstruction of the kiln during its life, using 'foreign' clay. When excavated it was found that the west side of the combustion chamber had been almost completely dismantled. The back wall of the rear cross flue was however particularly well preserved, and was formed of *lydion* bricks. At the rear end of the main flue were three stacks of brick. The central stack was heavily burnt on all four sides, but the two on either side were burnt on their inner faces only. This suggests that the two outer stacks were probably added during modifications or maintenance of the kiln during its working life.

The bottom of the main flue was covered by layers of rubble, ash and charcoal. Some tiles in a flat position, possibly paving, were found at the south end. On the east side of the main flue, five cross walls (separating cross flues) survived almost intact, and from these sprang the eastern remnants of the arches which originally carried over the main flue. The top of the side wall was 0.7m from the main flue floor and the entire structure survived to a maximum height of 1m. The bottoms of the cross flues were 0.45m above the floor of the main flue and were angled back at *c* 40° to the horizontal. The angle had been built up with a mixture of clay, mortar and tile rubble and this had subsequently been fired. At the time of excavation the cross flues were found to be choked with burnt clay and tile fragments. All the internal faces of the combustion chamber made from bricks and tiles had been burnt blue-black; the bonding mortar had been

Fig 17. Tile-Kiln: view of the east wall of the main flue and congested cross flues, from the west, during excavation in 1974 (scale 2m).

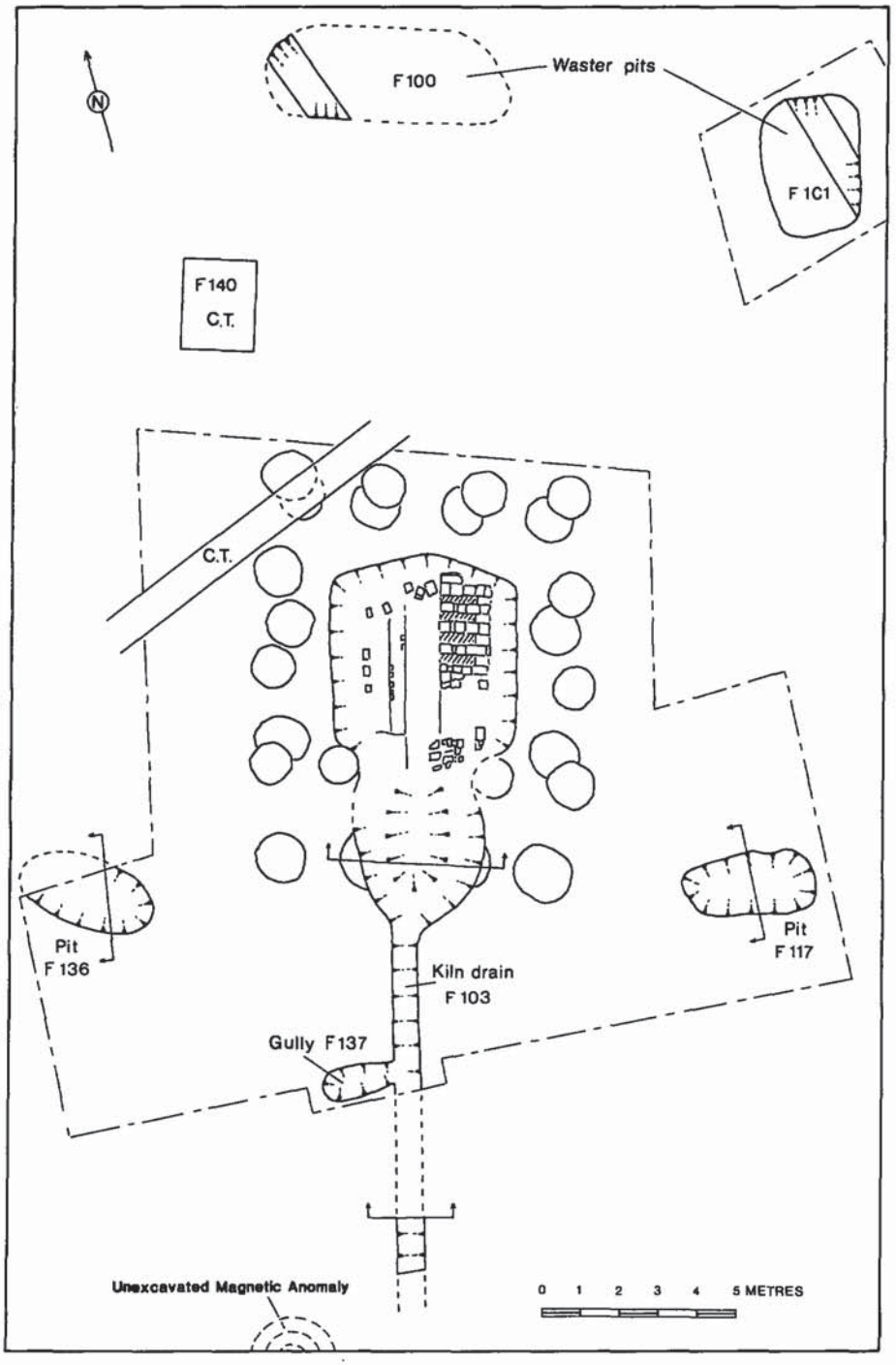


Fig 18. Tile-Kiln: plan of associated features in vicinity of kiln, and key to sections (Fig 19).

completely vitrified by the fierce heat generated within the flues.

The stoke pit was oval in plan with steeply sloping east and west sides. During its use it had been enlarged at least once. It contained occupation refuse including one coin, together with pottery, charcoal and ash. A gully ran south from the stoke pit and was filled with similar material. A short lateral gully joined it on its west side. The longer gully has been interpreted as the kiln drain similar to a feature found at the Cranleigh tile-kiln (Goodchild 1937, and see discussion below).

The kiln was enclosed within two phases of building contemporary with its use. The main evidence consisted of two groups of large post holes 1.0–1.2m wide and 0.6–1.0m deep. Twelve posts formed the principal elements of the first building, their centres forming a rectangular structure 9.2m long and 7.0m wide (Fig 20.A). The posts were evenly spaced around the kiln and those at the south end partially overlapped the stoke pit. Seven post holes were cut into by the post holes of the second building and two by the widening of the stoke pit during the construction of the second building. The packing of all the first phase post holes was of flints set in yellow-grey sand, the flints being concentrated in the top of the fill. These post holes did not contain tile rubble and this suggests they were dug before the kiln was in production. They may however have enclosed an earlier kiln or clamp in which were made the bricks and tiles from which the kiln was constructed.

The second building (Fig 20.B) also survived as 12 post holes, but formed in plan a square of 7.5m around the kiln pit only. This building was thus shorter than the earlier structure but its construction appears to have corresponded with an enlargement of the stoke pit. In the second building the post holes were predominantly packed with stiff red clay, tile rubble and some flints and sand. Traces of the posts themselves were recorded in both phases and their average cross section was 23cm square. The tops of the second phase post holes were *c* 7–15cm higher than those of the first phase building, indicating a build up of surface soil and other material just prior to the construction of the second phase building. Apart from the posts themselves there was no trace of the superstructure of these buildings although a surface build-up of red clay and tile rubble was much in evidence around the second phase post holes.

North of the tile-kiln five test trenches 25m long were cut on a north-west to south-east alignment. These revealed two tile waster pits and also exposed a firm, continuous expanse of tile rubble, *c* 15–25cm thick, extending north from the kiln for a distance of up to 12m. Beyond this distance the layer thinned out to a scatter but was still evident at 20m. This phenomenon might be interpreted as the working floor for at least some of the tile manufacturing processes.

A rectangular pit was cut through this layer by the contractors for a service manhole (pit F140; Fig 18), and it was from this location that the fragment of stamped tile was recovered. The significance of this find is discussed below.

Section through the main flue of the tile-kiln (F115) (Figs 14 & 15)

The main flue was sectioned at the north end to investigate the build-up of material within it. This consisted of layers of fired clay, sand and ash. The three brick stacks at the north end of the flue were constructed on top of these layers. The fill contained in addition to pottery, a hand-made bowl and a probable cavity-wall spacer bobbin, both in tile fabric (Fig 36.2 & 3).

Features directly associated with the tile-kiln

The post holes of the first phase cover building (Figs 20.A, 21 & 22)

F107. Diameter 1.55m, depth 0.75m. Sloping sides with step all round. Packing of flints in brown sand. Post position indicated by column of dark brown sand and tile fragments, tapering from 31cm (top) to 23cm (bottom). No finds.

F108. Diameter *c* 1.2m, depth 0.8m. Partially destroyed by widening of stoke pit. Packing of dark grey sandy soil with flint capping. No finds.

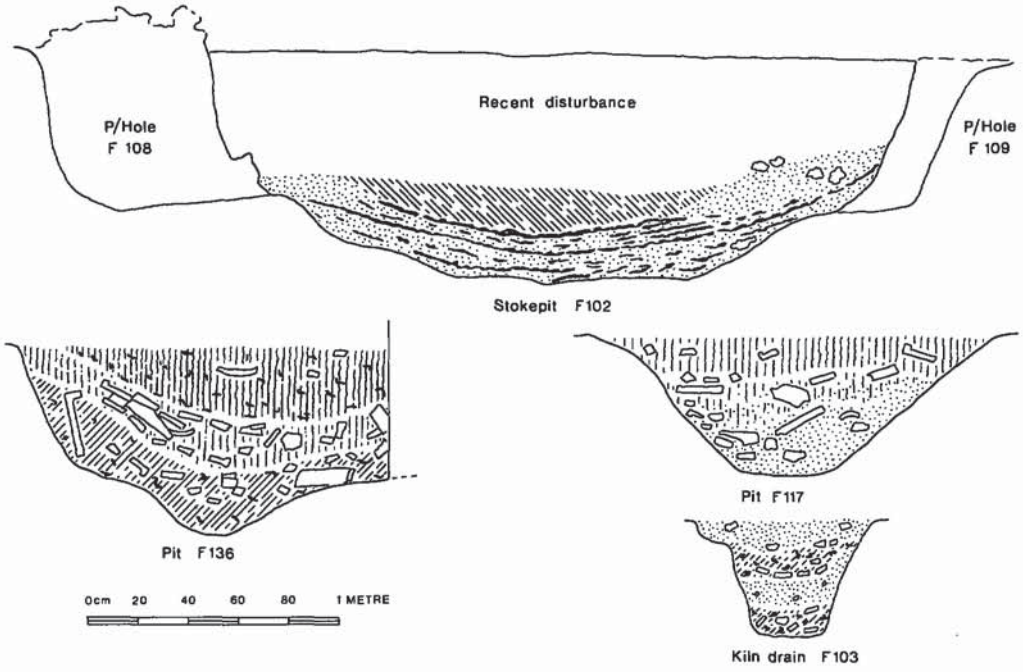


Fig 19. Tile-Kiln: sections of stoke pit, kiln drain and pits F117 and F136 (see plan Fig 18).

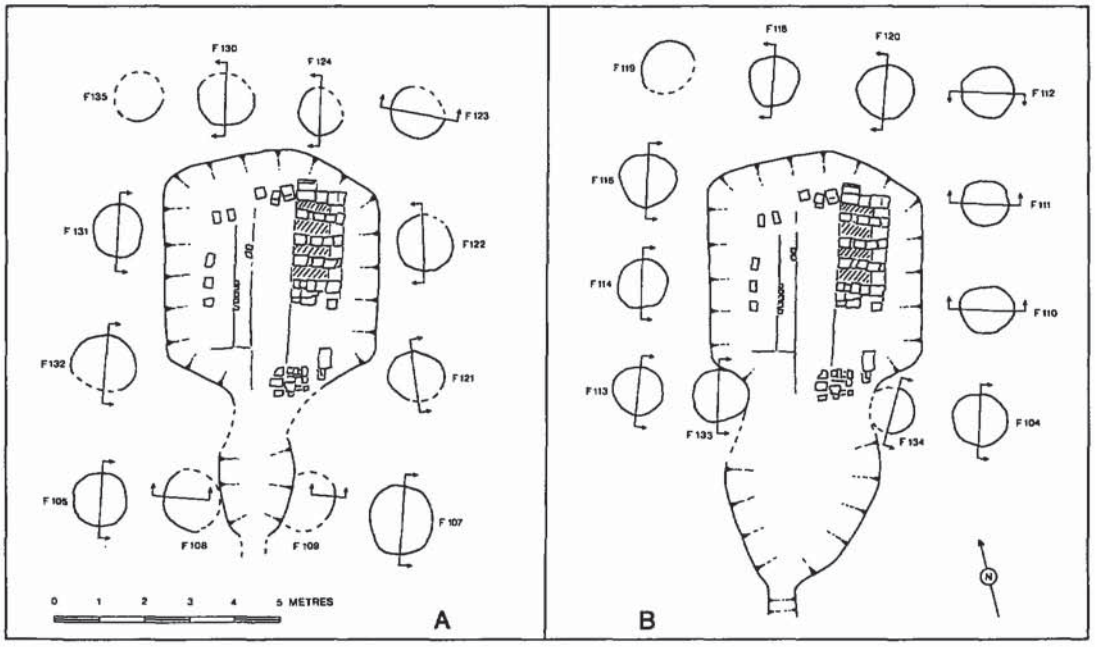


Fig 20. Tile-Kiln Cover Building: plans of two phases of cover building surrounding the kiln, and key to post hole sections. **A** first phase. **B** second phase.

F109. Almost completely destroyed by widening of stoke pit. Packing of dark grey sandy soil with some flints. No finds.

F121. Diameter 1.2m, depth 0.7m. Sloping sides, rounded bottom cut into phase 2 post hole F104. Packing in two layers: bottom 20cm yellow sand with some brown clay, beneath dark brown sandy soil with flint capping. Post position indicated only in lower layer as short column of brown sandy soil with some charcoal. Contained sherd of storage jar in tile fabric (Fig 36.6).

F122. Diameter 1.2m, depth 0.9m. Straight sides, flat bottom. Cut into by phase 2 post hole F111. Packed with light brown sandy soil with flint capping. Post position indicated by column of red clay with some charcoal, tapering from 40cm (top) to 10cm. No finds.

F123. Diameter 1.2m, depth 0.8m. Sloping sides, flat bottom. Cut into by phase 2 post hole F112 and disturbed area F142. Packing of yellow-grey sand and flints. Post position indicated by column of red clay and tile rubble with charcoal smears on one side and bottom, tapering from 32cm (top) to 20cm. No finds.

F124. Diameter 1.1m, depth 0.8m. Sloping sides, rounded bottom. Cut into by phase 2 post hole F120. Packing of grey sand with flint and tile capping. Post position indicated by column of red clay with flints and tile rubble, tapering from 27cm (top) to 15cm. No finds.

F130. Diameter *c.* 1.2m, depth 0.8m. Vertical sides, flat bottom. Cut by phase 2 post hole F118. Packed with grey sandy soil and flint capping. Post position indicated by column of red clay, tapering from 21cm (top) to 11cm. No finds.

F131. Diameter 1.2m, depth 0.8m. Sloping sides, flat bottom. Packed with grey-yellow sand with thick capping of flints in brown soil. Post position of *c* 21cm diameter. Filled by burnt tile rubble and flints. No finds.

F132. Diameter 1.3m, depth 0.5m. Rounded bottom. Cut by phase 2 post hole F113. Packing of light brown sandy soil with flint capping. No finds.

F135. Almost completely destroyed by contractor's pipe trench. Not illustrated in section. No finds.

The post holes of the second phase cover building (Figs 20.B, 23 & 24)

F104. Diameter 1.15m, depth 0.65m. Vertical sides, stepped on south. Flat bottom. Packed with red clay and flints. Post position indicated by leaning column of dark brown soil and tile rubble.

F110. Diameter 1.1m, depth 0.8m. Sloping sides, flat bottom. Packed with two layers of red clay, broken tiles and flints, separated by layer of grey clayey soil also containing tile and flints, 20cm thick. No trace of post position. No finds.

F111. Diameter 1.1m, depth 1.0m. Sloping sides, flat bottom. Packed with red clay, broken tile and flints. No trace of post position. No finds.

F112. Diameter 1.2m, depth 1.05m. Sloping sides, flat bottom. Packed with brown sandy soil, tile rubble and flints surrounding central core of red clay with charcoal 'smears' on one side and bottom, containing distorted cone of similar fill defined by more abundant charcoal.

F113. Diameter 1.1m, depth 0.8m. Vertical sides, flat bottom. Packed with red clay, tile rubble and flints. Post position indicated by column off-set to south, of dark brown soil containing some flints and tile rubble.

F114. Diameter 1.1m, depth 0.75m. Sloping sides, flat bottom. Packing of two layers of red clay, broken tile and flints separated by layer of dark soil 20cm thick. A similar layered fill occurred in post hole F110 which occupied the corresponding position on the opposite side of the building. No trace of post position. No finds.

F116. Diameter 1.3m, depth 0.8m. Sloping sides, flat bottom. Packed with red clay and tile rubble except for layer of sand and soil at bottom, 20cm thick. No trace of post position. No finds.

F118. Diameter 1.0m, depth 0.9m. Near vertical sides, flat bottom. Packed with red clay and tile rubble. Post position indicated by column of brown sandy soil tapering from 24cm (top) to 14cm. No finds.

F119. Not illustrated in section. Diameter 1.2m. Partially destroyed by contractor's pipe trench. No finds.

F120. Diameter 0.8m, depth 1.0m. Near vertical sides, flat bottom. Packed with red clay, tile rubble, flints and pockets of sand. No trace of post position. No finds.

F133. Diameter 1.0m, depth 0.6m. Near vertical sides, flat bottom. Packed with sandy soil and flints *c* 30cm thick, overlaid with red clay capped with flints. No trace of post position. No finds.

F134. Diameter 1.1m, depth 0.6m. Near vertical sides, flat bottom. Packed with brown sandy soil, tile rubble and flints. Post position indicated by column of red clay and charcoal flecks, *c* 28cm square. No finds.

The tile-kiln stoke pit, F102 (Figs 14, 16.1 & 19)

The surviving stoke pit belonged to a secondary phase of the kiln structure and represented an

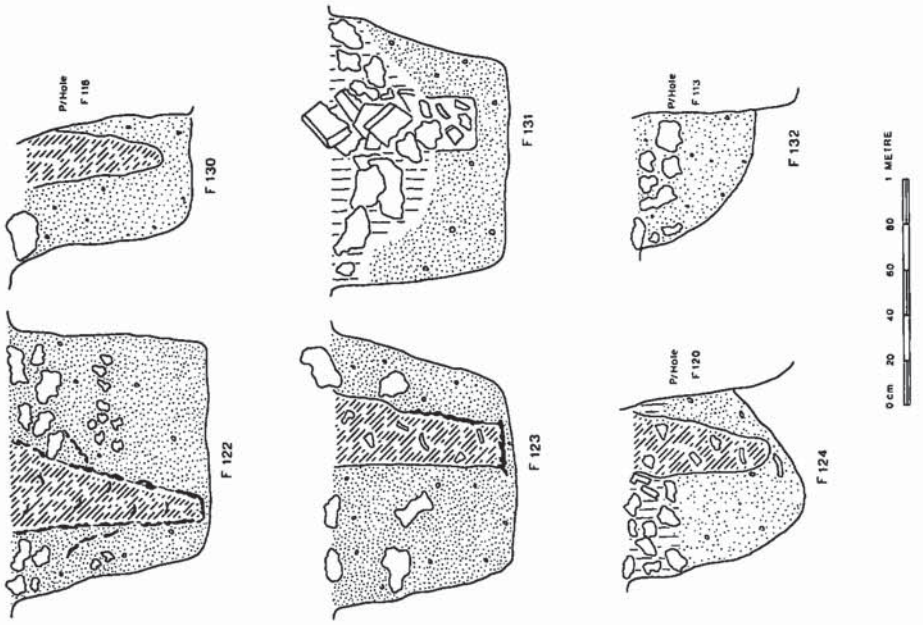


Fig 22. Tile-Kiln Cover Building: post hole sections first phase, F122, F123, F124, F130, F131, F132.

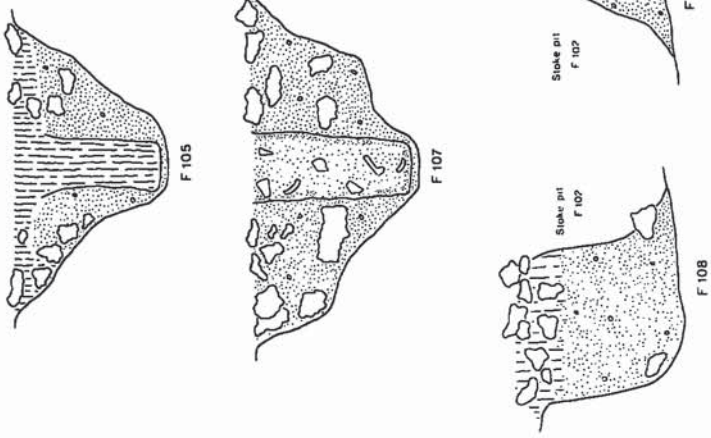


Fig 21. Tile-Kiln Cover Building: post hole sections first phase, F105, F107, F108, F109, F121.

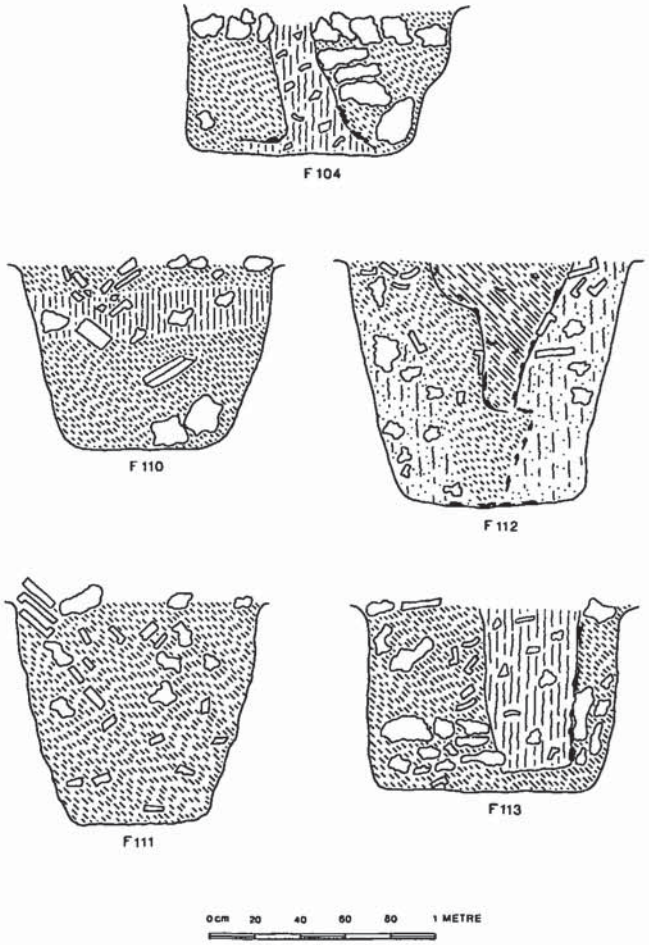


Fig 23. Tile-Kiln Cover Building: post hole sections second phase, F104, F110, F111, F112, F113.

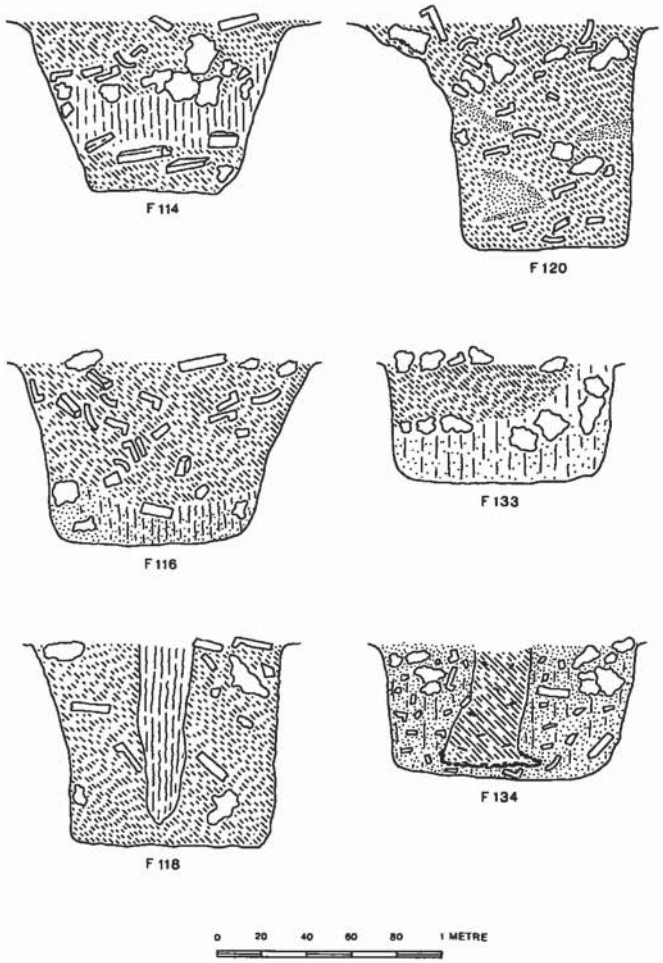


Fig 24. Tile-Kiln Cover Building: post hole sections second phase, F114, F116, F118, F120, F113, F134.

enlargement of an earlier stoke pit. In plan it consisted of an oval 4m long, 3.4m wide and 0.9m deep. It had been backfilled to a height of 15–20cm above the level of its rim and appeared as a low mound when first exposed. It was unfortunately one of several features dug into or otherwise interfered with by vandals whilst the site was unattended, making it impossible to record fully. However, the disturbance did not penetrate to the bottom of the pit, which was covered by a layer 20cm thick. This was made up of lenses of ash and charcoal separated by sandy clay. A similar thickness of clay and tile rubble survived above these. This was presumably part of the general fill which was observed when the contents of the pit were exposed as a low mound of red and brown clay, containing tile rubble and pottery. Over 2kg of pottery was recovered, in 8 fabric types, together with 18 iron nails, one piece of sheet lead and a very worn coin of mid 2nd-century date.

The kiln drain, F103 (Figs 18 & 19)

A flat-bottomed gully with sloping sides up to 0.8m wide and 0.58m deep. It was traced for 9m running down-slope from the south end of the stoke pit towards the pond/clay pit, into which it probably drained. Filled with red clay, ash, charcoal, sand, tile rubble and pottery.

Gully, F137 (Figs 18 & 19)

Length 1.5m, width 0.7m, depth 0.25m. One end opening into the west side of the kiln drain. Filled with black soil, charcoal, tile rubble and pottery.

Tile waster pit, F100 (Fig 18)

Not fully excavated. Size estimated from fluxgate gradiometer readings: *c* 8m long, 2.8m wide. Section across west end indicated fill to be entirely of broken brick and tile wasters. No other finds.

Tile waster pit, F101 (Fig 18)

A rectangular pit, length 3.55m, width 2.5m, depth 0.75m. Exposed in plan and sectioned across north-east corner. Filled with small fragments of soft, underfired brick and tile wasters. No other finds.

Pit, F117 (Figs 18 & 19)

A rectangular pit, length 3.3m, width 1.6m, depth 0.55m. Filled with a layer of grey sand, 30cm thick, covered with a layer of red stained sandy soil. Both layers containing broken bricks and tiles, pottery, quern fragments, loom weights, iron nails and a knife.

Pit, F136 (Figs 18 & 19)

An oval pit, not fully excavated, length (estimated) 3.5m, width 1.6m, depth 0.75m. The fill was of three layers: lower layer *c* 25cm thick, of black soil and charcoal; middle layer *c* 20cm thick, of dark brown soil; upper layer 30cm thick, of brown soil and charcoal. Broken tile and pottery in all layers. Other finds include a whetstone, quernstone, and parts of two vessels in tile fabric.

Occupation layer around stoke pit (layer 1)

A layer of compacted dark brown soil, 10–15cm thick, extended east and west of the kiln stoke pit and drain as far as pits F117 and 136. It contained brick and tile rubble and pottery, and rested on the ground surface belonging to the period of use of the kiln, on a level with the tops of the stoke pit and other features.

Pit, F142 (Fig 14)

An oval pit, length *c* 2m, width 1.5m, depth 0.45m. Of uncertain date. It was filled with brown soil and had cut into and disturbed the packing of post holes F120 and 123. No finds.

Concentration of pottery east of Site B

A few metres east of Site B (the exact location is not known), contractors reported the discovery and removal of a concentration of pottery. A dish in tile fabric (Fig 36.1) is the only find recorded.

Group of post holes north of Site B (Fig 2.B)

During contractors' levelling for a playground on the north side of the new school building, a group of 13 post holes was briefly exposed and destroyed *c* 50m north of the tile-kiln. Their positions were planned but none could be excavated. They were of similar size and character to those in the aisled building; seven formed a line running NNE–SSW corresponding to the general axis of the aisled building and tile-kiln. A narrow gully ran east out of one post hole in the line. Six other post holes were

found west of the line. The association of these features with a scatter of Romano-British pottery and tile fragments and their similarity with post holes on Site A indicate that they may represent contemporary structures, possibly sheds used to cover drying bricks and tiles before firing.

Magnetic anomaly south-east of the tile-kiln (Fig 18)

This magnetic anomaly gave a reading of similar intensity to that given by the tile-kiln before its excavation (see report above), but was of small area in plan. Owing to the circumstances of the excavation, it could not be investigated further. Its area was probably too small to suggest another tile-kiln, but it may have indicated a waster pit or the redeposited remains of the western cross walls of the combustion chamber of the excavated kiln.

The Archaeomagnetic Dating of the Tile-Kiln (Measurement ref AJC–42) by A J Clark and A D H Bartlett

The Crookhorn tile-kiln was sampled for archaeomagnetic dating by the directional method. The samples were taken by S Chase and A D H Bartlett, then of the Ancient Monuments Laboratory, and measured in the Department of Geophysics and Planetary Physics, University of Newcastle upon Tyne, with the help of D H Tarling and M Noel. The samples were taken at the beginning of a programme of cooperation between the two organisations, and the results are reassessed below in the light of the greater understanding that we now have of the archaeomagnetic calibration curve and the evaluation of measurements, as discussed in Clark *et al* (1988).

Two bricks forming part of the east wall of the main flue of the kiln were sampled. Each was given a horizontal reference surface by pouring Plaster of Paris into a Plasticine 'coffer dam' on its surface, and a declination reference was obtained by marking the plaster with a line related to magnetic north, which was measured away from the kiln to avoid magnetic interference from it. Both bricks were removed from the kiln and, in the laboratory, four samples were obtained from one of them and nine from the other by taking 2.5cm cores. Ten samples were also taken from the hard baked floor of the main flue by Plaster of Paris encapsulation of small prepared pillars of the material in 5cm diameter uPVC tubes.

All the samples were measured in a Digico spinner magnetometer. Partial AC demagnetisation was applied at suitable levels to remove any viscous magnetisation acquired since firing. The combined results were as follows.

Bricks: Dec = 7.6°W; Inc = 57.6°; alpha-95 = 1.8°
Floor: Dec = 1.1°W; Inc = 62.0°; alpha-95 = 4.2°

The behaviour of the archaeomagnetic curve in the Roman period is complex; there is little variation in declination, and dating depends mainly on inclination changes. The magnetic direction of the brick samples is too far west, probably due to refraction effects that one would expect in a relatively strongly magnetised feature such as this kiln. The refraction in floor samples is relatively uncomplicated, and can usually be compensated for by applying a small standard correction to the inclination value. The floor measurement in the present case is the less precise, but, in keeping with precedent, does fall sensibly on the curve.

Making due allowance for these problems, three possible date spans emerge: cal AD 100–200, AD 280–330, or 370–410, all at the 68% confidence level. Bearing in mind the archaeological context, the AD 280–330 span seems the most probable.

Site C

The Corn-Drying Oven, F26 (Figs 25 & 26)

The remains of the corn-drying oven clearly showed it to have been a two-phase structure of two T-shaped flues laid out to a V-shaped plan. Only the substructure of the oven survived – to a maximum height of 35cm. The drying floor and superstructure of the oven no longer survived, but their possible reconstruction is discussed below. The principal building materials used were *tegulae, bessales*, heptagonal tiles, flint nodules and sandstone blocks. Clay was used as a bonding agent.

The structure was founded upon a flat course of bricks and some tiles. Above these another course of bricks, tiles and flints was laid, with, in some places, the bricks and tiles laid in herring-bone fashion. Parts of the transverse flue walls were constructed from stacks of *tegulae*. The flues were choked with soil, tile rubble and some pottery, lying over a layer of ash and soot which contained a small quantity

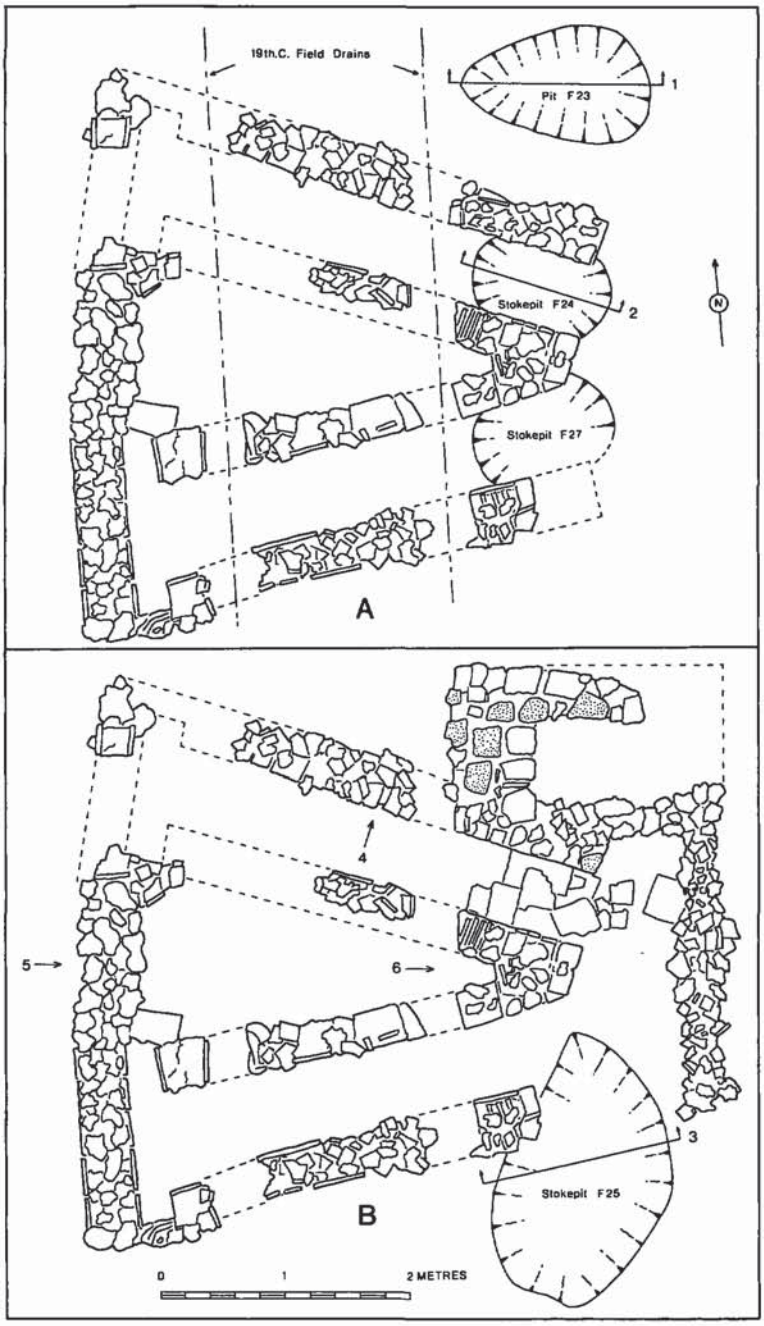


Fig 25. Corn-Drying Oven: plans of the two phases with key to sections and elevations. **A** Phase 1, **B** Phase 2.

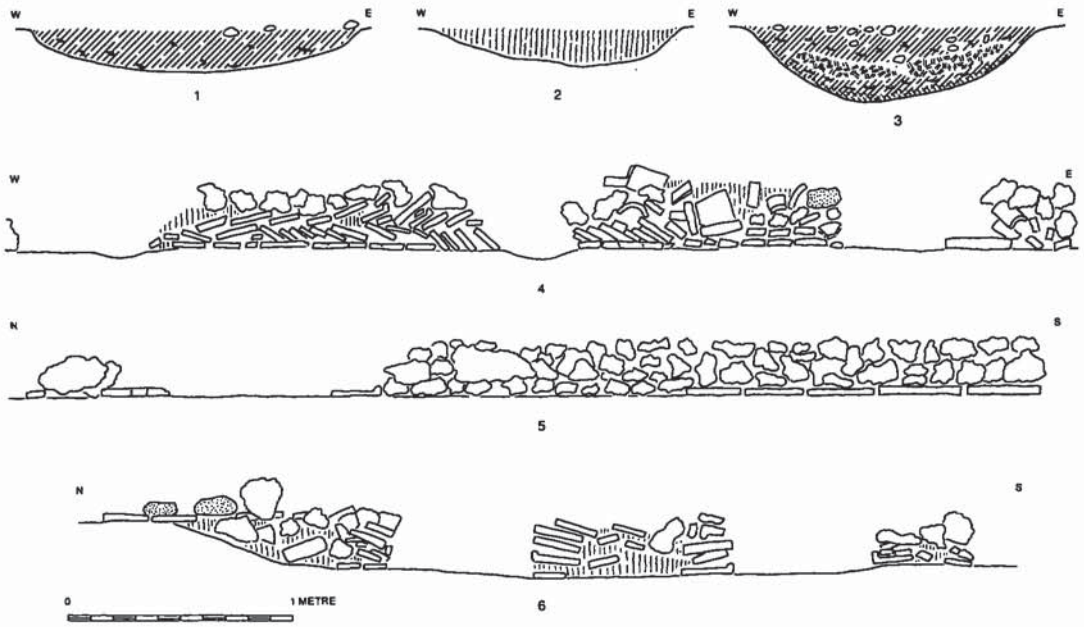


Fig 26. Corn-Drying Oven: sections and elevations. **1** pit F23, **2** stoke pit F24, **3** stoke pit F25, **4** elevation of north wall from inside of flue, **5** elevation of outside of west wall, **6** section on east side of field drain cutting.

of carbonized seeds. The seeds from the flues and the stoke pit F25 are reported on below. The earth floors of the flues were baked hard and blackened. Two 19th-century field drains of 'cup and saucer' type had cut through the whole structure from north to south.

The first phase oven (Fig 25.A) had a stoke pit at the eastern end of each main flue, but in the second phase (Fig 25.B) these were filled in and replaced by a single larger stoke pit in the south-east corner of the oven. To allow this pit to serve both flues a low wall of flint and tile had been built across the east end to form a transverse flue. The north of this flue was sealed by the further addition in the north-east corner of a floor made up of tiles and sandstone blocks. This feature was very disturbed and survived only as an L-shaped structure, but was probably originally completely paved over to provide a rectangular platform. In the second phase the floors of the flues may have been completely paved as some brick paving survived at the east end of the northern main flue overlying stoke pit F24. Under the second phase east wall, part of a remarkable decorated stand made of tile fabric was found; this is fully discussed below.

Pit (possibly a stoke pit), F23 (Figs 25.A & 26.1)

A shallow pear-shaped pit, length 1.5m, width 0.9m, depth 0.2m. Outside north-east corner of corn-drying oven. Filled with black sandy soil with some charcoal at the bottom. Possibly the stoke pit of an earlier oven. No finds.

Stoke Pit, F24 (for first phase oven) (Figs 25.A & 26.2)

Length 1.2m, width 0.6m, depth 0.35m. Served the northern flue. Filled with dark brown soil. Levelled and tiled over in the second phase.

Stoke Pit, F27 (for first phase oven) (Fig 25.A)

Length 1.2m, width 0.6m. Served the southern flue. Largely destroyed by the second phase stoke pit F25. Filled with dark brown soil. No finds.

Stoke Pit, F25 (for second phase oven) (Figs 25.B & 26.3)

Length 2.2m, width 1.4m, depth 0.35m. The bottom fired hard and covered with layer of black soil and charcoal. Sealed by a lens of yellow sandy clay, also fire hardened. Remaining fill was a mixture of black soil, charcoal, and chalk fragments, with pottery and 12 iron nails.

THE KILN PRODUCTS

Introduction

A large variety of products were manufactured at the Crookhorn tilery. In addition to the traditional comb-patterned flue tiles, roof tiles and bricks, the kiln specialised in the production of a rare form of heptagonal roof tile and a number of miscellaneous items such as hand-made bowls, loom-weights and a decorated stand. All these products are described and briefly discussed below. Of the tiles and bricks, complete examples of seven types (nos 1–5, 8–9) were found (Fig 27), but only one example of type 1. The shapes and sizes of the remainder listed below are averages obtained from fragments found in the waster and rubbish pits, or used in the construction of the corn-drying oven.

Some brick and tile fragments bore imprints made before firing of human fingers, feet and nail-studded shoes, and particularly those of animal tracks. These provide a valuable indication of the environment of the industry and reflect on the social setting of the tilery within a farming economy. This evidence is reported on below. Most of the flue tiles and some other types of tile and brick were combed with a variety of patterns, to form a key for the plaster or mortar when used in building. The comb and other markings are also discussed and illustrated more fully below.

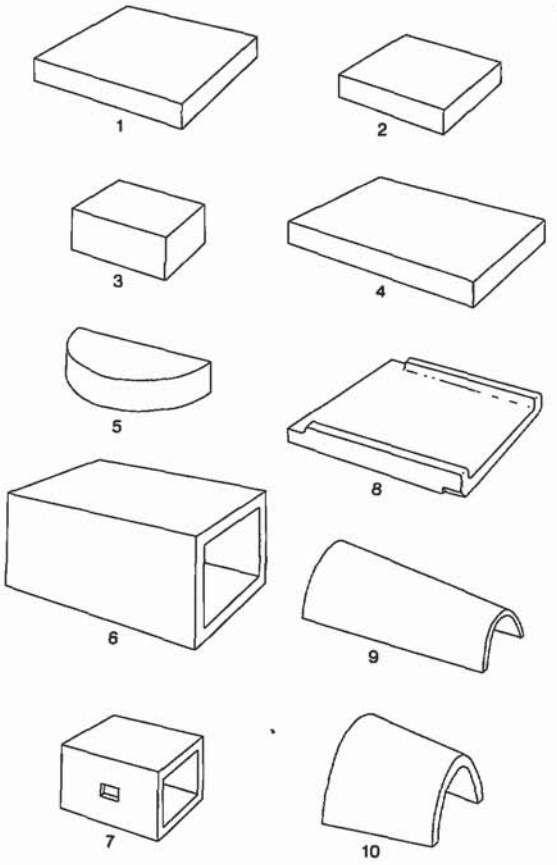


Fig 27. Brick and tile types manufactured at the tilery (scale 1:12).

Fabrics

All fragments found exhibit a variety of broad fabric types which are simply described in colour, hardness and texture below. These descriptions are based on macroscopic examination without petrological analysis, but it has proved impossible to assign fabric types to particular forms or products. Many of the harder fabric types displayed a blue-grey core. The following inclusions have been noted: Bagshot pebbles, burnt flints, small potsherds and haematite grains of up to 6mm in diameter.

The fabrics can be described as: *1* red-buff, soft; *2* red-orange, dusty; *3* pink-buff, dusty; *4* cream-buff, hard, sandy; *5* dark red, soft, sandy; *6* dark red, soft, soapy; *7* dark red with cream mottling, soft; *8* blue-grey, very hard, sandy; *9* red-brown, hard, smooth.

No evidence was found to suggest that kiln products were made from anything other than the obvious immediate source of clay and sand – the

pond/clay pit. Nevertheless, without petrological analysis it is impossible to be certain that other deposits were not also quarried. A programme of petrological analysis of bricks and tiles from other Roman sites in the area would, without doubt, add to our knowledge of the distribution of products from the tilery.

The Brick and Tile Types (**1–10** Fig 27, **11** Fig 28)

1. Large square brick (*pedalis*), 310 × 310 × 39mm. The chief function of this type of brick was to act as a cap or base for *pilae* made of the smaller *bessales*. Only one example was found, used as a foundation to a wooden arcade post in its hole (F16) within the aisled building, and it is interesting that this use is so similar to its normal function. Its fabric is generally similar to the other kiln products, but its uniqueness and its use in the construction, or perhaps repair, of the aisled building, may suggest that it was not a product of the Crookhorn tilery, or that it may have been reused from a disused hypocaust. The type is discussed by Brodribb (1987, 36–7).

2. Standard *pila* brick (*bessalis*), 210 × 210 × 30/40mm. Bricks of this type were generally used to build up the *pilae* of hypocausts and for flooring, particularly in bath-suites (Brodribb 1987, 34–6).

3. Rectangular brick, 183 × 137 × 69mm. A rare form of Roman brick, more similar in shape to the typical post-medieval form. Two complete and four broken examples were found. This type is twice as wide as it is thick, although neither dimension seems to be in direct proportion to its length. Brodribb, in discussing the type (1987, 57–8), notes that the closest parallels to the Crookhorn examples come from Chichester and Highdown in Sussex.

4. Rectangular brick (*lydion*), 405 × 275 × 40mm. Bricks of this type were used for bonding courses in the walls of large (often public) buildings and defences. They were also used for floors (Brodribb 1987, 37–40).

5. Semicircular brick, 50mm thick, 295mm diameter, 140mm wide. This form of brick was generally used to provide the core of architectural details such as columns and half-columns, which were then stuccoed. This technique is very well seen at two local sites, Meonstoke villa (King 1988) and Fishbourne palace (Cunliffe 1971, 44).

6. Large box flue tile (*tubulus*), 440 × 260 × 180mm overall, 20–25mm thick. This type of tile was generally used in conducting hot air from hypocausts and in structures such as bath-suites. It was invariably combed (Brodribb 1987, 70–83).

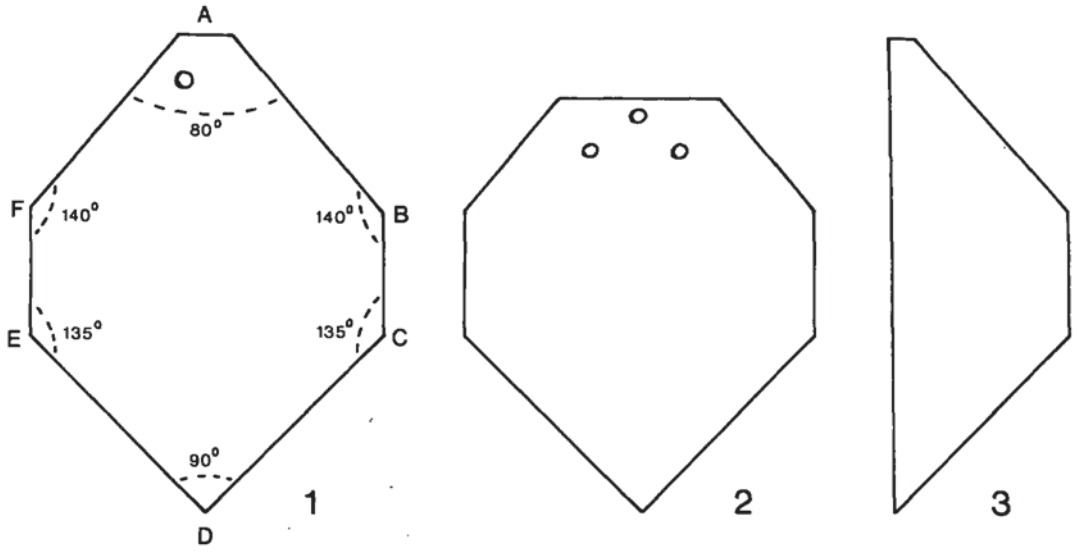


Fig 28. Heptagonal Tiles: **1** standard form, **2** top course tile, **3** end course tile (scale 1:6).

7. Small box flue tile (*tubulus*), 190 × 160 × 110mm overall, 15–20mm thick.

8. Flanged roof tile (*tegula*), 320mm wide at the top and tapering to 295mm wide at the bottom end, 380mm long and 23mm thick. The flanges are 42mm high. Some examples are pierced with a single nail or peg hole at the top, suggesting that they were used for the lowest course of the eaves, acting as a support for the other courses sitting under their own weight on a low-pitched roof. Pierced Horsham stone tiles from the Chilgrove villas (Down 1979, 175), may have been put to similar use. *Tegulae* are fully discussed by Brodribb (1987, 5–22).

9. Curved roof tile or rain tile (*imbrex*), 180mm wide × 120mm high tapering to 120 × 75mm. 395mm long and 18mm thick (Brodribb 1987, 22-7). This tile fitted over the flanges of the *tegulae*, thus preventing rain percolating between them. They overlapped each other in a similar way to the *tegulae*.

10. Curved tile, 260mm wide × 155mm high, tapering to 210 × 120mm, 200mm long and 24mm thick. Only one example known. It is much wider and shorter than a normal *imbrex* and may have been used as a drain or ridge tile, the tapering allowing for overlapping.

11. Heptagonal roof tile without flanges (*tegulae pavonis*) (Fig 28). This type of tile has been found only at Crookhorn; no other ceramic examples are known (Brodribb 1987, 18). Its form is reconstructed below from a number of fragments from pit F117 (6 pieces) and the construction of the corn-drying oven, F26 (19 pieces). There are many instances of this form of tile being made in Roman Britain of cut or split stone slabs, for instance in the Cotswolds. The closest parallels in stone are the heptagonal split Horsham stone tiles used in two villas not far east of Crookhorn, at Chilgrove in West Sussex (Down 1979, 175, fig 66). The only other ceramic tiles of similar form are pear-shaped and made at the Cranleigh tilery in Surrey (Goodchild 1937, 93–4). Both the Crookhorn and Cranleigh types would have been laid overlapping each other like the stone examples, and possibly like the feathers in the tail of a peacock. Brodribb gives a drawing of this with Crookhorn tiles (1987, 18, fig 8). Indeed, Pliny (*NH* 36, 159) in an interesting reference to this arrangement states that 'in the province of Belgic Gaul, a white stone is said to be cut with a saw, just like wood, only even more easily, so as to serve as ordinary roof tiles and as rain tiles, or, if so desired, as the kind of roofing known as peacock-style. – *. . . ad tegularum et imbricum, vicem vel, si libiat, quae vocant pavonacae tegendi genera.*' The Crookhorn tiles were probably therefore the ceramic equivalent to the stone tiles. They could have been produced to go with stone tiles to form a patterned roof design (like a peacock's tail feathers), or to patch a roof for which stone tiles were no longer readily available.

In an effort to establish the dimensions of a specimen Crookhorn heptagonal tile, the fragments were numbered, a template made of each, and the corner angles measured. Nine of the pieces have a hole pierced in one corner suggesting that the tile was intended to be hung. This corner has therefore been placed at the top and lettered A. The other corners are lettered clockwise: B, C, D, E, and F. It is notable that without exception the striations left by the tile-maker's levelling bar or cutting wire run from end to end. This is relevant in that when coupled with the measured angle it is possible to allocate a correct position to those fragments with only one side angle surviving. The angles were tabulated in conjunction with the position allocated to each angle (Table 1).

From the table it is possible to deduce that the desired angles are, for A, 80°; B and F, 140°; C and E, 135°, and for D, 90°. Twenty-five of the thirty angles given (83% of the whole sample) are within 5° of these figures. Item 15 is unusual in that angle A is only 65°, and the side angles increase accordingly, but this probably serves to emphasise the practice of having a more acute angle at the top. If this tile is excluded, the above percentage increases to 92%.

The tile width is obtained from items 3 and 4 (which probably came from the same mould frame). Each has a top and one side angle surviving and represent left- and right-hand fragments respectively. Aligning the common edges gives a width of 280mm. The length of the sides is taken from items 15 and 18, both having two adjacent side angles surviving, although on item 15, one is too close to a break to allow measurement of the angle. Both fragments give a length of 100mm.

Two pieces from pit F117 (items 26 and 27, not included in the table) appear to be the top right-hand fragments of half tiles, i.e. A-B-C-D, and would probably have been used to finish a course. Of the tiles used to build the herring-bone walls of the corn-drying oven, an attempt seems to have been made to render them a suitable size by breaking them along the lines F-B and E-C. Items 1 to 9 inclusive are the upper ends of tiles and with

Table 1. Calculated angles of corners and numbers of pierced holes obtained from 25 fragments of heptagonal tile.

No	*Origin*	*Angles (Degrees)*						*Pierced*
		A	B	C	D	E	F	*Holes*
1	F117	80						1
2	F117	80						1
3	F26	78	145					1
4	F26	78					141	1
5	F26	77						1
6	F26	87						1
7	F26	75						3
8	F26							1
9	F26							1
10	F26				86	140		
11	F26				91	130		
12	F26				88			
13	F26				90			
14	F26				90			
15	F26	65	146				149	
16	F117		140					
17	F26		140					
18	F26					135	142	
19	F26						140	
20	F26					135		
21	F26					126		
22	F117			132				
23	F117			135				
24	F117			135				
25	F26			136				
DEDUCED ANGLE		80	140	135	90	135	140	

one exception have one hole near the top. The exception, item 7, has three holes, is 50mm shorter, and was probably intended for the top course. On the standard heptagonal tile, as a measure of weather-proofing, the peg or nail hole was offset so that it did not come below the joint of the two tiles overlapping above it. It was in order to accommodate this offset without increasing the length or decreasing the distance of the hole from the bottom angle (D), that the top angle was made more acute at 80°. It was probably important that these dimensions and angles were always applied in a standard maintained at the Crookhorn tilery. The overall dimensions of the heptagonal tiles were virtually identical to those of the *tegulae* (Table 2).

The sizes of the Crookhorn heptagonal tiles and *tegulae* are compared with the Chilgrove tiles and the products of other kilns in Table 2.

Note: Two complete tiles, a *tegula* and an *imbrex*, made in a fine pink-buff sandy fabric, were found in the rubble of the corn-drying oven. The *imbrex* has two finger grooves around the upper surface of the wide end. The fabric and markings are unique at Crookhorn and their origin is unknown. They may have been brought in as patterns or samples, perhaps before production began.

The Combs and Comb Markings (Figs 29 & 30)

Most of the box flue tiles and some of the other brick and tile types were combed before firing with a variety of patterns, to form a key for the plaster or mortar when used in building. Nine examples of these patterns are illustrated, as they would have been produced with a six-tooth comb on the face of a small box flue tile. Similar patterns were also

Table 2. Dimensions (in millimetres) of heptagonal tiles and tegulae *from Crookhorn and other sites.*

Site	*tile type*	*length*	*width*
Crookhorn	heptagonal	380	280
Crookhorn	*tegula*	380	280–320
Chilgrove, W Sx (Down 1979)	stone hept.	420	280
Scotland Farm, Hook (Graham 1971)	*tegula*	380	280
Itchingfield, Horsham, W Sx (Green 1970)	*tegula*	430	320
Elstree, Herts (O'Neil 1951)	*tegula*	420	325
Wykehurst Farm, Cranleigh, Sy (Goodchild 1937)	*tegula*	420	325
Wykehurst Farm, Cranleigh	pear-shaped	380	280

made with combs having different numbers of teeth, while other examples displayed combing confined to one or more straight strokes along or across the tile. The use of combs in general has been discussed by Brodribb (1987, 105–117).

In fig 30 are illustrated diagrammatic representations of tile sections made with the impressions of 16 different identified combs, giving the number of teeth and the dimensions between the outer teeth. No attempt has been made to show the pitches of the intermediate ones. It will be appreciated that varying degrees of shrinkage in firing could alter the pitch of comb impressions, as would holding the comb at an angle to the axis of the stroke, this last point applying particularly if more than one person was using the same comb. Therefore identification should be based on a number of examples, and with the quantity of material available at Crookhorn it was possible to recognise repeated use of some combs.

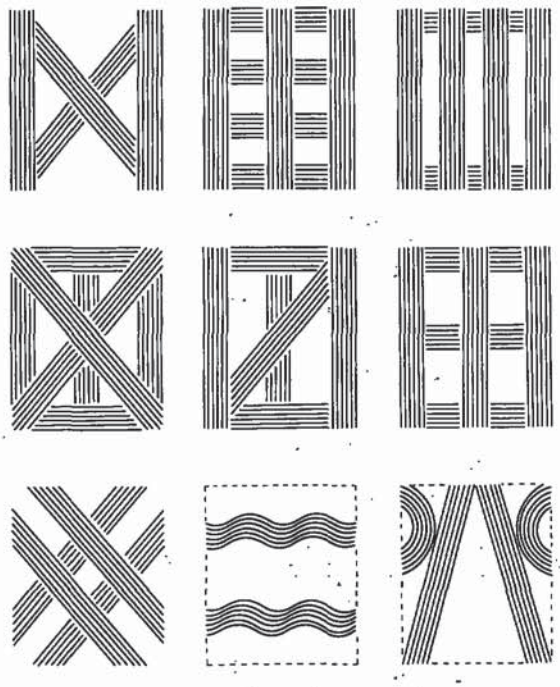


Fig 29. Brick and Tiles: nine examples of comb designs as produced by a 6-toothed comb on the face of a small box tile.

The Tile-Stamps (Fig 31)

During the excavation of the tile-kiln and its associated structures, a rather over-fired fragment of stamped *tegula* was found when a contractor's trench sectioned an area of waster scatter adjacent to the kiln. The impressed stamp reads TI[FR (Fig 31, bottom). The stamp can be reconstructed from a nearly complete *tegula* (Fig 31, top) bearing an almost identical stamp reading TIFR, found on the site of the main house of the villa during the 1926 excavations (Taylor & Collingwood 1927, 244, no 25), and now in Portsmouth City Museum. Both stamps are situated near the edge of the upper surface of each tile, and centrally, astride the long axis. Another tile stamped TIFR was found during the excavation of the Roman building at Langstone (Warren 1926/30, 286) together with one stamped]ORIS. Both of these are now lost.

The discovery of the stamped tile at the Crookhorn tilery is important for two reasons. Firstly, it indicates that tiles from the same manufacturer and almost certainly from the same factory were being used in the early 4th century in the main buildings of the villa and also at Langstone, 4km to

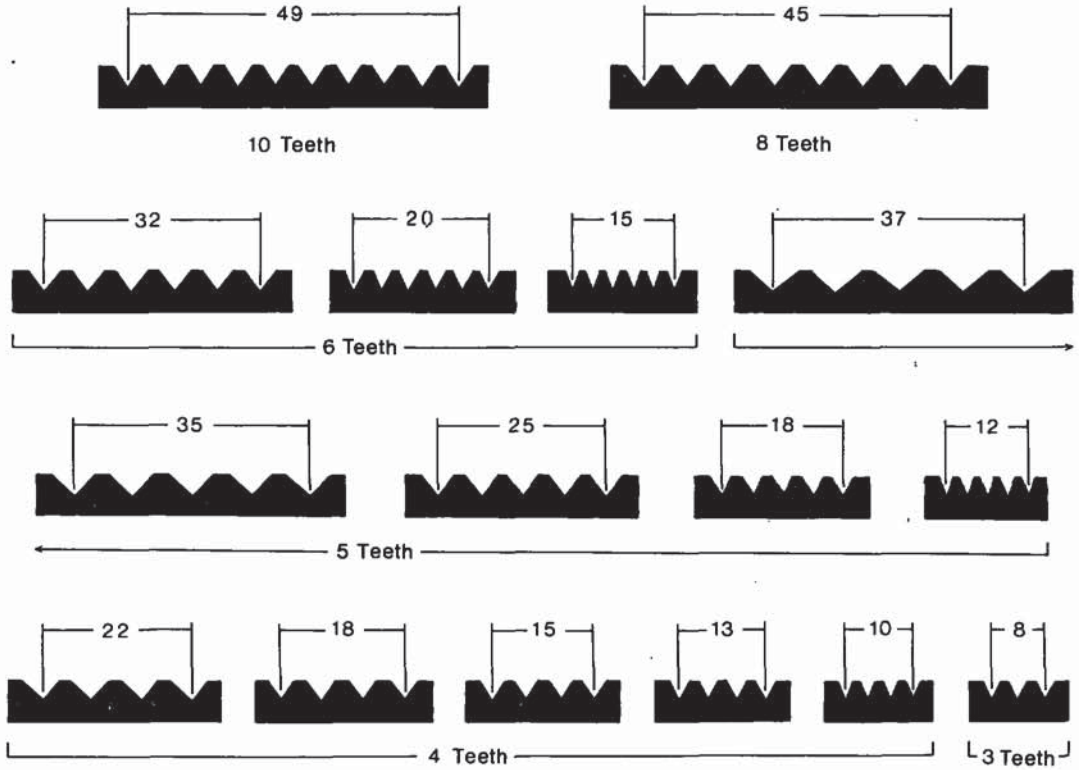


Fig 30. Bricks and Tiles: diagrammatic representation of profiles produced by 16 different combs, showing number of teeth and dimension in mm between outer teeth (scale 1:1).

the south-east. Secondly, it presents a rare example of a civilian tile-works producing stamped products. Although legionary tile-stamps such as LEG II AVG and official stamps such as CLBR (*Classis Britannica*) (Peacock 1977), and PR BR LON are known in Britain, there are few civilian kilns producing stamped tiles. There is a group of 43 tiles from Lincoln (Bogaers 1977) but, as has recently been emphasised by McWhirr and Viner (1978), the one part of the province which has produced significant numbers of stamped tiles is the area of Gloucestershire and north Wiltshire forming the *civitas* of the Dobunni. The *colonia* at Gloucester had its own municipal tilery producing tiles stamped RPG (*Rei Publicae Glevensium*), suffixed with the names of magistrates. From the rest of the region come a variety of stamps, amongst which is a large group stamped with the letters TPF either on their own or with the suffix A, B, C or P. McWhirr and Viner have shown that these stamps have a common source – the group of kilns at Minety near Cirencester – and a common distribution within that area (cf also Darvill 1979).

The Crookhorn stamps are strikingly similar to the TPF stamps from the Cirencester region. In both cases the letters exhibit the unusual characteristic of being impressed into the tile (perhaps with a metal die or dies) and the form of the letters (Roman capitals with serifs) is also very similar. The stamped tile industry in the Cirencester region seems to have declined by the end of the 3rd century, and in Cirencester itself it is rare to find tiles being used for roofs on 4th-century buildings. Where tiles were essential, old ones were reused (McWhirr & Viner 1978, 371). There is, perhaps, a case for suggesting that the Crookhorn industry had its origins in the early 4th century in the Cirencester region, with possibly a group of enterprising craftsmen migrating to the south in search of new business in an area of new building and prosperity.

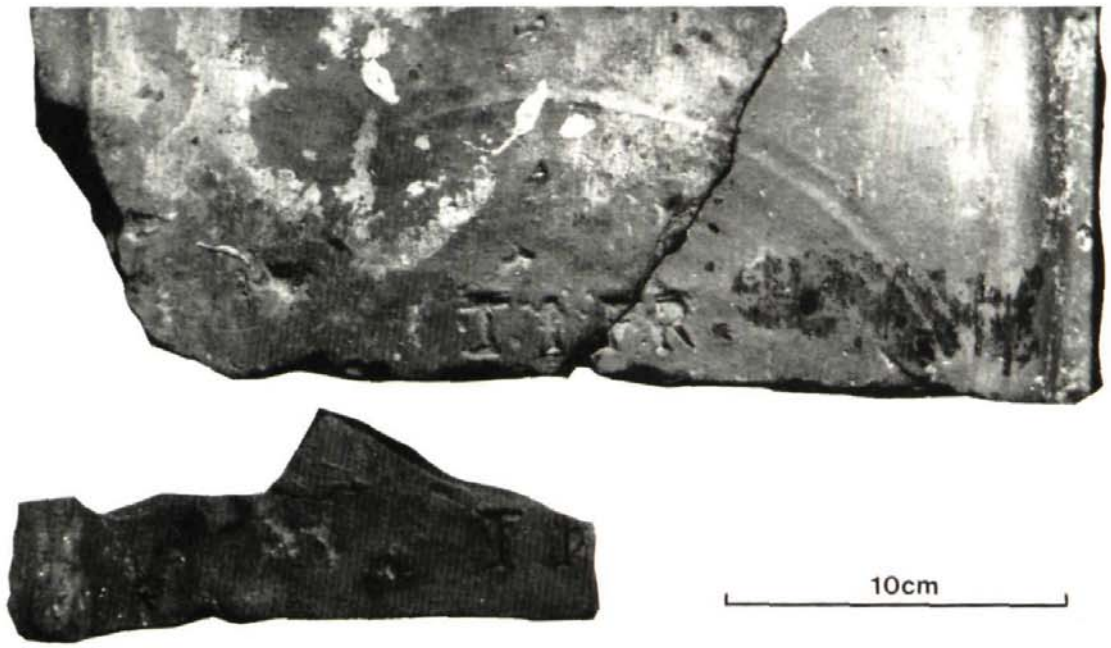


Fig 31. Tile Stamps: Top – the lower part of the upper side of a *tegula* stamped TIFR, from the villa. Bottom – similarly stamped *tegula* fragment from the vicinity of the tile-kiln.

A parallel situation may be reflected in the establishment of craftsmen responsible for the 'Central Southern Group' of mosaics at this time in the same area as the Crookhorn industry. It has been shown that these mosaics have strong affinities to those of the 'Corinian School' in the Cirencester region (Johnston 1977).

The interpretation of the Crookhorn stamps presents a number of possibilities. Following the example of Clifford (1955, 69), the T may stand for *tegulae*, the I for *imbrices*, the F for *fecit* and the R for a personal name. Other possibilities for F could be *filius* or even *figlinae* – a word occurring in Roman tile-stamps in Italy, and meaning the clay-digging site and factory together, 'in cases where primary production and processing form an integrated procedure' (Helen 1975, 45). However, from the 1st century, manufacturers' name-stamps would have been a common sight in Britain on imported amphoras, mortaria and samian ware, and a much more likely interpretation for the tile-stamps is that the letters are an abbreviated form of the *tria nomina*, like examples from Italy which are sometimes given in full but are more often abbreviated. On the same lines as his comments on the Cirencester stamps (McWhirr & Viner 1978, 367), Professor T P Wiseman suggests (pers comm) that the TI in the Crookhorn stamp represents the standard abbreviation for the common *praenomen* Tiberius, with the F and R standing for the *nomen* and *cognomen* (cf also Wiseman 1980). If this is so, who was the person named in the stamp? The name is more likely to be a firm's trade-mark rather than an individual craftsman's name, and Italian examples indicate the direction of the collective production process, whose name represents all those who took part in the process, from clay-diggers to firers (Helen 1975, 48). He could either be a landowner (*dominus*) or manufacturer (*officinator*), or serve both these functions at once.

If the operator were an independent specialist (*officinator*), he could easily, as suggested above, have moved in from outside the district and then become contracted to the landowner or villa's bailiff (*vilicus*). This would make it easier to explain why the tiles were stamped in the first place. If the tiles were used only within the villa estate, stamps would have been of little interest to producer or user. It can only be assumed that stamps were intended to indicate the consignments of individual producers or kilns during transport and storage outside the estate.

Human, Animal and Other Imprints and their Contribution to an Understanding of the Environment of the Tilery (Figs 32–34)

About 377kg of brick and tile fragments were recovered and retained. These were carefully examined for human and animal markings. It was not possible to carry out a statistical analysis as material was collected at random and conditions of excavation prevented a complete sample being recovered from any context. Nevertheless, this is the first Roman tilery in Britain to be excavated where this form of evidence has been noted.

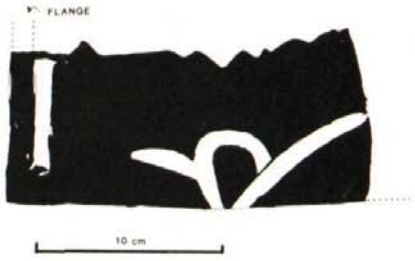


Fig 32. Finger signature on top surface of a *tegula*.

Human fingerprints occur frequently on the tops and undersides of all brick and tile types, presumably as a result of their being turned (skintled) in the process of drying, their having been carried out to the drying place in the mould or on wooden palettes as they are today in the 'soft-mud' process. From data collected at a local brickfield (at Hayling Island) using this traditional method, it would appear that the majority of human and animal impressions would have occurred within the first day or so of a drying period of between 10 and 20 days prior to stacking in the kiln. After this initial period the clay would be sufficiently dried to withstand most 'casual' impressions. Apart from fingerprints, all human and animal imprints occur on flat bricks and *tegulae*. No deliberately made complete hand impressions were found at Crookhorn, although this device appears to be a manufacturer's signature on bricks from local settlements such as the Portchester Roman fort and on the Isle of Wight (Soffe 1988). Finger-tip signatures forming a letter R have also been found at

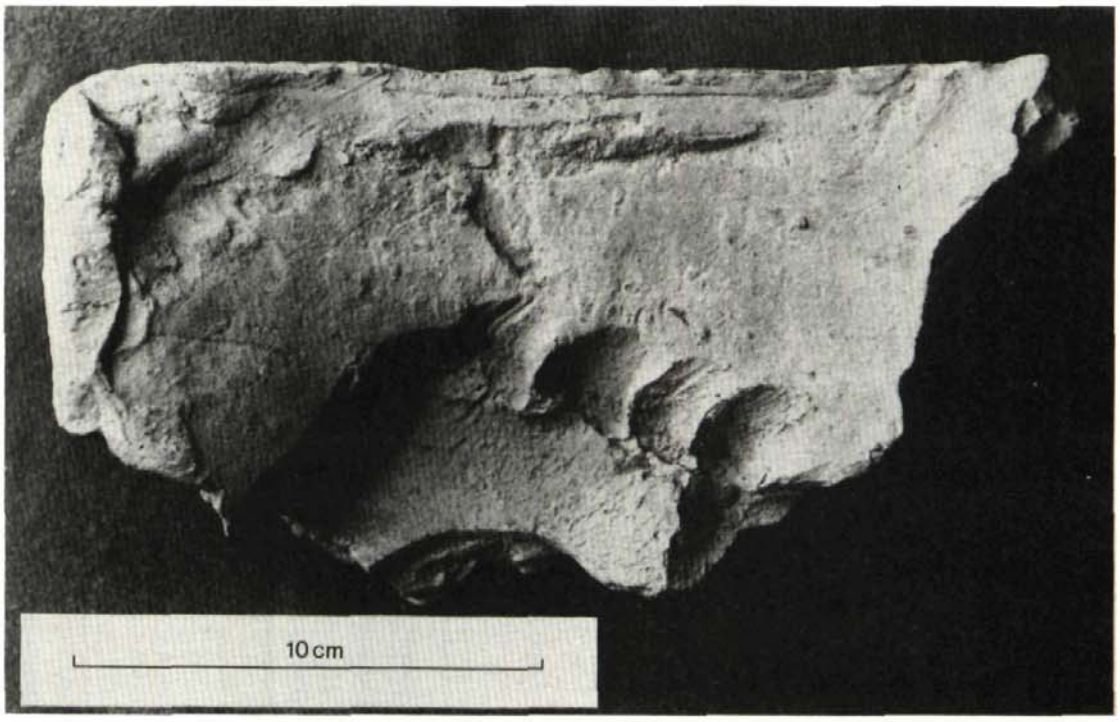


Fig 33. Human footprint on the top surface of a flat brick.

Fig 34. Animal prints on the surface of a *lydion* brick.

these locations, but again these are not found at Crookhorn. This suggests that particular local products so marked were not made at the Crookhorn tilery but more probably on the Isle of Wight. One *tegula* from pit F136 at Crookhorn carries a finger-tip signature on its top near the edge (Fig 32), but other signatures at Crookhorn are confined to the standard semi-circular marks also found on the top of *tegulae* near the lower edge (Brodribb 1987, 99–105) and double marks on the edges of some *imbrices*. The Crookhorn stamped tile from the villa illustrated above (Fig 31) shows such a mark, forming an arc around the stamp impression.

The number of bricks and tiles with footprints was relatively small. One flat brick from the scatter of waste material extending north from the tile-kiln bears the imprint of a bare human foot – a well-formed left foot of an adult male (Fig 33). It is deep, and must have been impressed at the earliest stage of drying. A *lydion*, type 4, from the kiln's main flue (F115) has faint traces of the hob-nails of a leather shoe.

The animal footprints have been identified using two standard texts referring to modern animal tracks (Lawrence & Brown 1973; Barig & Dahlström 1974). These footprints are mostly those of canids – probably domestic dogs. They are found on a flat brick from the back wall of the main flue, two bricks from the main flue, a *tegula* from pit F136, and three *tegulae* fragments from the rubble around the corn-drying oven. The prints vary considerably in size. One flat brick from the kiln stoke-pit bears two footprints of a small felid – probably a domestic cat. A *lydion* from the rubble spread north of the kiln (Fig 34) and another from site A, layer 102, has imprints of dog with those of other animals having cloven hoofs. These appear to be the footprints of sheep or goats, having a more pointed toe form than in modern breeds. Similar footprints have likewise been identified elsewhere, particularly at Silchester (Cram & Fulford 1979; Cram 1984; 1985). At other sites, such as Hartfield, they may have been mistakenly identified using the texts referred to above as those of small (i.e. young) red deer. The illustrated brick (Fig 34) also has one footprint similar to that of a pig, but the two back toes do not show, so this ascription is open to question.

Comparison can now be made with the few other sites where this form of evidence has been collected. These include two tileries, at Hartfield, East Sussex (Rudling 1986) and the military works near the fort at Dormagen, Rhineland (Müller 1979). Both produced marked wasters and used tiles in similar numbers to Crookhorn with dog and cat marks predominating, and five human shoe prints at Dormagen. Apart from the tileries themselves, two other sites where tile products were used in buildings have produced large samples. Out of 12.8 tons found at the Beauport Park bath-house, East Sussex (excluding fingerprints), 173 bore imprints (Brodribb 1979; Brodribb & Cleere 1988), and out of *c* 600 bricks and tiles recovered from Silchester, 2% have animal and human footprints. Current studies on the Roman villa Am Silberberg, Ahrweiler, Rheinland-Pfalz, West Germany, by Mark Redknap (forthcoming), and on the bath-houses at Binchester and Chester-le-Street (A Bowman, pers comm), appear to be producing similar results.

Several conclusions can be drawn from this body of information. The evidence from used tiles from buildings is statistically similar to that derived from tilery wasters. In other words, imprinted bricks and tiles were generally acceptable for use. Dogs and cats always predominate, with dog footprints occurring *c* 4.5 times more frequently than those of cat at sites where large samples have been collected. This indicates that after the processes of moulding, combing and stamping, flat bricks and tiles must have been laid to dry or 'cure' either on the ground or close to the ground. Some practical details can be gleaned from better documented traditional brick and tile manufacturing processes in more recent times. For example, it seems that ground moisture, and certainly rainfall and uncontrolled air currents, would all have hindered the drying process. It is possible that drying ('green') bricks and tiles were laid on raised earth banks (hacks), layers of hay, straw or even low wooden platforms. Impressions of sand on the underside of bricks and tiles may result from its use as an anti-sticking agent in moulds rather than the materials on which the products were laid to dry.

The lack of animal imprints on *imbrices* and box flue tiles (although the number of fragments available for examination was comparatively small), suggest that these products were possibly either dried by stacking upon one another or on shelves. Alternatively, examples damaged by animals may have been destroyed before firing. It is very unlikely for the reasons mentioned above that bricks and tiles were dried in the open air. Thatched caps may have been used to cover specialised types such as box tiles drying on hacks, but the evidence points to open sheds to which the animals might gain access. At Crookhorn the group of post holes briefly observed at the northern extremity of the area of tile rubble to the north of the kiln, may represent the

remains of such structures (Fig 2.B). The spread of tile rubble may have accumulated in the area where such buildings (possibly temporary structures) were set up. The aisled building is less likely as a drying location (see discussion below). No evidence of tile making was found inside it or in its immediate vicinity on the south side of the pond/clay pit, both areas being conspicuously free of tile waster rubble. There may have been space for drying in the northern (working) end of the building but this would have proved inconvenient in what was essentially the main dwelling house of the site.

The conspicuous presence of dogs at Crookhorn and other sites begs the question of their purpose. Were they being kept as pets, as working animals or for food? The first two requirements seem most likely because there is an absence of butchered or burnt dog bones in food refuse deposits of the period (Harcourt 1974). Also, some footprints indicate very small adult animals which can only have been lap dogs. Evidence from art, literature and bone deposits indicates that dogs played a significant part in the ritual of Celtic and Roman religion and were sometimes sacrificed (Henig 1984, 29–30).

If, as seems likely, footprints of domestic sheep and/or goats are present at Crookhorn, it could be argued that the tilery was closely integrated with or at least near a farmyard. This might not have been expected if the tile-makers were full-time specialists with no opportunity to farm or keep stock. Roman tiles in Britain bearing graffito inscriptions of dates ranging from July to September (Tomlin 1979), and the practice of more recent traditional industries in north-west Europe suggest that brick and tile-making was a summer occupation. Tile-makers might be engaged in farming activities for much of their remaining time. Indeed the tile-makers themselves may have been farmers as well as specialist artisans, who saw the industry as an adjunct to agriculture and stock rearing. The evidence of the Crookhorn tile stamps discussed above also points to a similar conclusion.

The impressions of human feet and shoes from Crookhorn and particularly elsewhere suggest that possibly at least 60% of people engaged in tile-making wore shoes but others went barefoot, at least when at the tilery. Indeed, until recent times clay was prepared by puddling with bare feet before being placed in the moulds. The presence of the imprints of children's feet at other sites also suggests that, as was the case in recent traditional brick and tile making, children may have been employed with adults in the processes of the tilery. The occurrence of graffito inscriptions in Latin made before firing on bricks and tiles from other Romano-British sites indicates some degree of literacy amongst those employed at tileries (Tomlin 1979). These quite frequently give the names of tilemakers and the tally of brick or tiles made per man per day; often in the region of 220.

Finally, there is a relative absence of footprints of pigs, cattle, horses and wild animals, at all sites. This may be surprising, for although bones do not survive at Crookhorn, food refuse deposits from other sites provide evidence for increased numbers of pigs and cattle over those of sheep in late Roman Britain (King 1978). These animals must therefore have been kept well away from the tilery and possibly in some cases, the farmyard. The weight of cattle and horses would easily have destroyed a drying brick or tile. Pigs might have been kept in enclosed woodland or in sties. Cattle and horses would have been pastured in fields enclosed with ditches and fences or hedges, and enclosing of the tilery itself would have protected it from some of the larger wild animals.

The Crookhorn Stand by Martin Henig

Part of a terracotta stand was found during the excavation beneath the wall that ran along the eastern side of the corn-drying oven (Site C, F26). It is of the same pink-orange fabric as the tiles from the site and it is reasonable to suppose that it was made in the tile-kiln (Fig 35).

It is very probable, if the stand is reconstructed symmetrically, that it originally had three legs on each side, each corner leg being common to two sides. Two remain; that on the corner, substantially complete, and another (a central one), preserved as a stub. In whatever way the object is reconstructed, at least one more support must be posited; that there were no more than three in a row is shown by the layout of the decoration scribed before firing on the upper surface around the central hexagonal opening, and also by the presence of two prominent conical depressions, one near the corner and the other in the middle of the side. A reconstruction must allow for a border of constant width and also for another hole in the row, and therefore we can be fairly confident of the reconstruction of the stand as shown in Fig 35.

The stand recalls the class of enamelled bronze stools or stands which have central openings and surrounding holes and were evidently designed to be assembled in tiers (Green 1975, 64f, Nos 42–47, fig 4; 1976, pl 28; 1978, pl 126-131). Many have been

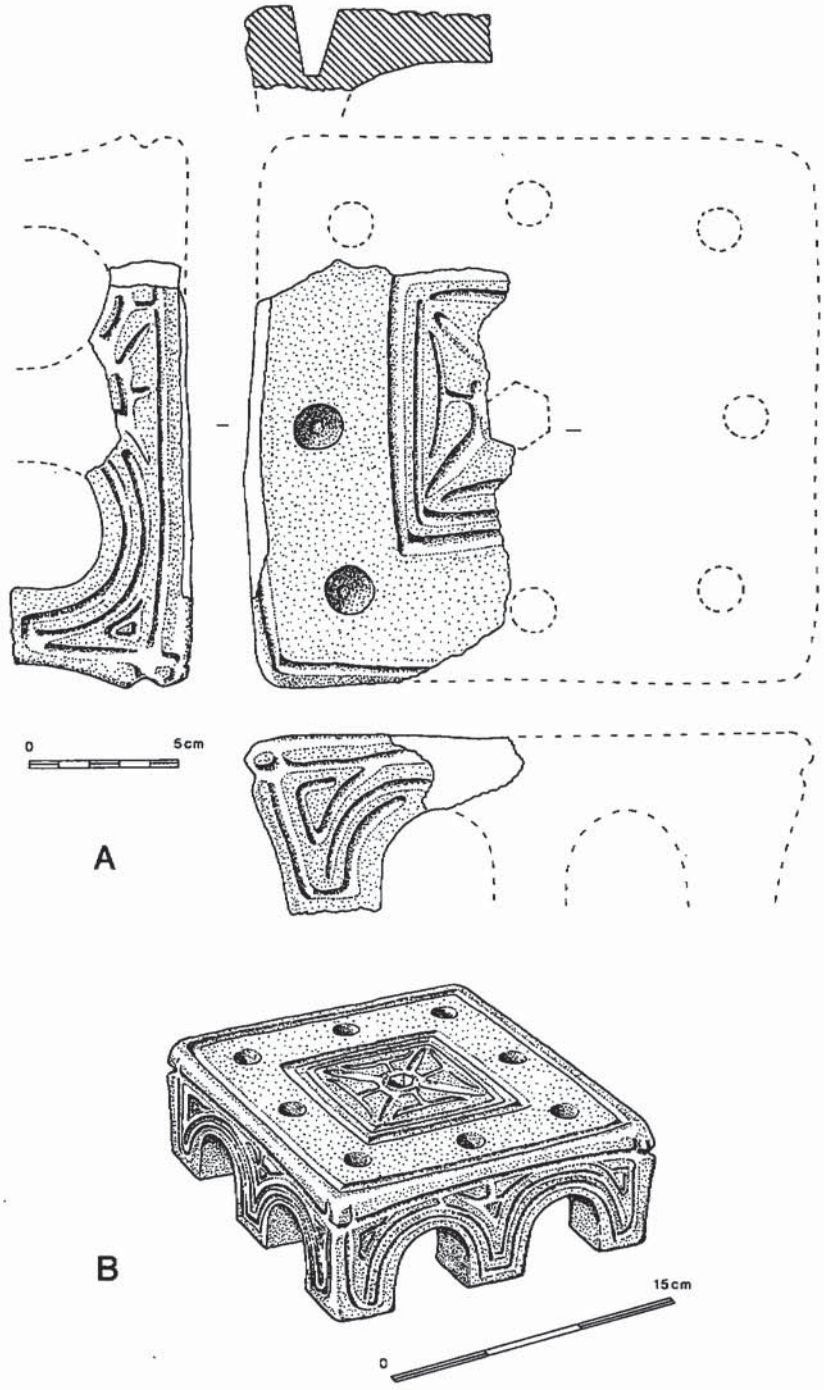


Fig 35. The Crookhorn Stand: **A** section and elevations, **B** reconstruction.

found on temple sites and Sarnia Butcher has recently made the suggestion that they were used ritually, with a central candle burning down inside the tier, a section being removed after it had sunk to a certain point. She compares this possible use to counting the beads on a rosary (Butcher 1977, 41 ff, esp 49–51, fig 4).

The only close parallel from Britain known to the writer comes from a 4th-century level in the Roman building complex at Colliton Park, Dorchester, west of building II (Mark Corney, pers comm). This object is also of ceramic and approximately the same size but circular in shape with eight depressions circling a deeper depression. Superficial examination suggests burning on the surface. I have already suggested (Henig 1982, 217–8) that offerings such as food and drink could have been placed in the depressions as in the Greek *kernos*, normally a vase with subsidiary containers (*kotyloskoi*) used to contain representative offerings of food, oil and wine in the Cult of Demeter at Eleusis (see Couve 1904) and also employed, perhaps less innocently, in the Cybele cult (Vermaseren 1977, 48). A large stone example from Mallia in Crete (Marinatos 1960, 64 & 137, pl 56) which takes the form of an offering-table with depressions, is justly famous, but others are known including one recently published from Knossos, perhaps again of Minoan date but conceivably later (Warren 1984, 321–2, pl 35c).

In view of the discovery of the Crookhorn stand beneath the wall of a corn-drying oven, the idea that it was used for offerings of first-fruits to Ceres-Demeter is a very attractive one. It is to be hoped that other stands of this sort will come to light in Roman contexts elsewhere.

Miscellaneous products in tile fabric (Fig 36)

1. Hand-made bowl in pink-buff tile fabric with internal finger impressions. Unstratified. Found by contractors while cutting a service trench east of the tile-kiln.

2. Hand-made bowl with plain rim in sandy orange tile fabric. From the floor of the main flue of the tile-kiln (F115).

3. Tubular object, probably a spacer bobbin for cavity walling, in hard grey tile fabric, pierced through with a hole of 6mm diameter. Broken at both ends. From the floor of the main flue of the tile-kiln (F115).

4. Handle or support in sandy orange tile fabric. From rubbish pit F136.

5. Body sherd from a large hand-made jar in sandy orange tile fabric. Internal finger impressions. Very similar to and probably a copy of a typical large wheel turned storage jar of the type known to have been produced at the nearby Roman pottery kilns at Rowlands Castle. From the rubbish pit F136.

6. Storage jar in sandy orange tile fabric with finger impressed decoration on rim. From a post hole (F121) of the first-phase building surrounding the tile-kiln.

7. Seven fragments (of which one is illustrated), probably from a set of loom-weights in tile fabric, 65–83mm thick with rounded corners forming angles of *c* 60°. The face of one and the edges of another two pieces, carry cord(?) impressed grooves. All fragments were from the rubbish pit F117.

The hand-made vessels would constitute a very rare find on any Romano-British site. Bowls in tile fabric have been found at the *mansio* on Stane Street at Alfoldean (Winbolt 1924) and the nearby tilery at Itchingfield, whose products have been linked with Alfoldean (Green 1970). It is possible that these vessels were made to meet an immediate and perhaps specific need, and were used by the tile makers on site when no other suitable containers were available. However, the profuse amount of contemporary pottery found during the excavations, and the suggestion at Alfoldean that these vessels were exported for domestic use, implies a more elusive explanation.

The tubular spacer bobbin is a rare find, and is the first example of this type of object to be found at its place of manufacture. In use it would have been held in position by an iron T-shaped cramp running through it. Examples have been found *in situ* in walling at a 2nd-century bath-house at Garden Hill, Sussex (Money 1974) and also at Canterbury (Grew 1980, 401). One of the closest parallels to the Crookhorn example was found at the nearby Roman palace at Fishbourne (Cunliffe 1971, 47, item 34). Spacer bobbins are fully discussed by Brodribb (1987, 67–9). The probable handle or support (no 4 above) is also a rare find. A similar object was found at the military tilery at Dormagen in the Rhineland (Müller 1979, 15, g, Taf 38.4).

The other fragments are also of some importance since very few loom-weights are known from Roman

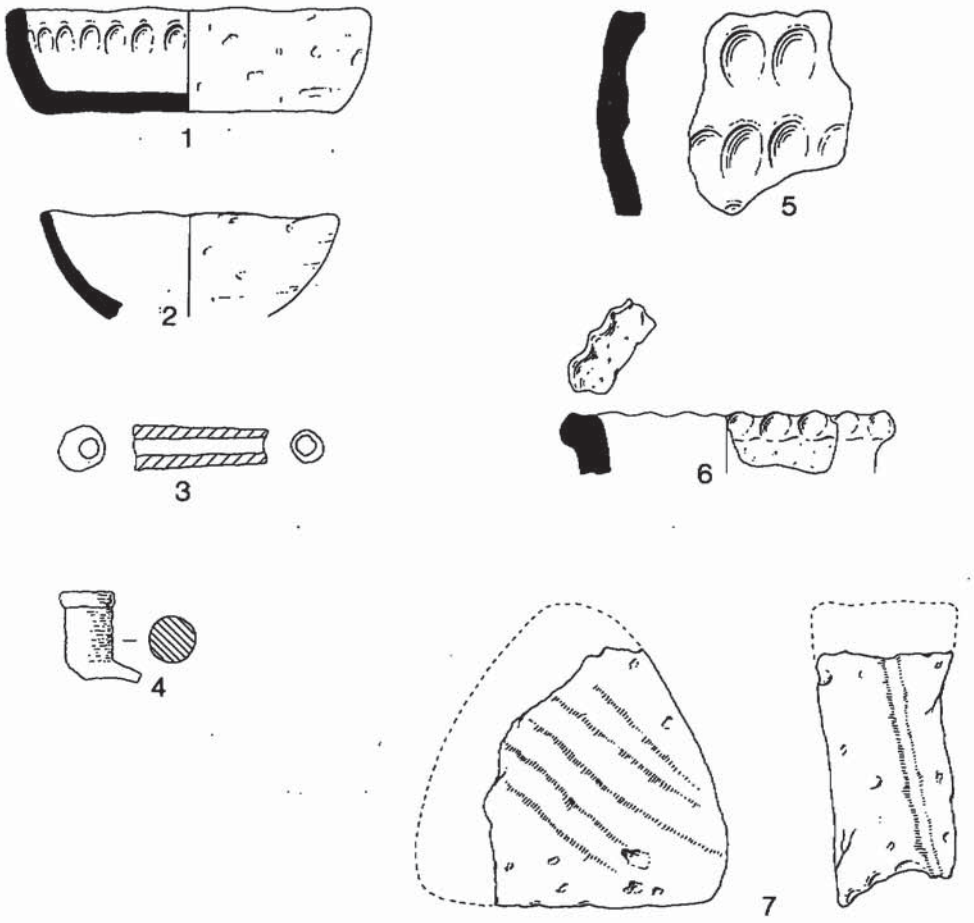


Fig 36. Miscellaneous Kiln Products (scale 1:4, except 3, scale 1:2).

Britain, and thus evidence for the continued use into the Roman period of the warp-weighted loom, common in Iron Age times, is extremely slim (Wild 1970). A reconstruction of the Crookhorn example (Fig 36.7) shows that they are similar in shape and size to typical Iron Age triangular weights, such as the nine found at the nearby Iron Age settlement at Wallington (Hughes 1974), although these are usually pierced across the corners. A pear-shaped chalk loom-weight with warp grooves is known from Middleton-on-the-Wolds, Yorks (Wild 1970), and clay weights of indeterminate shape from late Roman contexts are known from Silchester (Boon 1974, 285), West Blatchington, Sussex (Norris & Burstow 1950) and Horndean, just north of Crookhorn (Cunliffe 1961b, 29). This slender evidence, to which can be added the Crookhorn finds, probably indicates that the warp-weighted loom continued in everyday use in Britain until the 4th century at least, and was not completely replaced by the two-beam loom, as suggested by classical written sources.

Kiln Furniture

Four lumps of hand-moulded clay were found, three from the main flue of the kiln (F115) and one in pit F117. These had been used as spacers in the kiln, and bore the impressions of tile edges and corners. All the pieces were fired very hard and one showed signs of vitrification.

THE POTTERY

A total of 25.5kg of pottery was recovered from the excavation. The majority of this came from six features: the east ditch (F4, F4A and F4B), the general surface layer surrounding the tile-kiln (Site B, layer 1) and the two pits F117 and F136. Both the pits were comparatively shallow and the contents of each probably represent a contemporary group.

The detailed report on the pottery from each context is given in the microfiche. In the printed text that follows are the fabric classification, illustrations of the types present in each fabric group, and a discussion.

Fabrics

Samian ware (160g; 0.6%)

All came from the hearth and pit area inside the aisled building and the ditches to the east and west of it. Sherds of cup form 33 came from F1 and F4; two dishes of form 18/31 from ditch F4B, and another from hearth area F8. No decorated forms were found.

New Forest fabrics

Fabric A (140g; 0.55%)

Fine hard grey fabric with red or dark grey slip over pale red-brown surface layer (Fulford 1975, 24, fabric 1a). Some sherds have a white-patterned decoration of straight lines. In addition to the illustrated vessels, a number of sherds from indented beakers was also found.

Fabric B (590g; 2.3%)

Fine pale orange to red fabric (Fulford 1975, 25, fabric 1b). The hardness varies from medium soft to stone ware. Most of the Crookhorn examples are of the softer type of fabric and surfaces have been eroded. Only one flanged bowl retains its original semi-glossy red-brown slip.

Fabric C (170g; 0.7%)

Fine medium hard pale cream fabric, sometimes with a light grey core (Fulford 1975, 26, fabric 2). Dark grey-black slip externally. Decoration of grooves and combed wavy lines. Sherds in this fabric are known from the New Forest kilns at Island Thorns and Pitts Wood.

Coarse wares

Fabric D: grey wares (14,115g; 55.0%)

This general group embraces a colour range from light grey to blue-black, and occasional shades of buff, brown and straw. Textures vary from coarse and sandy to powdery and sand-free. Slip finish, where present, is either black or a thin wash of red-orange or silvery grey. Decoration is confined to a few examples of straight or straight-and-wavy line patterns (e.g. 222 and 225).

Fabric E (3,206g; 12.5%)

Medium sandy light brown to red-brown fabric, sometimes with a grey core. Frequently has a black slip which is occasionally burnished. A few pieces have tooled decoration (e.g. 246).

Fabric F (1,115g; 4.37%)

A coarse fairly hard sandy brown fabric, usually with a well defined grey core. The main differences from fabric E are rougher surfaces and the presence of soft cream and brown inclusions up to 3mm in size, and some flint grits. A good example of a form in this fabric is the hemispherical bowl (206).

Fabric G: grog-tempered ware (345g; 1.35%)

Dark brown to black fabric tempered with red and grey grog. Hand-made and burnished externally. This ware is classed as fabric A at Portchester (Fulford in Cunliffe 1975, 286–91).

Fabric H: black-burnished ware (BB1) (1,830g; 7.17%)

Black or dark grey sandy fabric. Most of the examples from Crookhorn have a red-brown layer under the black surface, which is not uncommon in BB1. The jar (85) from the stoke-pit F25 has acquired a red oxidised surface layer after it was originally discarded, presumably as a result of heating from the furnace of the corn-drying oven.

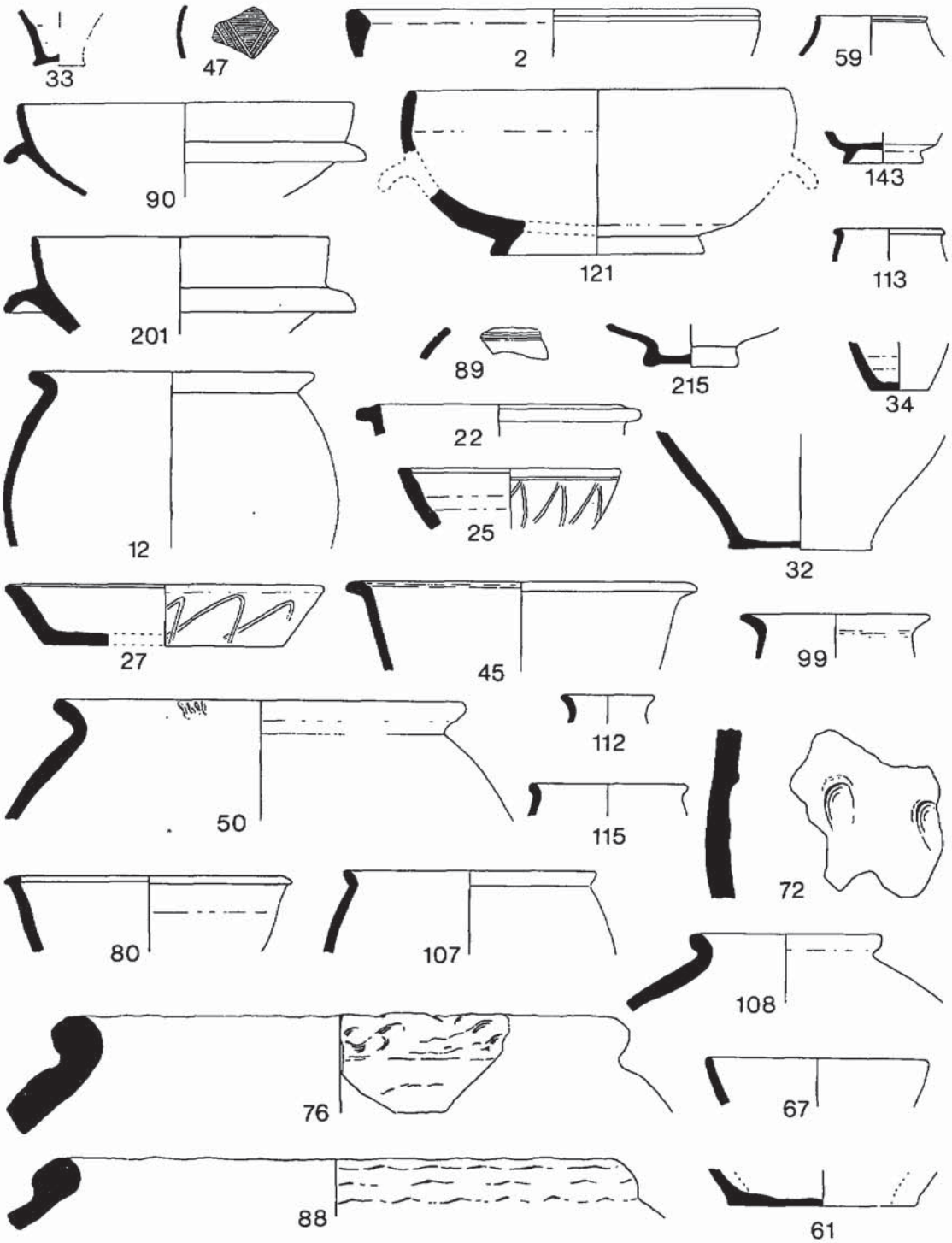


Fig 37. Pottery: fabrics A, B, C and D (scale 1:4).

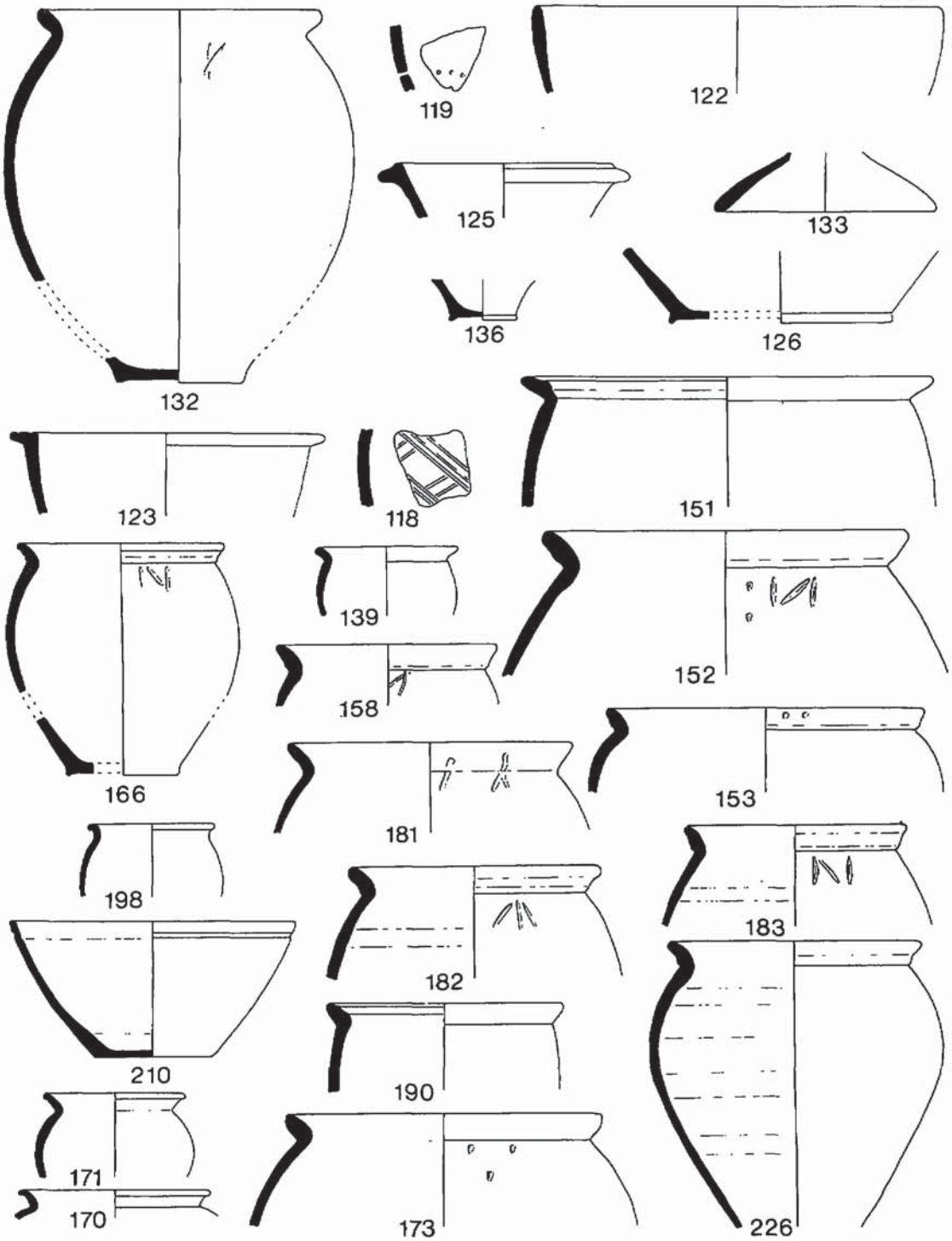


Fig 38. Pottery: fabric D (scale 1:4).

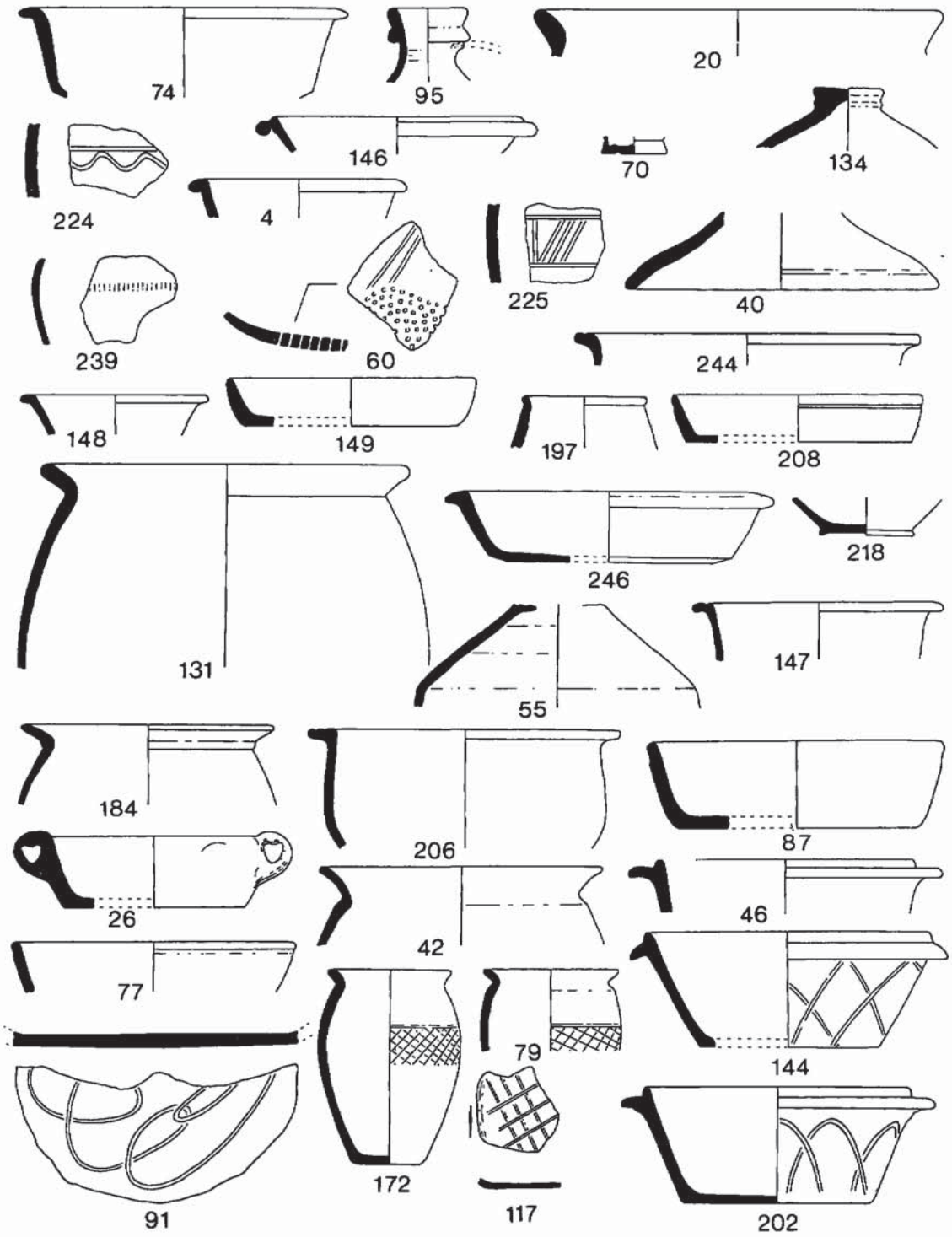


Fig 39. Pottery: fabrics D, E, F, G and H (scale 1:4).

Decoration, where present, consists of patterns of tooled lines; on jars a zone of lattice work around the girth, on dishes an arcaded design on the external wall. Two fragments of dish bases have the decoration on the underside; on one, a series of loops (91), and on the other, lattice work (117). Vessels are made without the wheel, although there is some evidence for the use of a turn-table, particularly for burnishing (Farrar 1973, 76).

Fabric J: black-burnished ware (BB2) (1,280g; 5.0%)

Grey-buff fine to medium sandy fabric with black to dark brown burnished surface and re-brown subcutaneous layer, as in BB1. Wheel-made. One vessel (1) was decorated with a wavy line and a series of straight lines tooled on the shoulder.

Fabric K (510g; 2.1%)

Medium sandy dull orange fabric with a grey core.

The Illustrated Pottery (Figs 37–40)

Full illustrated descriptions of 246 coarse ware vessels are given in the microfiche. Of these, a selection has been chosen to show the range of types present for each fabric group outlined above. In addition, all illustrated everted rim jars with pre-firing batch-marks are included, because this class of pottery occurs more frequently at Crookhorn than at any other excavated site.

The drawings are given in fabric type order, as below, and there is an illustration number for each drawing that allows for cross-reference to the full report on microfiche. Also given here are the feature number (which is not repeated after the first example for each fabric), and brief comment on burnishing, slip or other characteristics not obvious from the illustration.

Fabric A 33 (F4), 47 (F4A) red-brown surface, black slip, painted lines, 114 (F102).

Fabric B 2 (F1), 59 (F4B), 90 (F25) black surface, red-brown slip, 121 (F102) red-brown slip, 142 (F115), 201 (F136) red-brown slip.

Fabric C 89 (F25) grey-black slip, 113 (F102) dark grey slip, 142 (F115), 215 (F136) dark grey slip.

Fabric D 12 (F4), 22 black slip, 25, 27 brown-orange slip, 32 flint tempering, brown-orange slip, 34 small brown-black inclusions, 45 (F4A) black slip, 50 (F4B), 61, 67 (F8), 72, 80 (F18) silver-grey slip, 88 (F25) grey slip, 99 (F26), 107 (F102) red-brown slip, 108, 112, 115, 118, 119, 122, 123, 125 black slip, 126 orange slip, 132 (F103) grit inclusions, 133 black inclusions, 136, 139 (F112), 151 (F117) black streaks, 152 ditto, 153, 158, 166 laminated red and grey, orange-red slip, 170, 171, 173 (F136), 181, 182, 183, 190 burnished, 198, 210 hand-made, black inclusions, 224, 225, 226 (F137) grit inclusions, grey slip, 239 (Site B layer 1).

Fabric E 4 (F1) black slip, 20 (F4), 40, 60 (F4B) black slip, 70 (F8), 74 (F10) burnished, burnt, 95 (F26) black slip, 131 (F103) black slip, burnished, 134, 146 (F117) black slip, 148 black slip, burnished, 149, 197 (F136) black slip, 208, 218, 244 (Site B layer 1), 246 black slip.

Fabric F 55 (F4B), 147 (F117) brown inclusions, 184 (F136), 206 grey core, soft light brown inclusions.

Fabric G 87 (F25) red & grey grog tempering, burnished.

Fabric H 26 (F4) burnished, 42 (F4A) burnished, 46 red-brown surface, burnished, 77 (F11) red-brown surface, burnished, 79 (F17) red-brown surface, burnished above lattice, 91 (F25) inside burnished, 117 (F102), 144 (F117) red-brown surface layer under black burnish, 172 burnished above lattice, 202 (F136) red-brown layer under black burnish, 209 burnished.

Fabric J 1 (F1) red-brown surface, burnished, mark scratched after firing, 56 (F4B) red-brown surface, horizontal burnished strokes.

Fabric K 31 (F4), 73 (F10) grit & haematite inclusions, 159 (F117), 230 (Site B layer 1), 236.

Miscellaneous 76 (F10) hand-made, hard sandy buff fabric, grit inclusions, finger impressed rim, 238 (Site B layer 1) cream-buff fabric, grey-black slip, probably New Forest.

Pottery Dating and Discussion

The grey wares (fabric D) make up over half the total weight of pottery recovered during the excavation and appear in 93% of the excavated features (Fig 41). Within this class there is a wide diversity in fabric, and even where there are close similarities in paste, the sherds as a whole exhibit considerable

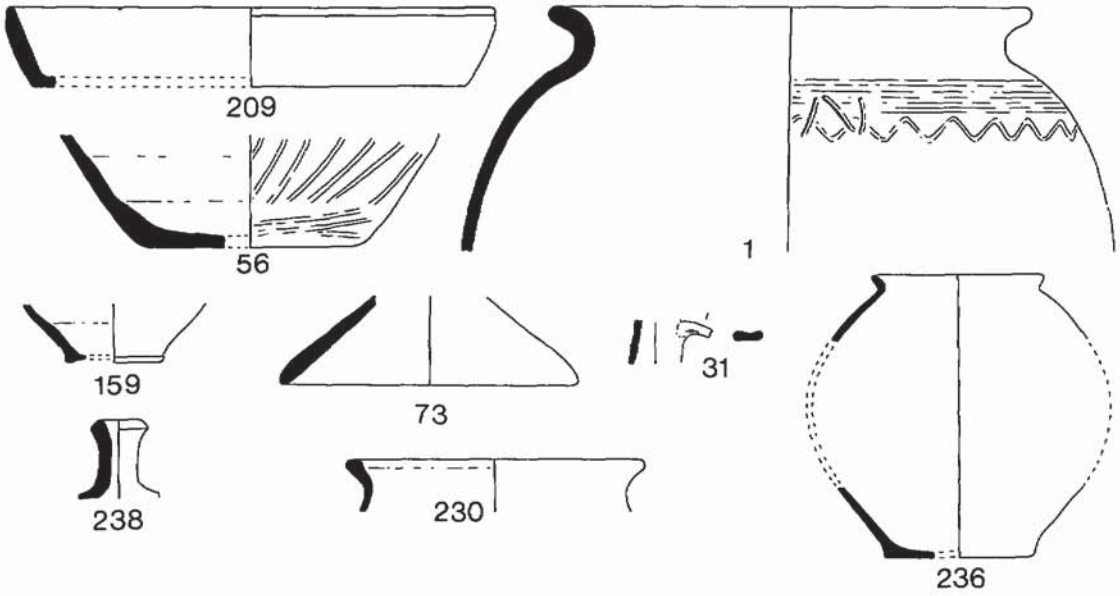


Fig 40. Pottery: fabrics H, J, K and Miscellaneous (scale 1:4)

differences in firing atmosphere and surface treatment. It would thus be possible to extract further fabric types from this broad classification, but as variations are known elsewhere to consistently occur within single groups of kilns it has not been considered worthwhile to do so, not at least because of the current scanty knowledge of local kiln products. A parallel situation has become apparent in fabric analysis of the very similar but larger group of coarse grey wares from the nearby site of the Roman temple on Hayling Island (King & Soffe forthcoming). The diversity of fabric within the grey wares may also point to a number of kiln centres being involved in their production, and those at Rowlands Castle and Shedfield must be considered as likely sources; certainly many of the jars closely resemble those known to have come from the former (Hodder 1974, type 1), and also occur in abundance within the broadly similar assemblage from the 1926 excavations in the main buildings of the villa. However, with New Forest and possibly Oxford fabrics forming part of the site assemblage, sources further afield cannot be discounted, although with the exception of a few dubious sherds, the major kiln centre in the Alice Holt Forest does not appear to have made a contribution (M Lyne, pers comm).

After fabric D, the brown ware (fabric E) figures most prominently, for although it comprises less than 13% of the total weight of pottery recovered, it occurred in 75% of the features. For the purpose of discussion, the similar fabric F can be grouped with it. If there is a possibility that the grey wares came from a number of sources, the same may not be true for fabrics E and F. A brown sandy ware is known to have been produced at the Rowlands Castle kilns (SHARG reference collection), but this is somewhat coarser in texture than the Crookhorn material and no examples have come to light from these kilns with the distinctive black slip found on some of the Crookhorn vessels. However, some sherds of this ware have come from a small site at Havant, excavated by SHARG in 1980, and one of the Hayling Island fabrics is similar. A number of forms are known in the Crookhorn brown ware, i.e. jars, flanged and plain rim dishes, perforated bowls, beakers, flagons or jugs and lids. The relatively high proportion of the ware present, and the large variety of forms may also indicate a local source.

New Forest wares, fabrics A, B and C, are only lightly represented, forming 3.5% of the total. They occur in the form of several beakers, red-slipped bowls and flagon necks and bases. It is often difficult to distinguish between red-slipped bowls from

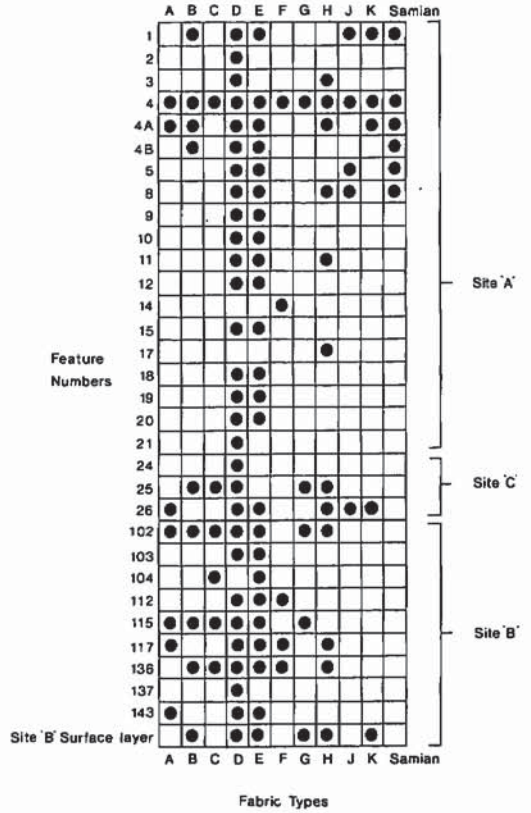


Fig 41. Pottery: distribution of fabric types by feature.

the New Forest and Oxford kilns, and in the case of examples found at Crookhorn, eroded surfaces add to the difficulty. Nevertheless, considering the presence of some of the more readily distinguishable New Forest fabrics and forms, it is probable that on balance the Crookhorn examples originate there. Very little of the pottery can in fact be definitely assigned to the Oxford kilns; but two likely products are the carinated jar (**58**) and the small jar (**166**). In addition, some of the orange ware cannot be entirely discounted. Similarly, fabric G, the grog-tempered ware, which at Portchester accounted for about one third of the non-colour coated ware from all the phases (Cunliffe 1975, 288–91), is scarce at Crookhorn, with only three vessels of this ware identified. This would lend additional weight to Fulford's statement that the 'main area using this fabric is narrowly defined by the triangle of Winchester, Portchester and Bitterne' (*ibid* 291).

Of the black-burnished fabrics, BB1 and BB2, the former was found in 37% of the excavated features and spread across the whole site with no specific concentration. It probably comes from a Purbeck (Dorset) production centre (R A H Farrar, pers comm). However, the isolation by D Tomalin of large quantities of black-burnished ware, also having a brown subcutaneous layer ('Vectis ware') on Isle of Wight sites, and the location of kiln sites there, make this also a possible local source. It may be that the 'Vectis ware' industry was no more than an eastward extension of the Purbeck production utilizing a similar geology of clays and tourmaline-rich sands (Tomalin 1987, 30–40).

The sources of the BB2 found in the south and south-east Britain have been recently discussed by Williams (1977). He also discusses other as yet ill-understood wheel-thrown black-burnished wares which are *not* like BB2 fabric. The distribution of BB2 at Crookhorn is confined to the southern half of the site, a pattern it shares with the samian ware. Each appears in six features, four of which (F1, F4, F5 & F8) coincide. However, as four of these were 'open' features (e.g. the hearth and ditches), it would be unwise to draw any conclusions from this.

With the exception of one small sherd set with rounded trituration grit, no mortaria were discovered. This is surprising, because the presence of an oven in the aisled building, and many cooking pots, gives ample evidence of food preparation.

Apart from the archaeomagnetic date obtained from the tile-kiln (see above), there is very little external evidence to assist in dating the pottery, and only one datable coin was found in a stratified context. Any attempt at dating the pottery must therefore rely on the forms and fabrics.

New Forest fine wares are known to occur from the latter half of the 3rd century, and in the case of red-slipped bowls, continue into the late 4th (Fulford 1975). Of the two known local kiln centres, Rowlands Castle was probably active throughout most of the Roman period. Grey wares typical of this centre occur in local assemblages datable from the mid-1st century (e.g. Chalton, Langstone and Hayling Island) to the 4th (e.g. Wakefords Copse and Portchester). The one excavated kiln in the Shedfield centre produced wasters which were assigned to the late 1st to early 2nd centuries (Cunliffe 1961a, 20–1). BB1 enjoyed a wide distribution from *c* 120 (Peacock 1973, 64), but close dates for individual Purbeck factories are as yet unknown. The ware is found at Portchester throughout the 4th century but in steadily declining quantity (Cunliffe 1975). BB2 or its closely allied

fabrics, with its initial parallel development with BB1, became fairly well established in south-east England by the end of the 2nd century. Although not having the same scale of production or distribution as BB1 it is probable that wheel-made black-burnished wares similar in fabric and form to BB2 continued into the 4th century, albeit at a number of local kilns rather than one major centre. The Oxford kilns were in production from the 1st to the 4th century (Young 1977). The date range for the Oxford carinated jar (referred to above) extends into the early 3rd century.

Unfortunately, it has not been possible to isolate any stratified sequences within the site features. This would have been particularly desirable in connection with modifications known to have taken place in the tile-kiln. It is clear, however, that the tilery, aisled building and corn-drying oven operated under the aegis of the villa estate whose centre lies just to the east. The pottery recovered and preserved from the excavations there in 1926 has much in common with that described here but was not recorded well enough to allow constructive comparisons to be made. One group of pottery found in 1926 was singled out as being of some special interest, that of jars with 'batch marks' in grey ware (fabric D) and it was during the early excavations that this type of pottery (which in the more recent literature is often associated with the Rowlands Castle kilns) was first recognized as a distinctive group.

With very few exceptions, the pottery assemblage described above can be placed within a period commencing in the last half of the 3rd century AD, extending into the first half of the 4th. This date bracket for the general floruit of Roman activity on the site agrees well with the archaeomagnetic evidence from the tile-kiln. The initial construction of the aisled building may have occurred slightly earlier but there is no evidence to indicate that it did not continue to function in some way after the beginning of the 4th century.

THE OTHER FINDS

Few small finds were recovered from the excavations. This may in part be a reflection of the status of the site in the late Roman period. It may also be a result of the rescue conditions under which excavations were carried out, in the shadow of modern building development. This meant that a number of features were half-sectioned rather than completely excavated, particularly ditches F4, F4A and F4B, and the rubbish pit F136.

The Coins

1. Fragments of AE coin. Obv. radiate bust. Probably late 3rd century AD. From the layer of tile rubble north of the tile kiln.
2. Three fragments of AE coin, corroded and illegible. From east ditch F4.
3. Two fragments of AE coin, corroded and illegible but impression of radiate bust seen in soil. Probably late 3rd century AD. From corn-drying oven, F26.
4. AE *As* or *Dup.* of Faustina I (Posthumous), Antoninus Pius. Obv. [DI]VA[FAUSTINA] Bust r. Rev. AV[GVSTA] Vesta stg. l sacrificing at altar and holding palladium. *RIC* III, 1180. After AD 141. Very worn. From the back-fill of the tile-kiln stoke pit, F102. (Thanks are due to Peter Curnow for identifying this coin.)

Comment. Few valid conclusions can be drawn from such a small number of coins. It should nevertheless be noted that the group compares with the equally small number of four late-3rd century coins from the 1926 excavations of the villa, and would not be in disagreement with a period of occupation for both Crookhorn sites spanning the late 3rd and early 4th centuries AD.

Bronze Objects (Fig 42)

1. Bracelet of rounded D-section decorated with diagonal grooves. East ditch F4.
2. Belt plate of thin sheet bronze, pierced for two rivets, one of which is still in place. Corn-drying oven F26.
3. Wire ring of round section with overlapping terminals. Unstratified.

Glass (not illustrated)

Two small triangular pieces of broken glass were found, both flat and possibly window panes. 1. A colourless fragment with dulled surface, 42 × 18mm and 2mm thick. East ditch. 2. A pale blue-green fragment with dulled surface, 43 × 17mm and 4mm thick, from under the east wall of the corn-drying oven, F26.

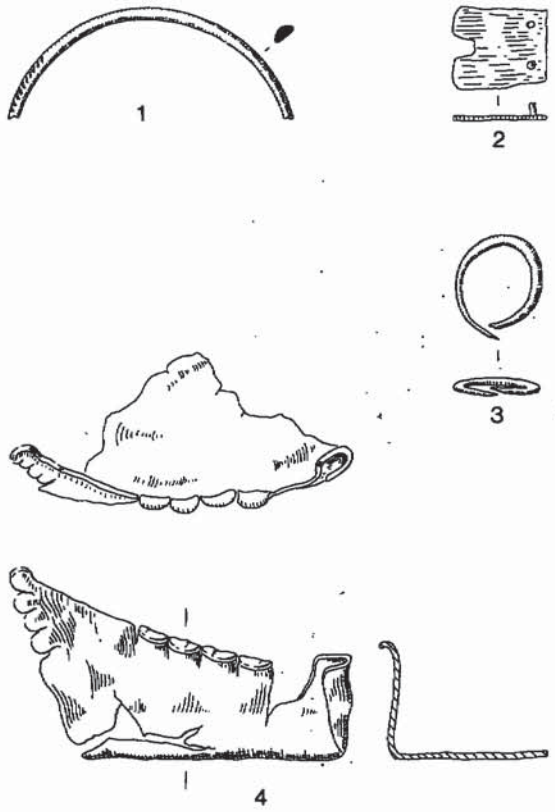


Fig 42. Other Finds: objects of bronze and lead (scale 2:3).

Lead Objects (Fig 42)

4. Remains of an object made from sheet lead, 1mm thick, with edges intermittently cut and frilled. It was folded and flattened when found. Weight 25g. East ditch F4.

Three other lead objects were found but are not illustrated: (i) A lump of melted lead. Weight 90g. East ditch F4. (ii) A lump of melted lead. Weight 15g. General surface layer in the aisled building. (iii) Piece of sheet lead. Weight 10g. Stoke pit F102.

Iron Objects (not illustrated)

i. Fragment of knife blade. East ditch F4.
ii. Ring. 60mm outside diameter. Made from round sectioned rod of 10mm diameter. East ditch F4.
iii. Thirty-two hob-nails and two small staples from a leather shoe. East ditch F4A.
iv. Fragment of knife blade. Pit F117.

Sixty-one nails were also found, varying in length between 45 and 150mm. They were distributed in the following features:

Feature	*Quantity*
F1, pit in aisled building	1
F4, East ditch	3
F4A, East ditch	9
F4B, East ditch	4
F7, Wall footings of aisled building	1
F8, Hearth area in aisled building	3
F10, Post hole in aisled building	2
F12, Post hole in aisled building	1
F20, Post hole in aisled building	1
F21, Post hole in aisled building	2
F25, Second phase stoke pit, corn-drying oven	12
F102, Stoke pit of tile-kiln	18
F112, Post hole at tile-kiln	1
F117, Rubbish pit	3

Querns and Whetstone (Fig 43)

Fragments from five hand-quernstones and two larger mill-stones were found. The size of the latter and the square centre hole in one of them, show them to be from mechanically-driven mills. All were made from ferruginous sandstone showing varying stages of oxidization, probably of Wealden origin. They are typical of normal Romano-British querns (Curwen 1937; Peacock 1987).

Hand-querns

1. Top stone with central boss and conical depression in top face. Working face smooth. Pit F136.
2. Top stone. Working face smooth. Ditch F4.
3. Top stone. Working face smooth. Ditch F4B.

Not illustrated:

i. Flat circular stone. 480mm diameter, 35mm thick. Heavy rotary wear on working face. Ditch F5.
ii. Flat circular stone. 480mm diameter, 28mm thick. Heavy rotary wear on working face. Pit F117.

Mill-stones

4. Large flat mill-stone. One face with tooled finish and three radical grooves, slightly off centre.

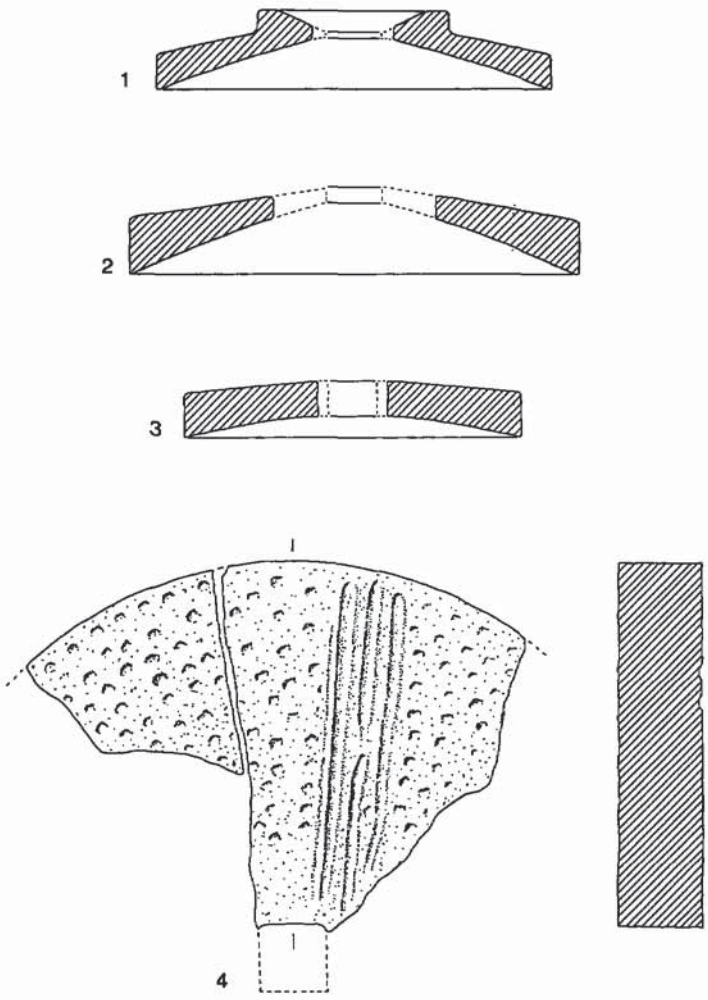


Fig 43. Other Finds: quernstones and mill-stone (scale 1:8).

The reverse is roughly dressed with two similar but shallower grooves. Edge smooth. No sign of wear on faces. Square hole in centre. The two pieces of this mill-stone were used in packing of post hole F12 in aisled building.

Not illustrated:

i. Fragment of large mill-stone. 750mm diameter, at least 70mm thick. Working face smooth, slightly concave. Pit F117.

Whetstone

Rectangular whetstone, tapered in section. 68 by 43mm and 9 to 12mm thick. Micaceous sandstone, grey-buff on surface, dark brown core. Pit F136.

Carbonised Cereals and Crop Weeds from the Corn-Drying Oven by Peter Murphy

Carbonised plant remains were recovered from four small samples by simple water flotation, collecting the flot in a 250 micron mesh sieve (Table 3).

Table 3. Fruits, seeds etc. identified in the samples.

Sample number			1/74	32	33	35
Context			Stoke pit	F26.9	F26.12	F26.5
Cereal indet	(unidentified cereal)	caryopses	76	5	5	4
Triticum sp	(indeterminate wheat)	caryopses	161	8	6	3
Triticum spelta-type	(spelt wheat)	caryopses	273	–	–	–
T. spelta L		spikelet forks	9	–	1	–
T. spelta L		glume bases	21	–	1	11
Triticum dicoccum Schubl.	(emmer wheat)	glume base	–	–	–	1
Hordeum vulgare L emend. Lam.	(6 row hulled barley)	caryopses	13	–	–	–
Avena sp	(oat)	caryopses	5	–	–	–
Bromus sp	(brome grass)	caryopses	2	–	–	–
Agrostemma githago L	(corn cockle)	seed	1	–	–	–
Rumex sp	(dock)	nutlet	1	–	–	–
Atriplex/Chenopodium sp	(orache?)	seed	1	–	–	–
Sample volume (approx) cc.			600	100	200	200

The condition of the material in these samples is generally poor. The plant remains have evidently been exposed to very high temperatures, and as a result, the cereal grains are puffed and encrusted with tar. For this reason, many could not be identified, even to genus. In these circumstances the survival rate of weed seeds and chaff must have been low.

Wheats. The better preserved wheat grains have blunt apices and broad flat ventral surfaces, features generally characteristic of spelt wheat. The glume bases confirm the predominance of spelt. With one exception they are broad and strongly veined, (Table 4). The exceptional glume base is much narrower, with two prominent marginal veins. It is of emmer wheat. The spikelet forks of spelt retain ascending internodes.

Barley The few grains from the stoke pit sample are of a six-row hulled variety. The adhering lemmas and paleas are partially preserved. There are two asymmetrical grains from lateral spikelets.

Oats The characteristic hairy surfaces of these oat caryopses are patchily preserved. In the absence of floret bases it is impossible to determine whether wild or cultivated oats are represented.

Weed seeds The surviving weed seeds are very poorly preserved. The taxa identified are all common arable weeds.

Table 4. Dimensions of wheat glume bases and spikelet forks (cf Helbaek 1952)
Width in mm at the articulation point

	Glume bases	Spikelet forks
CRI/1/74. Stoke pit sample	1.02 – 1.44	2.3 – 2.9
Sample 33.	–	2.5
Sample 35.	1.04 – 1.42	–
	0.76 (emmer)	–

DISCUSSION

The Tile-Kiln

Over the last few decades, interest in Romano-British kilns has centred upon those designed for pottery manufacture (Corder 1959 RCHME 1984) at the expense of brick and tile-kilns. Recently however, with the discovery of more tile-kilns through rescue excavations, there has been renewed interest and this has been illustrated by two conferences (McWhirr 1979a). Nevertheless, any study of Roman tile-kilns in the western Empire still has to rely greatly on Professor Grimes's classic report on the excavation of the legionary kilns at Holt (Grimes 1930). When compared with more recent discoveries the excavated Holt complex was extremely well preserved, and this, together with clear recording, helped to provide new light on the intricacies of kiln structure and led to the first classification of rectangular up-draught kilns.

The Crookhorn tile-kiln fits well Grimes's original description of a typical Roman rectangular kiln. The floor of the oven was supported by a series of cross-walls which were carried on arches over the main flue, and divided the combustion chamber into a number of cross flues by which heat was distributed to the vent-holes in the oven floor and from thence up, throughout the kiln. Grimes's classification of variations was based on the form of the cross flue bottoms. In some cases these are horizontal, on a level with the main flue bottom or set above it. But the Crookhorn kiln conforms to Grimes's commonest type (III) which has upward sloping flue bottoms and is found in all eight of the kilns in the main plant at Holt. On similar lines to Grimes's classification, Berger (1969) has produced a more detailed typology drawn from the larger number of kilns now known from the western Empire. Little work has been done to relate these types to function, time or geographical distribution, but advantages can be seen in examples where sloping cross flues exist. They would in the first place allow the easier digging of a V-shaped ditch to accommodate the combustion chamber and would encourage the upward movement of hot gases and prevent baffling and consequent waste of heat by eliminating waste or 'dead' space.

Besides the 'standard' form of kiln, two other main forms have been postulated by Berger and one of these is illustrated by Crookhorn. The first and more complex has two parallel main flues and combustion chambers. A fine example was found at Holt and a small one at Horton, Surrey (Goodchild 1937) showed that this design was for reasons of efficiency rather than capacity. Secondly, there are a number of excavated tile-kilns which have lacked cross flues, such as at Canterbury (Jenkins 1956), Scotland Farm, Hants (Graham 1971) and Heckington, Lincs (Simmons 1977). But in all these cases it seems that cross walls were carefully dismantled after the kilns had become redundant and the material, usually vitrified brick, reused elsewhere. This process may have taken place at Crookhorn, but only on the west side of the main flue.

Although at Crookhorn the arches of the cross-walls over the main flue had been destroyed, their reconstruction as true, rather than corbelled arches is certain from the survival of their springers on the east side. Examples of both types of arch occur at other kilns. For instance, at Holt all the tile-kilns had true arches but the two rectangular pottery kilns had corbelled arches. The Cranleigh tile-kiln had corbelled arches but true arches over the tunnel leading from the stoke hole to the combustion chamber. Well preserved corbels were found throughout a tile-kiln excavated by Leva at Marilles, Belgium (Thoen 1977).

The oven floor at Crookhorn would have rested on top of the arches and cross walls of the combustion chamber, but as with most other excavated examples, this had been destroyed when the kiln was abandoned. In a few rare cases, such as Holt and Marilles, the oven floor survived where a kiln had been prepared for a firing but not used, and the usual method of construction could be observed. Flat leather-hard ('green') bricks were laid across the gaps between the cross

walls with spaces or notches between them to serve as vent-holes, thus providing a setting for a thick layer of clay daub, pierced at the vent-holes, which formed the seating for the load. After the construction of the floor the whole structure was usually fired to harden and consolidate it, before a heavy load was set on it. Surrounding the oven was a rectangular wall whose foundation at Crookhorn took the form of gravel and tile wasters set in clay. At Holt and the military kilns at Brampton (Hogg 1965), stone masonry was used as well as brick, but in no Roman rectangular kiln have the oven walls been found surviving to any height above the floor. Some clues to superstructure can be gathered from medieval rectangular tile-kilns which, from their surviving remains appear to have been structurally identical to Roman examples, and have the advantage of being generally better preserved. The best illustration of this is the recently excavated tile factory at Danbury, Essex (Drury & Pratt 1975), where a remarkably well preserved kiln (kiln 1) allowed some attempt at reconstruction. Drury and Pratt have shown that three principal forms of oven superstructure are possible in kilns of normal type, viz: (a) Open-topped boxes, without a roof, i.e. skotch kilns, the load being covered with a layer of wasters and/or clay. A vast pottery kiln of this type was found at Verwood, Hants, and this method also has some similarity with the wall and roof of pre-fired bricks used in clamp-firing today by Pycroft's brickworks on Hayling Island, Hants. (b) Open-topped boxes, the load being covered with a temporary dome of clay or roof or reusable segments. Evidence for this has recently come from fragments of a clay dome built on a wattle frame in a medieval tile-kiln at Radwinter, Essex (Drury, pers comm), and of segmented roofs at sites such as Meaux, Yorks and Danbury itself. (c) Structures with permanent vaulted roofs, necessitating at least two opposing thick walls to take the thrust from the vault and a permanent doorway for loading and unloading, doubtless bricked up for each firing.

As an alternative to an ordinary dome ((b) above) Berger has put forward the suggestion of a circular cross-vault on the basis of a rectangular enclosing wall (Berger 1969, 13–14) with the Roman tile-kiln at Kaiseraugst, Switzerland as an example. However, the Kaiseraugst oven is enclosed by a simple thin brick wall and the outer structure, to which Berger refers (Fig 44.2), a far more massive foundation of limestone and wasters set in clay, must be the remains of an outer cover building like the Crookhorn post-hole structure (see below) and not an oven vault.

It might be supposed that however constructed, a rectangular tile-kiln would be provided with an entrance to facilitate loading. However, the Danbury oven walls have no such opening in spite of the luxury of steps leading down into the walled stoke pit. There are therefore two alternatives; either such kilns were loaded from the top by means of ladders, or the wall was built after the load was set on the floor. Medieval documentary evidence implies that ladders were used by setters. Unfortunately, there is not enough evidence from the Crookhorn kiln itself to show how its walls were built or which of the above alternatives is the most likely. All that can be pointed out is that the wall foundation was fairly substantial with a slight swelling at the back.

The kiln had ample signs of a long period of use and repair; a situation found at many other sites, especially Holt. Each firing and cooling would have taken several weeks and involved, together with tile making and kiln building, a small labour force of about six men. A slow oven temperature of 800–950°C would have to be sustained for the firing and vitrification shows that considerably higher temperatures were reached in the combustion chamber. Roman epigraphical evidence shows that tiles were usually fired in a season between May and October and the clay dug and weathered in the winter months (although there is nothing to prove that this was the case at Crookhorn). Wet weather was certainly a threat to production at Crookhorn as it was to the excavation in 1974, and to ensure against it, or even perhaps as a result of it, a drainage ditch (F103) was dug from the stoke pit

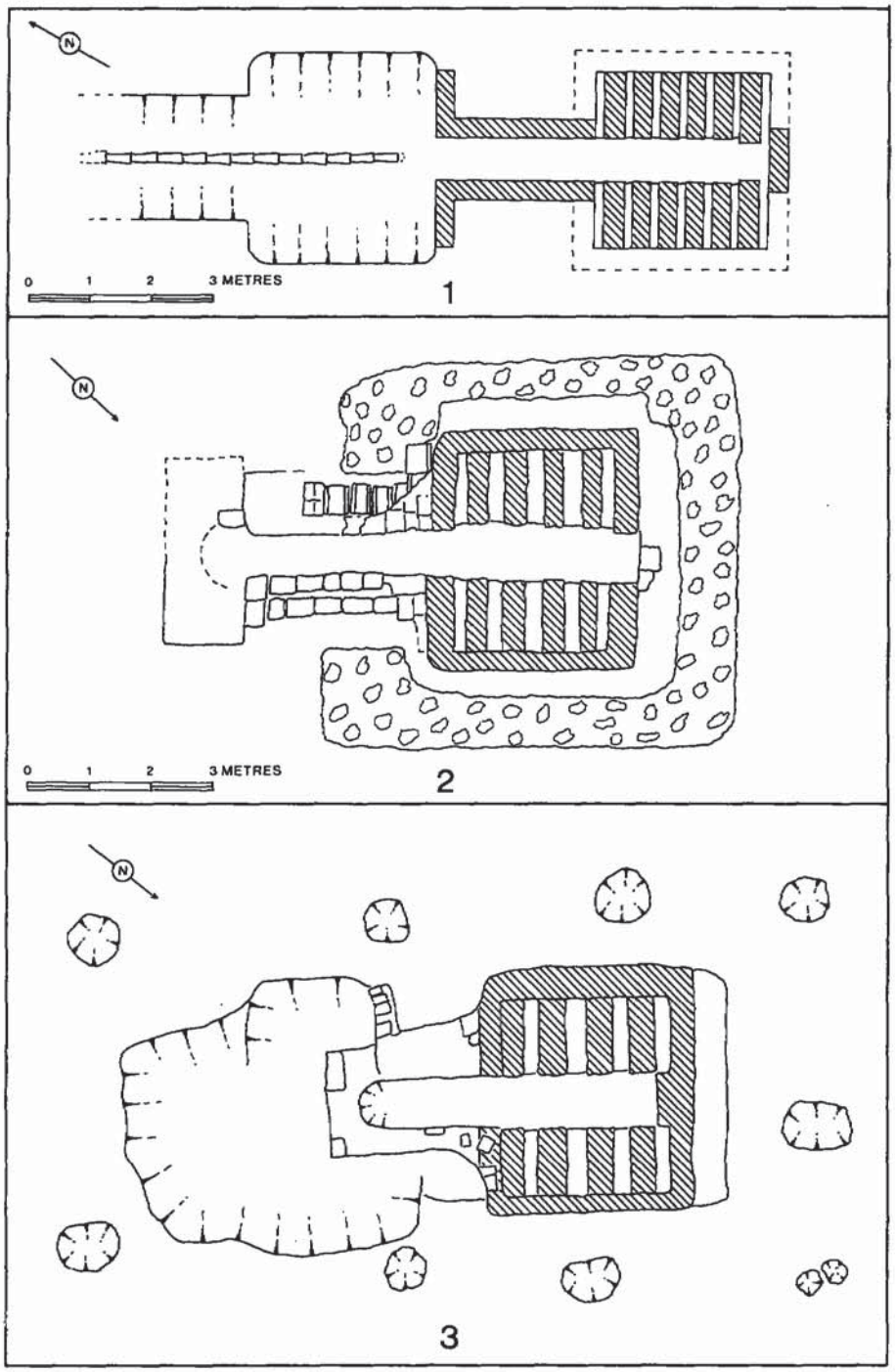


Fig 44. Comparative plans of tile-kilns: **1** Cranleigh (after Goodchild), **2** Kaiseraugst (after Berger), **3** Rheinzabern (after Rau).

towards the clay pit. This drain is closely paralleled at the Cranleigh kiln (Goodchild 1937, 80–81) where one was found running into a stream (Fig 44.1). It had a continuous row of overlapping *imbrices* along its bottom. Experimental work by B Johnston in Cheshire has suggested that timber is preferable to charcoal as a fuel in firing this type of kiln and that *c* 50 lbs of timber per hour of firing would be required.

In many other respects the Cranleigh tile works were very similar to Crookhorn. Both sites have evidence for clay pits and a yard or working area paved with waster fragments. They also both have large pits filled with wasters which were probably originally dug for their clay or used for clay storage. Both sites were close to trunk roads and an abundance of combustible timber and both were civilian establishments manufacturing initially to fulfil some specific local need. The structural similarity between the kilns themselves might indicate that they were built by the same firm, or it could equally show adherence to the instructions laid down in some contemporary engineering manual after the nature of Vitruvius. This hypothesis was put forward by Goodchild on the basis of Cranleigh's similarity with tile-kilns at Hoheneck, Germany, and kiln XIV at *Aquincum* (Budapest).

The Kiln Cover Building

One of the more important aspects of the excavation was the discovery of the two sets of post holes surrounding the kiln. They represent a feature unique amongst the Roman tile-kilns so far known in Britain.

The first phase of post holes were packed with flint and uncontaminated with the tile waste which was to accumulate once the kiln commenced production. They formed the foundations for a post-built rectangular structure which totally surrounded the oven walls and the stoke pit. Each side of the building had four posts although it was narrower at the ends. This building was probably completed before the excavation for the combustion chamber and stoke pit, and was to ensure against flooding. Later it was completely replaced by another more compact near-square structure using the same number and arrangement of posts. The building of the second structure probably corresponded with the enlarging of the stoke pit which in the kiln's final stage may have extended beyond and outside the building. However, the two corner posts of the first building at the stoke pit end (F105 & F107) could have been incorporated into the second building thus allowing the stoke pit to remain covered; there is no evidence that they were replaced. The second phase post holes with their packing of stiff clay and wasters represent a firmer foundation to the rebuilding after the kiln had been in production for some time.

It seems clear that the posts in both phases supported roofs which were intended to cover the main working parts of the kiln. The most likely reconstruction is that of a pitched roof with the gables at the back and stoke pit ends of the kiln. This would have served principally as a rain-shelter and confirms the concern with wet weather and flooding indicated by the digging of the drain which may have been provided with the second cover building to drain the kiln and stoke pit if the latter had become exposed to the sky. Experimental work and observation of modern tile-kilns and clamps has shown that it is imperative that they be kept dry during building, setting and firing and that some form of covering (usually wooden 'caps and loos') is also necessary when drying out 'green' tiles before firing.

In view of the probable non-availability of ready fired tiles on the site when the first cover building was set up, it is likely that, in the first instance, it was roofed in thatch or shingles. The eaves may have extended a short distance beyond the side posts and if, as seems probable, there was no wall-infilling between the posts, additional shelter would be made available around the kiln to allow easy access at all stages of manufacture and larger areas for drying and stacking 'green' tiles and the work of the setters. During firing, the kiln would have had to be carefully maintained and constantly watched day and night and the

tilers would have probably sheltered under the cover building during this period. The second building, a more compact and sturdy structure was doubtless roofed with tiles.

From the above it is clear that some form of cover would be a prerequisite to any tile-kiln and thus it appears remarkable that so little evidence for these structures has come from Britain. The simplest explanation is that in fact they existed but have either not been recognised or taken notice of by early excavators, or else areas around apparently free-standing kilns have not been adequately investigated. Invariably where large areas are examined, ancillary structures are found. A good example of this is the main kiln plant at Holt where almost all the kilns were incorporated in a massive stone building. Again, the recently excavated tile-kiln at the Eccles villa, Kent appears to have been enclosed by a building on foundations over 1m thick (Detsicas 1967). A reinterpretation would suggest a similar structure founded on clay and wasters around the Ashdon tile-kiln, Essex (Neville 1853). In some cases such a building may be misunderstood by its excavator and the tile-kiln at Kaiseraugst is a good example of this (Berger 1969). At this site the oven is surrounded by a further foundation *c* 1m thick of limestone and wasters in clay (Fig 44.2) which Berger interprets as the base of a permanent cross-vault (Kreuzgewölbe) partially on the basis of thickenings of the foundation at its corners. Any superstructure to the oven would normally have been supported on the oven walls and the outer foundation must be for a cover building, either of cob (of which rounded corners are typical of more recent vernacular buildings) or mud-and-stud with enlarged corner posts.

Germany has provided the only close parallel to the Crookhorn building; consisting of a post-built structure surrounding a rectangular kiln (Ofen II) at the recently excavated samian ware factory site at Rheinzabern (Rau 1977 and Fig 44.3). At this site a large area was examined to reveal a number of kilns, work-buildings and clay pits given over to samian production. The kiln in question was built of *tegulae* and adjacent to it were two rectangular clay storage pits (like F101 at Crookhorn), and rectangular areas of laid *tegulae*. Rau has pointed out that the lack of waste material makes it difficult to prove this to have been a tile-kiln but this function seems likely on the remaining evidence. There can be little doubt that the Rheinzabern post-holes belonged to a roofed rain-shelter similar to the Crookhorn arrangement and in 1977 a further kiln (this time for samian) was found to be also surrounded by large post-holes (Rau, pers comm).

More recently still (1979), three post-holes of a four-post rectangular cover building have been found around the Radwinter medieval tile-kiln (Drury, pers comm), and documentary support for a tiled roof over a medieval kiln is provided by a lease of a manorial tile-kiln at Moulsham, Essex, of 1425 which requires the tiler to keep the kiln well-covered with new tiles at his expense, the lord to find laths for the roof and tile-pins (Drury & Pratt 1975, 137). A few recent and modern examples of post-built cover buildings have been observed in Turkey and Portugal, and such a structure with a corrugated iron roof was recently set up over a reconstructed Roman kiln at Metaponto, Italy.

The Corn-Drying Oven and its Economic Implications

The double T-shaped corn-drying oven at Crookhorn is an interesting example of what has become a familiar feature of Romano-British agriculture. The question of the function of these structures was first answered when the villa at Hambleden, Bucks, was excavated (Cocks 1921). Here fourteen specimens were found, ranging from the simple T-shaped type to structures of considerable elaboration. In an appendix to the excavators' report, Prof Gowland stated that 'In my opinion, they are the flues of drying-floors which have been used for drying harvested grain, and the specimens of barley and wheat found in all probability represent the grain which was being dried'. To date, over two hundred corn-drying ovens have been found in Britain and

together they provide strong corroboration of Gowland's hypothesis.

As is the case at Crookhorn, most corn-drying ovens are found in a denuded state with their upper parts missing, so that it is difficult to show how heat was transmitted from flue to oven-floor. The problem was partially resolved with the excavation and discussion of a well-preserved oven at the Atworth villa, Wilts. (Goodchild 1943). Sufficient evidence remained to show that the oven had had two stone floors with a 15cm space between them. The lower floor was not continued up to the back wall like the upper floor, but terminated so as to allow the vertical flue (the cross-arm of the T) to enter the space between the floors. Therefore the heat and smoke from the main flue, instead of penetrating through the oven floor, as in updraught tile- and pottery-kilns, was confined between the two floors. It escaped, maintaining the necessary draught by means of a small chimney cut in the side of the oven between the floors. The advantages of this, Goodchild suggested, were to protect the grain from smoking and scorching. The oven had the additional device of two adjustable slotted baffles, one at the chimney end and another at the stoke pit end of the main flue, to regulate the draught. Recently, two very well-preserved ovens have been excavated at Kingscote, Glouc s (Swain 1980, 18) and at Hertford, with evidence of drying platforms of wooden boards. The latter has been reconstructed at the Butser Hill Ancient Farm (Reynolds & Langley 1980).

With her recent corpus of corn-drying ovens, Matthews (1978, 13–15) has been able to formulate a classification based on the shape and arrangement of flues. Double T-shaped examples fall into two types. The first, where the main flues are set parallel to each other like: TT, can be illustrated by an example at Huntsham, Herefs (Bridgewater 1962) which had two separate stoke pits and therefore perhaps had two separate drying chambers which could be used independently. The other type is similar to the above system in that the vertical flues lie in a straight line, but the main flues are not parallel and meet in a single stoke pit, so forming a V-shape. Obviously this arrangement works as in the first type, to double the surface area of the drying-floor. But the system represents an advantage over the first in that only one stoke pit was required, thus saving labour and time in stoking, and two separate chambers could have their temperatures independently regulated by means of baffles. In addition to the Crookhorn example, only two other corn-drying ovens of this type are known; at Downton, Wilts, and Rockbourne Down, Hants. At the Downton villa (Rahtz 1963) one large stoke pit fed the main flues. The substructure of the oven consisted of packed flint and chalk and the walls of the flues were lined with tiles, as at Crookhorn, and sandstone blocks similar to those of the enigmatic 'platform' (F) on the Crookhorn oven. However, at Crookhorn, the tiles in the main flue walls were laid in herring-bone fashion, a feature which occurs occasionally elsewhere, such as in the late third-century walls of the Roman fort at Portchester (Cunliffe 1975, pl VIIb). Herring-bone masonry was also used in the walls of the Kingscote oven (Swain 1980, 18). The corn-drying oven on Rockbourne Down is one of several associated with a large stock and arable enclosure (Sumner 1914, 'hypocaust LL'). The main structure and the stoke pit were surrounded by flint masonry walls and the main flues were arched with flint and stone with a floor of rammed chalk above. It seems clear that this establishment formed part of the rich 4th-century villa estate centred 1½ miles away, which must have supplied the combed box-tiles and Purbeck roofing slabs used in the other corn-dryers (Bowen 1969, 47). In its first phase the Crookhorn corn-drying oven had a small stoke-hole for each main flue, a feature not consistent with the type. Their forward position may indicate that the flues were slightly lengthened, perhaps in the second phase, but any evidence for this would have been destroyed when the land-drains cut through the structure. Alternatively, a more likely explanation would be that the original oven was smaller with the main flues running parallel to each other from sepa-

rate stoke pits as in the Huntsham example cited above. This earlier layout would have required almost total rebuilding to conform with the final plan. Crookhorn, like Rockbourne Down, seems to have had the finishing touch of a single stoke pit retained within flint walls which must have sheltered it in a similar way to the massive screen at the Gadebridge Park villa, Herts (Neal 1974, 39–41). The Crookhorn corn-drying oven probably had floors like Downton or Rockbourne Down, although no trace survived. However, a timber floor cannot be entirely ruled out. The large number of nails found in the flues of many ovens may indicate this and a circular wattle and daub chamber was found on a Roman drier at Flitwick, Beds. It should also be noted that the more recent Hampshire hop-kilns and the corn-drying kilns (*sinnies*) of the Far North used to dry malt, oats and bere, had wooden floors (Fenton 1976, 95–9).

The probable early 4th-century date of the Crookhorn corn-drying oven conforms well with the majority of others in Roman Britain, although several, such as Huntsham, can be proved to be earlier. Many of the later examples were ruthlessly inserted into existing buildings as at the rich villa at Brading in the Isle of Wight, where one was cut through the mosaic floor of the main corridor of the main house (Price & Hilton-Price 1881). This led Goodchild to speculate a deliberate economic policy in the 4th century initiated by the central government. If this was so, could it have been connected with the *annona* or corn tax, levied to feed the army? Elaborate corn-driers such as the one at the Reculver fort may illustrate this (Philp 1968). Alternatively, corn-drying ovens may represent a technological advance on simpler drying methods. Another important factor is their association with aisled and other agricultural buildings at this period. Crookhorn provides a good example. However, it has only been in the last few years that difficulties in the interpretation of these buildings have been partially ironed out (see below).

This leads to the problem of function. Today, the main reason for drying harvested grain is to reduce a high moisture content before storage and milling. In storage the moisture and temperature level must be kept low because the corn will begin to germinate if it is too warm or damp. However, as has been pointed out by Reynolds (1974, 26) it is impracticable to parch seedcorn, except at very low temperatures, because the germination potential and malting qualities are destroyed. Also, in wheats the gluten content of the grain can be severely reduced by parching, suggesting perhaps that spelt for example was eaten in the form of pasta, porridge or soup, rather than leavened loaves. The need to dry grains before milling has been shown by experiments carried out on Romano-British querns from Sussex (Moritz 1958, 169–70). It is difficult to dry soft wheat (*Triticum vulgare*) since the middlings of the grain tend to clog the grinding surfaces, whilst heat-hardened grains can be more easily ground.

Some clues to the function of Roman corn-drying ovens is provided by the carbonized grains which have fallen through into the flues. It seems that a likely function was in parching husked cereals such as spelt and emmer whilst still on the ear, before threshing. This process is described by ancient writers (Ovid *Fasti* VI,313; Pliny *NH* 18, 10, 23, 72) and Columella (I,6,24) mentions a drying-chamber (*nubilarium*) adjacent to the threshing floor (*area*), to which half-threshed grain could be moved. Helbaek points out that the grains of husked wheats cannot be separated from the husk by simple threshing in the state of natural ripeness (Helbaek 1957, 206). They must be parched to embrittle the husk so that it can be removed. Since spelt wheat is widely found in carbonized deposits in corn-drying ovens in lowland Britain (and Crookhorn is a good example), this drying process must have been carried out. Helbaek argues that this was probably the main and possibly the only reason for the use of corn-drying ovens. The presence of other species does however, suggest that they may have sometimes been used for other reasons, though these may merely be contaminants of the spelt crop. The provision of corn-driers may on the other hand indicate some insurance against sudden showers or

prolonged wet weather at harvest time, thus discouraging the stooking of sheaves, but if the drying of the crop was a necessity when it consisted of spelt, it seems most probable that an oven was installed to handle it rather than for any climatic reason. It may be that parching spelt before threshing requires a higher temperature than drying grain before storage and milling. Husked cereals would therefore be more easily accidentally carbonized, thus providing an additional reason for the predominance of spelt in samples. Murphy's study of seed samples from the Hampshire area (Murphy 1977) does indicate a correspondence between a concentration of corn-drying ovens and a predominance of spelt. In contrast to this, the predominance of barley production and a lack of corn-drying ovens presents a differing economy in Roman Kent (Applebaum 1972, 110–11). A study of seed samples from ovens throughout lowland Britain might go a considerable way in indicating further the extent of the spelt growing areas in the Roman period. Finally, although there is now little doubt that these ovens were used in heating and drying grain, the recent experiments at Butser indicate that grain must have been invariably moistened during heating, thus creating conditions suitable for preparing malt barley and ale. Reynolds and Langley (1980) have therefore offered an alternative hypothesis that corn-drying ovens are malting floors.

The Crookhorn grain samples suggest a cereal economy almost identical to that found on the open Hampshire chalklands at Owslebury (Murphy 1977, 22–3) and a close similarity to Downton and two other sites in Gloucs. This probably indicates that the chalk of Portsdown, immediately south of the site, formed the main part of the villa-estate's arable in the early 4th century. This need not be surprising, for Portsdown remained notable for its excellent and early cereal crops well into the 19th century (Cobbett 1830).

The Aisled Building

The characteristics of the aisled building make it a valuable addition to the corpus of similar structures now known from Roman Britain. J T Smith's seminal study (1963) recognises the building type as essentially belonging to a distinct vernacular form of dwelling-house that occurred in increasing numbers in southern Britain from the 2nd century onwards. He also provides a valuable discussion of possible parallels amongst aisled houses on the Roman villa estates of mainland Europe and timber aisled halls in farms and villages of the Roman Iron Age in the Low Countries and northern Germany. He makes it clear that the origins of the building type in Britain remain uncertain (1963, 19; see also Wild 1974, 159), although it should be noted that some pre-Roman Iron Age aisled 'longhouses' are now known from sites such as Crickley Hill (Dixon 1972). Since Smith's study, two other surveys, by Hadnam (1978) and Morris (1979) have provided further discussion based on the evidence of more recently excavated examples. The Crookhorn building is commented on in both. Hadnam's discussion stems from the simple aisled buildings associated with the industrial development in and around *Durobrivae* in the Nene Valley. Morris examines those associated with villas, or at least with a clear agricultural function. She also provides a selection of simplified plans, including Crookhorn, drawn to a common scale. Since 1979 further excavation and air photography has revealed other examples, particularly prior to gravel extraction on the terraces of the upper and middle Thames Valley (Miles 1984), some of which provide useful parallels to Crookhorn. It is against this corpus of data that the Crookhorn building should be seen in terms of function, plan, building materials, structure, reconstruction and date.

It is clear that in the majority of aisled buildings, plan form and structure are related directly to function. In their simplest 'undeveloped' form interiors were divided by two rows of posts into a central nave with narrower side aisles. The posts provided the main support for the broad sweep of the roof which extended down to low walls on the long sides. Each end would probably have presented lofty gables pierced by entrances and

the principal window openings. Important evidence of a collapsed gable-end wall has recently been provided at the massive flint-built aisled house at the Meonstoke villa, Hants (King 1988). In terms of function, most aisled buildings can be shown from structural and other archaeological evidence to have been originally divided laterally between their upper and lower ends. The upper end was essentially the dwelling area where domestic activities took place. The lower end comprised an open hall where communal 'work' activities were carried out associated with agricultural and/or industrial processes. In many examples the lower end is cobbled, it contains corn-drying ovens and/or furnaces, and a wide entrance in the gable end. Smith (1963) illustrates how this basic pattern is also found in Frisian longhouses in the Netherlands where the hall may have a separate hearth, and may be used for spinning, threshing, crop storage and the housing of animals as well. However, little archaeological evidence for these functions has come from Romano-British aisled buildings except at North Warnborough, Hants, which contains a possible granary in an aisle (Liddell 1931). Crop storage is often implied by the use of the term 'aisled barn' in describing these buildings (e.g. Hadnam 1978, Down 1979), but is generally a misconception derived from their superficial resemblance to familiar forms of medieval and post-medieval English barns.

Crookhorn conforms broadly with this general scheme, with the upper, domestic area at the south end with hearth and pit, and the lower 'work-hall' area at the north end opening towards the tilery. This pattern can be discerned at undeveloped aisled buildings in the Nene Valley, particularly those at Lynch Farm; Normangate Field, Castor, and Hall Farm, Orton Longueville (Wild 1974, 157–160; Dannell 1974; Mackreth 1978), and in the Upper Thames Valley, particularly at Claydon Pike, Fairford (Miles 1984), where it has been suggested that building B3 was a barn (on the basis of grain found in an adjacent well), and at Somerford Keynes (D Miles, pers comm). Also, at the walled settlement at Gatcombe, Somerset, aisled buildings may have been used in grain processing (Cunliffe 1967). All these undeveloped buildings parallel the plan of Crookhorn closely.

A further clarification of function is provided by the gradual development of certain aisled buildings throughout the 2nd to 4th centuries by the building of partition walls to create rooms. The partitions were erected between the posts of the upper end. Rooms initially appeared at the upper end of the nave or beyond it as an extension, and then in the aisles. The simplest examples of this development occur in the Hampshire area at two sites discovered from the air at Great Wellsworth, near Crookhorn (Soffe forthcoming), and Finchampstead, Berks. In the latter, planned by one of us (GS in Hampton & Palmer 1978, fig 2), five aisled buildings stand astride the Roman road between Silchester and London to form a possible *mansio* where the lower end 'halls' opening onto the road must have provided travellers with specific services. More advanced forms of upper end development occur amongst local villas. The Crookhorn villa itself has two such buildings. Others are at Brading (Price & Hilton-Price 1881), Carisbrooke and Combley, on the Isle of Wight (Tomalin 1987), Castlefield, Clanville (Englehart 1898) and Thruxton near Andover, Lippen Wood, West Meon (Moray Williams 1907) and Meonstoke (King 1988), Stroud near Petersfield (Moray Williams 1909), Sparsholt (Johnston 1972), Chilgrove 2 (Down 1979) and Fishbourne Creek (Rudkin 1986) in West Sussex, and West Blatchington, East Sussex (Norris & Burstow 1950). Some of these incorporate tessellated floors, mosaics, painted walls and glazed windows in rooms at the upper end, bath suites in the aisles at the lower end, and squared sandstone blocks as post bases in place of holes. Most also have flint footings like Crookhorn but are generally mortared and of greater depth indicating that some supported solid flint walls to full height (as is confirmed at Meonstoke).

At Crookhorn the walls were probably of lighter timber frame and/or cob construction like those at Lynch Farm where the settings for

timber uprights were noted on the foundations (Wild 1974, n101). No such settings or traces of sill beams were detected at Crookhorn although the footings were very level. Some Nene Valley buildings have thicker footings at the gable ends indicating walls of greater height and at Crookhorn the whole of the upper domestic end has deeper foundations corresponding with more widely spaced aisle posts. This doubtless reflects the functional division between upper and lower ends, but also indicates a significant structural difference between the two parts. There may simply have been a need for more floor space at the domestic end with more substantial walls allowing less internal roof support; or the walls here supported a lofty superstructure (Neal 1982), or an upper timber storey like the structure which collapsed into the upper end room of Chilgrove 2. It could be argued that the closely spaced posts at the lower end supported a storage loft. A close parallel to this phenomenon occurs at Knowl Hill, Berks (Seaby & Pollen 1934), where *only* the upper end has detectable footings. Differences in walling may reflect the initial improvements occurring in many aisled buildings, beginning at the domestic end, but Crookhorn has a smaller plan than fully developed aisled villa houses in the local region and may never have been intended for 'development'. Although undeveloped aisled buildings of Crookhorn type may have been principal houses in 2nd-century villas, by the 3rd and 4th centuries (if they had not already been 'developed') they were perhaps only built for the use of people of a lower social status than those occupying principal houses.

The Crookhorn aisle posts at 30–40cm square are of similar size to others, e.g. Stroud and Rapsley (Hanworth 1968), where they are bedded in cement grouting. Oak timbers of this size bedded in the ground could last at least 100 years (Morris 1979). At Crookhorn and Rapsley the lengthwise alignment of the posts is imperfect, indicating 'reversed assembly' of trusses, i.e. with plates or purlins set above a tie-beam supported on the posts. The function of the central post at Crookhorn, however, is obscure. Presumably it supported a ridgepiece and if there were another similarly positioned post at the lower end it would have proved very inconvenient to passage through an end-wall entrance. Interestingly, there are no parallels for this feature in other Romano-British aisled buildings. The closest is the Gallo-Roman aisled house at Hinterbohl, Switzerland (Fellman 1950; Kapossy 1966) which Smith (1963, 21–3) derives from buildings with a middle row of ridge-posts developed by stages from late prehistoric 'Danubian' houses. Wijchen is another example where the middle row is partially suppressed.

Most vernacular aisled buildings in Roman Britain probably never had a clerestory and should not be described as basilican, but a conjectural reconstruction of the Meonstoke wall in 1989 indicates a probable clerestory and surprising architectural elaboration in that building's final phase, and by inference in other larger aisled buildings. For reconstructions of non-clerestoried buildings, we have to turn to the continental parallels (Harsema 1982; Baumgarten 1976).

The lower end at Crookhorn was possibly partially demolished or eroded away by the expanding clay pit after the building went out of its original use. The area of pebbles on the west wall footing could just indicate a threshold of an entry serving both ends, as in a medieval cross-passage, but originally there was very probably a wide entrance in the north wall beyond the sixth truss. Such entrances can be easily paralleled at Stroud and Meonstoke, and were perhaps to allow the passage of carts. It is difficult, however, to ascertain to what extent the building was shortened, particularly as some very long aisled buildings are known, such as at Stroud and the 19-bay building P at Winterton, Lincs (Goodburn 1978). If, as argued below, drainage ditches originally surrounded the building on the north side, an original length of *c* 24m for Crookhorn might be reasonable, giving a length-width ratio of 2:1, which Morris shows applies to 30% of her corpus.

As mentioned above, no direct evidence for tile-making activity was found within the work-

ing area of the building but the presence of the corn-drying oven just outside, as at Great Casterton, Leics (Corder 1954), and querns and millstones in associated rubbish deposits, indicates grain processing. It is likely therefore that the flint ramp was indeed a very late addition, directly associated with the clay pit when it had been extended southwards. It could then have been made from flints robbed from a demolished north end of the building which by that time was being used for a purpose for which it was not originally intended.

The surrounding ditches to east and west of the aisled building ran into a sump-like area to the south which could not be properly examined. They originally appear to have drained the platform on which the building stood, although the negligible gradient of the east ditch shows that it would have been difficult to achieve an adequate flow. This ditch was congested with silt deposits and domestic refuse, and was recut, whereas the west ditch had filled rapidly with clean soil containing few finds. The levels also show that neither could have drained the clay pit and they may even have originally joined each other north of the building. Certainly they were both cut off by the clay pit when it was enlarged southwards. Similar drainage arrangements are known from the parallel sites in the Nene and Thames Valleys.

CONCLUSION

The structures excavated at Crookhorn form a unit of planned development within the organised landscape of a Roman villa estate. Indeed, there is clear association of the tilery with the main complex of villa buildings to the east, in a flow of products to the villa and beyond via the road to Havant and Chichester. The symmetry of this landscape will be discussed further in the forthcoming report on the villa. The site thus became a working 'hamlet' associated with the villa proper, a status echoed in the Saxon and later medieval period when Crookhorn was a sub-manorial farm to the principal settlement at Farlington. However, it is only through large-scale modern archaeological field survey and excavation that such relationships during the Roman period can be established clearly, as at Stanwick, Northants (Neal forthcoming).

The social implications of Crookhorn settlement are probably complex and difficult to determine (see e.g. Smith 1978), but chronologically it is likely that the aisled building was the first structure on the site in the mid/late 3rd century, serving as a nucleus for agricultural activity. The building contains few tiles and those in the post holes are possibly related to repairs. Its associated pottery also appears slightly earlier than that found in occupation deposits adjacent to the tile-kiln. With the establishment of the tilery in the early 4th century, the aisled building may have witnessed some changes in use, with agricultural workers specialising in a seasonal but vital local industry on a scale approaching that of the possibly related civilian tilery at Minety. Perhaps the domestic deposits to the south and east of the kiln indicate other occupation areas associated more directly than the aisled building with the brick and tile production and distribution. The tilery underwent a series of structural modifications in at least two major phases of activity. For instance, the rebuilding of the kiln cover building could even have accompanied a complete rebuilding of the kiln itself, as red clay in the base of the kiln wall was similarly found in the post holes of the second cover building. Furthermore, the tank-shaped waster pits may have originally been used as levigation or clay moistening tanks (Peacock 1982, 54). Eventually, the rectangular clay pit was sufficiently enlarged to take in the north end of the aisled building.

Since this excavation (and the writing of the cover building discussion above), no further tile-kiln cover building has been found in Britain or France despite the recent excavation of two kiln sites in Sussex (Rudling 1986; 1987) and the publication of a major corpus of Gallo-Roman tile-kilns (Le Ny 1988). However, yet another has been found in Germany (Jüngling 1983), suggesting that more large-scale area investigation is needed on such

sites. In these circumstances, it is remarkable that such a wealth of data should have been recovered from Crookhorn, a site excavated under the most difficult of conditions.

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