

THE ROMAN BRICKWORKS AT WYKEHURST FARM IN THE PARISH OF CRANLEIGH.

With a note on a Roman tile-kiln at Horton, Epsom.

BY

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THE excavation of the Roman villa at Ashtead by Mr. A. W. G. Lowther from 1925 onwards revealed the fact that a considerable brickmaking industry had flourished on Ashtead Common during the first and second centuries A.D. The purpose of this present report is to place on record the discovery in 1936, by the Cranleigh School Archæological Society, of traces of a similar industry situated in the Weald at the side of the Roman branch road from Stane Street at Rowhook (Sussex) to the Romano-British settlement on Farley Heath; and to conclude with a brief description of a Roman tile-kiln found several years ago (but hitherto unpublished) at Green Man Farm, Horton, adjacent to, and probably connected with the Ashtead industry.

General Conclusions.

Both the Ashtead and Cranleigh industries were established on sites which would never normally have been selected for occupation in Roman times. The Ashtead site lacked a pure water supply; that at Cranleigh was damp and inhospitable, situated on the verge of the exaggerated but nevertheless formidable "Anderida Silva." To outweigh these natural disadvantages, however, both sites possessed an unlimited supply of first-rate clay and an abundance of combustible timber, both of which had to be near at hand to any brickworks. Furthermore, both sites were in contact with an

efficient road system which would greatly facilitate the transport of heavy building materials from kiln to building site.

Yet in spite of these superficial similarities, the two industries represent widely differing aspects of Roman brick-making, even though the technical process was much the same in each case. Ashtead was the centre of a district devoted fairly extensively to brickmaking; several kilns were doubtless at work, and were scattered over a wide area; the workmen were provided with a substantial set of baths (a great luxury for brickmakers, and one which the workmen of the twentieth Legion also enjoyed at their works-depot at Holt, Denbighshire¹); the manager of the brickworks seems to have resided in a comparatively large house; whilst, finally, the elaborate products of the industry appear to have been distributed over an unusually wide area.²

At Cranleigh, however, the industry was on a very modest scale: one kiln only was at work, and this seems to have been constructed with slavish adherence to instructions laid down in some contemporary engineering manual³; there are no traces of permanent accommodation for the workmen; whilst the products of the brickworks were of the simplest nature and were probably manufactured to fulfil some specific local purpose, such as the construction of the Romano-Celtic temple on Farley Heath.

To summarize, then, we have in the Ashtead and Cranleigh sites a perfect epitome of industrial organization in Roman Britain. On one hand there is a highly developed and long-lived (*circ.* A.D. 70-150) industry producing for export to sites as much as forty miles away; on the other an apparently temporary industry producing simple commodities to meet the simple local demands of a part of the country where romanization was scanty. By a careful study of the distribution of the products of industries like these many important problems concerning the economic side of Roman Britain may be solved.

¹ Grimes, *Y Cymmrodor*, XLI, p. 16.

² Mr. Lowther is at the moment investigating the distribution of Ashtead products. They appear to have reached sites as far afield as Verulamium, Silchester, Chelmsford, and Alfoldean.

³ See Appendix II.

A. THE BRICKWORKS AT CRANLEIGH.

The Site.

The site is in the north-east corner of a pasture field (formerly ploughed) of 4.044 acres, due south of Wykehurst Farm, and bounded on the south by the private drive to High Wykehurst. Through this field runs the line of the Roman Road from Rowhook to Farley Heath, as marked on the Ordnance Maps. The site is exactly five miles from Rowhook, and three miles direct from Farley Heath.

Geologically the site is on the Wealden Clay, less than a mile from Pitch Hill and the Greensand escarpment.

O/S 25-inch Sheet XXXIX 8. Enclosure no. 122 (Cranleigh Parish) on the 1916 edition.

Previous Evidence.

Although the 1874 survey of the Roman road¹ traces its line through the land of "Wickhurst Farm," the existence of Roman structural remains near by seems to have been unsuspected. The first suggestion of Roman occupation in this area was made in 1923 by Mr. S. E. Winbolt. It appears that when the field was formerly ploughed, red brick used to turn up in large quantities in this particular corner. While investigating the Roman Road, Mr. Winbolt heard of this, and, in his own words:

Acting on the suggestion of the farmer at Wykehurst who used to plough it, north of the lodge and in the north-east corner of a grass field, I looked for red brick and found it in plenty just under the grass. Its character seems to denote a former Roman building just off the road.²

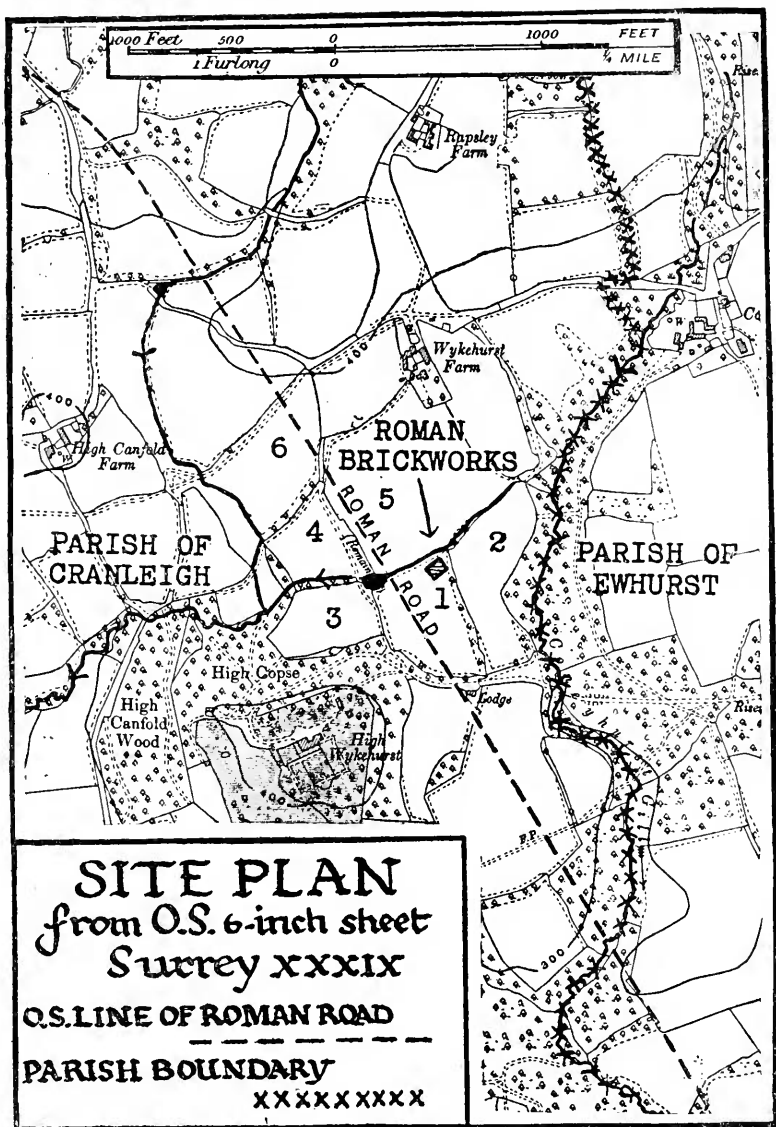
Visits to the site made by members of Cranleigh School in the years 1933-34 brought to light fragments of flanged roof-tile and other obviously Roman materials. Consequently when the School Archæological Society was revived in 1935, the Wykehurst site was marked down for future investigation.

The Excavation.

With the kind permission of Mr. Bray, Lord of the Manor, and Mr. Fooks, of Coneyhurst Farm, the present tenant of the

¹ *Surrey Archæological Collections*, VI, p. 1.

² *S.A.C.*, XXXV, p. 59.



Based on the Ordnance Survey Map, with the sanction of the Controller of H.M. Stationery Office.

FIG. I.

Wykehurst Farm land, excavations were begun by members of the Society, under the leadership of the writer, on May 9th, 1936.

The first day's work resulted in the discovery of the rubble paving of the brickyard, whilst within a few days the nature of the site was suspected. Cross-trenching in an attempt to discover the kiln cut across the kiln's drainage trench on June 6th, and by following its direction up the slope of the field we discovered the kiln itself four days later.

A generous grant of £10 from the Council of the Surrey Archæological Society enabled the kiln to be completely excavated and adequately photographed. Since no traces of further kilns, or of structures connected with the brickworks could be located, the excavations were brought to a close early in July. The convenience of the farmer and the ruinous state of the kiln's fabric necessitated that the filling in should be completed immediately.

The bulk of the manual labour was done by volunteers from Cranleigh School, whose enthusiasm in all weathers left nothing to be desired: the absence of stratified deposits simplified work considerably, and made the site an admirable training-ground in elementary archæology. Our thanks are due to Messrs. S. E. Winbolt and A. W. G. Lowther for visiting so outlandish a site and giving valuable advice, and to all those others who helped in various ways.

The Roman Brickworks at Cranleigh consisted of three main features: the clay-pits whence came the material with which the tiles were made; a large paved area used apparently as a drying-floor and workshop, and described hereafter as the "brickyard"; finally, the kiln. A fourth feature, namely a habitation area where the workmen dwelt presumably existed but could not be located.

The Clay-pits.

No marked depressions could be identified with certainty as the sites of clay-pits, but doubtless they would have been situated as near as possible to the brickyard and kiln. The slight hollow running east and west, just to the north of the brickyard, suggests itself as a likely site: the excavations

were probably of a shallow nature, and have been obliterated by ploughing and the enclosing of fields. Along this hollow runs a slight stream which, towards the end of the field, seems formerly to have been dammed to make a pond. Indications, however, are generally vague, and no definite conclusions can be drawn.

The Brickyard.

On the southern bank of the stream, in the corner of Field 1 (Fig. 1) was the roughly paved brickyard. Trenching across

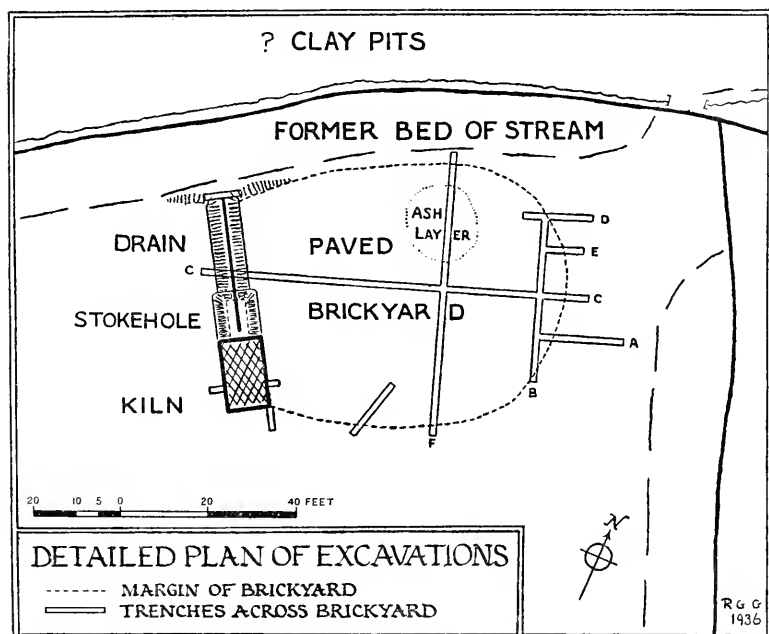


FIG. 2.

it (Fig. 2) revealed at a depth of only 7-9 inches a 3-inch layer of broken brick, in which all types of Roman tile were represented, the greater part being "wasters" from the kiln. Although thin in parts and much scattered at its edges, this paving was level, except where it sloped down towards the stream: it was obviously an intentionally deposited layer, rather than a mere scattering of debris.

This brickyard was bounded on the north by the stream, on the west by the kiln and its drainage trench; the other two margins, however, were much disturbed, and the dotted line on the plan (Fig. 2) is only approximate. Roughly of an oval shape, the brickyard measured 70 feet east-west and about 56 feet north-south.

Its purpose is obvious: owing to the damp soil, a large dry area was clearly necessary on which the shaped tiles might lie to dry in the sun before being put into the kiln. In addition, part of the brickyard was used as a workshop for the manufacture of tesserae; red-brick cubes, many of them very roughly shaped were found in large quantities scattered over the brickyard floor. In one trench as many as 23 were found within the area of a square foot. None of these tesserae bore traces of cement, and their rough workmanship clearly denoted them as the "throw-outs" of a considerable tessera industry. Presumably only cracked and overbaked tiles would be cut into tesserae (red, blue and brown in colour); a broken wedge-shaped piece of iron found near by may have been a chisel used in the process.

It was considered inadvisable to uncover completely the brickyard paving: it was cut through at many points and found in all cases but one to be resting on the undisturbed clay subsoil. Under part of the north end of the brickyard, however, was found a curious layer of ash running between the rubble paving and the subsoil; in it were several fragments of coarse Roman pottery. This layer, being under the brickyard, may be the debris of the clamp in which the tiles used in the construction of the kiln were fired: they could hardly have been transported to the site.

The Kiln.

On the west side of the brickyard lay the kiln, almost certainly the only one in operation. It was first located by the presence of much wood ash at this end of the brickyard, and by the subsequent discovery of the deep drainage trench leading from the kiln down to the adjacent stream. This trench (Fig. 3) was of curious section with a continuous row of overlapping imbrex tiles along the bottom. The necessity of such a drain on a heavy clay subsoil was clearly demon-

strated by the experience of the excavators, who frequently had occasion to wish that the drain was still working. When discovered, the drainage trench had a stiff filling of ashes and "wasters": it would appear that while the kiln was being dismantled (see below), large piles of "wasters" and charcoal were shovelled into the drain.

The kiln itself was of the "cross-wall" type used generally throughout the Roman Empire for the manufacture of tiles, and frequently for the manufacture of pottery. Tiles, however, were the sole product of the Cranleigh kiln. The classical

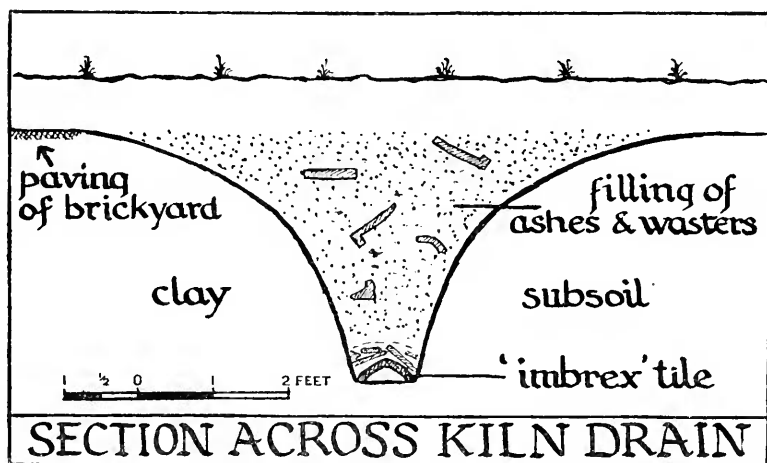


FIG. 3.

work on Roman tile-kilns in Britain is Mr. W. F. Grimes's account of the legionary works-depot at Holt, Denbighshire,¹ and under Mr. Grimes's classification, the Cranleigh example is a "rectangular up-draught kiln, Type III."

The kiln itself consists of three main features; stokehole, combustion chamber, and oven. The principle of the arrangement is that a furnace in the combustion chamber is fed from a stokehole outside, and that the heat of the furnace penetrates through flues and vents into the oven. The latter is placed on top of the combustion chamber, and on its perforated floor the unfired tiles are piled up, allowing room for the heat to

¹ Grimes, *op. cit.*, pp. 1-235.

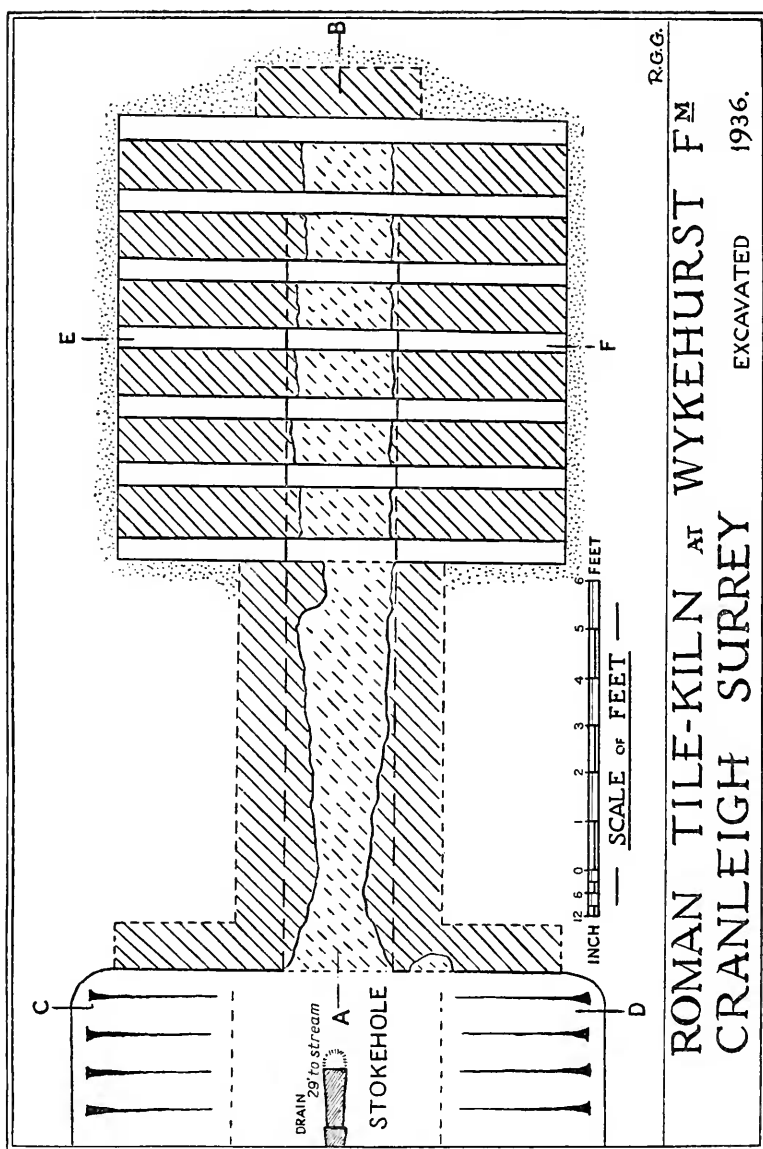


FIG. 4.

circulate. Since the floor of the oven must be on ground level to facilitate the insertion of tiles, the combustion chamber is underground, and fed from a sunk stokehole.

The rather complicated structure of the combustion chamber is best understood by reference to Plates IX and X and Figs. 4 and 5. (It should be noted that in Sections CD and EF the tile walls are restored so far as their original nature was obvious.) It was constructed by digging a wide V-shaped trench, about 18 feet long and 4 feet deep. Along the bottom was laid out the main flue, $17\frac{3}{4}$ feet long, and 28–30 inches wide, with side walls of tile set in clay daub. This flue ran from the stokehole to the end wall of the kiln; for 8 feet 6 inches from the stokehole it was arched over, forming the “stoking tunnel,” and for the remaining 9 feet 2 inches it formed the bottom of the combustion chamber proper, being spanned by the cross-walls.

The latter, six in number, were similarly of flat tiles set in clay daub, and formed a series of seven sloping flues, at right-angles to the main flue, rising from the latter to the oven floor. The oven floor itself, of which only detached fragments were found, would have had perforated vents in it over the sloping flues; it was made by placing tegulæ across the spaces between the cross-walls, leaving small gaps for the vents, and finally covering the tegulæ with a thick layer of clay daub. The purpose of the arrangement was that the heat from a furnace kindled in the main flue should rise up the sloping flues, penetrate into the oven through the vents, and circulate around the unfired tiles which were piled up on edge over the oven floor.

The oven itself would have been perfectly square, 9 feet 2 inches each side. Once the tiles had been stacked up on the oven floor (perhaps to a height of over 6 feet), they were enclosed with a wall of clay blocks, which was removed after the firing had been completed. Large numbers of these clay blocks, darkened by the smoke from the furnace, were found crammed into the main flue, where they had been thrown after the kiln was dismantled.

The following points of detail may be noted: (1) except for a few broken tiles at the mouth of the stoking tunnel, to act as a base for the stoker's shovel, the main flue was

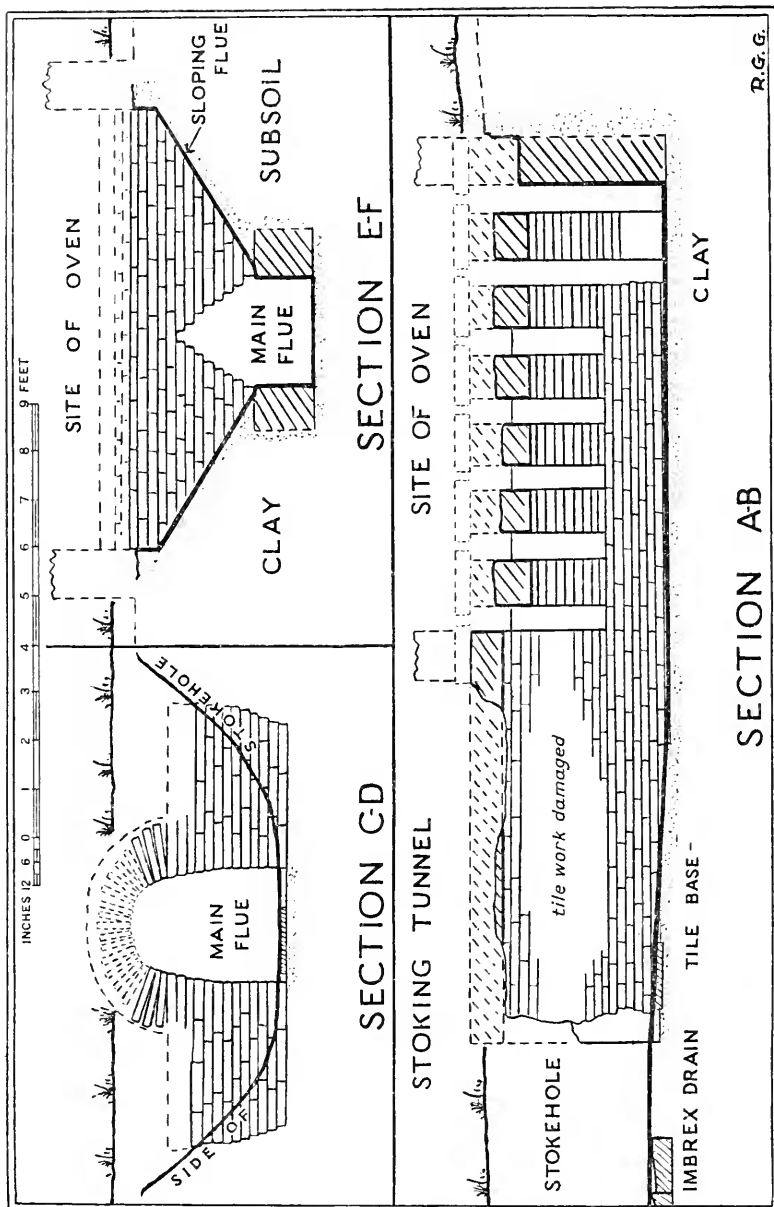


FIG. 5.

not in any way floored: the ash from the furnace was found to be resting on the burnt clay subsoil; (2) similarly the sloping cross-flues rested on the clay subsoil, although the heat of the furnace had hardened the latter and covered it with a vitrified coating; (such vitrification had, incidentally, affected every wall in the kiln which had been subjected to any heat); (3) the kiln was constructed entirely of clay and tile, no traces of stone or mortar being apparent; the tiles were almost invariably flat and an inch thick, their overall dimensions varying a great deal, but in the construction of the oven floor and of the return walls of the main flue, fronting the stokehole, flanged tegulæ had been used.

The stokehole had no surrounding walls and was little more than a pit dug into the clay: it was devoid of interest and difficult to excavate, owing to a stiff filling of clay and "wasters"; its dimensions were not therefore ascertained, although it seems to have been about 11 feet square with sloping sides.

The Kiln at Work.

From the indications obtained it is easy to picture the brickworks in course of operation. Workmen, probably few in number, dig the clay from the adjacent clay-pits, prepare and season it, mould it in wooden frames to the correct sizes and shapes, and then leave it on the brickyard to dry. During the course of this drying the workmen's dogs and animals from the adjacent woods run over the soft clay, leaving distinct footprints.

At length the unfired tiles are heaped up edgeways on the oven floor, with gaps left to enable the heat to penetrate through the vents and circulate: the surrounding walls are built up with clay blocks, and the firing is commenced. After a fortnight or so, the clay walls are taken down and the completed tiles removed; a fair proportion, particularly those placed close to the vents, must be rejected as "wasters," being distorted and blackened. The remainder are laden on pack-horses to be conveyed along the road and over the sandhills via Jelley's Hollow and Winterfold Heath.

The Destruction of the Kiln.

The type of kiln and the simplicity of its products, together with the scanty traces of occupation around it, all go to suggest that the kiln was intended to supply building materials during one particular period of building activity in the neighbourhood, and that once this purpose was served it was abandoned. It was noticeable that no traces of repair could be detected in the existing walls of the kiln, and had its period of activity been a long one, such repairs would have been essential. Although the excavations were confined to one area, there is no reason to suspect the existence of further kilns used after the abandonment of the one discovered. The demands of the neighbourhood could hardly have been so great as to have necessitated a permanent brickmaking industry. One year's work at Cranleigh would have produced sufficient tiles for far more Roman buildings than are known in the neighbourhood.

The kiln was not merely abandoned when its work was over; it was systematically dismantled. The clay blocks from the surrounding walls were crammed into the main flue; the corbelled arches of the cross-walls were broken in and the walls themselves on one side of the kiln largely destroyed; both stokehole and stoking tunnel were filled up with clay and "wasters"; finally, the drainage trench was filled in with ashes and wasters. It would appear that large piles of cinders, clay, and "wasters" had stood around the kiln, and that these were used to level the site.

This drastic clearing-up and levelling of the site seems to bear the mark of Roman workmen rather than of a medieval farmer. The latter, living in a district where stone is fairly scarce, would have preferred to use the debris of the Roman kiln for useful purposes rather than cover it up for the sake of a few square yards of soil. Furthermore, the nature of the dismantlement and filling showed that it had taken place soon after the kiln had ceased work. That this dismantlement was effected is clear evidence that once some local demand was fulfilled the brickworks was no longer considered useful.



General view of the Tile-kiln at Cranleigh, looking north-west towards the stokehole.



The main flue and eastern half of the cross-walls, looking east.
facing page 86]

PLATE X



Detail of the end wall of the kiln, showing the broken corbelling of the cross-walls.



View along the main flue from the stoke-hole end of the stoking tunnel.

An Occupation Area?

The site was not a suitable one for permanent habitation, but while brickmaking was in progress the workmen would have found it necessary to live on the spot. At Ashted where the industry was permanent it seems that the workmen's dwellings were probably of timber—although their baths naturally had to be more substantial: it can be imagined therefore, that at Cranleigh the workmen's quarters would have been of the simplest nature and would leave few traces of their existence. A rough timber shed close to the kiln would have sufficed, and it is possible that traces of such an occupation area exist in a part of the brickyard which was not excavated. There are certainly no obvious signs of buildings in the adjacent fields.

The Surroundings of the Brickworks.

Systematic trenching was restricted to the corner of Field 1, but test-pits were sunk and a probing-bar liberally used throughout this field and in the adjacent ones. No further structural remains could be located, and the general scarcity of Roman brick rubble outside the area excavated suggests that the industry was restricted to this one corner. It should be remembered that the farmer who first drew attention to the site mentioned this one corner only, although his ploughing had been done for many years in most of the other adjacent fields.

Efforts were also made to verify the line of the Roman Road itself, which is marked on the O.S. map as crossing Fields 1 and 5 diagonally. Extensive use of the probing-bar throughout this O.S. line, especially in hedges and ditches where road-metal might have been less disturbed, failed to locate the slightest traces of the road. Furthermore, since the small stream between Fields 1 and 5 constituted a greater obstacle in Roman times than it does to-day, some form of causeway or culvert would have been necessary to take the road across, and there are no signs whatsoever of such a construction.

On the other hand, 100 feet to the west of the O.S. line were found definite indications of an old way, although its origin cannot be considered at all certain. An old field-track runs

down in a cutting beside the east hedge of Field 3, *crosses the stream by a substantial causeway*, and continues along the eastern side of Field 4. The nature of the causeway suggested that here was the real line of the Roman Road, and a section was therefore cut across the overgrown cutting in Field 3. This revealed several inches of road metal about 9 feet wide, consisting mostly of local chert, with a few pieces of flint and some minute fragments of Roman brick. Until a section is cut across the causeway, however, the origin of this track must remain undecided.

Finally, one might perhaps mention that Field 6 should be the starting point of any detailed investigation of the line of the Roman Road hereabouts. Mr. Winbolt asserts that in 1923 "a special mass of stone stands out convincingly," the present owner confirms the discovery of road-metal in the field, whilst the writer picked up some years ago a piece of Roman tile, and a mass of cemented flints.

The Date and Purpose of the Brickworks.

The total absence of finds which might be dated makes it difficult to form any definite conclusions as to the date and purpose of the Cranleigh brickworks. Circumstantial evidence does, however, give many clues, and these may be mentioned here for what they are worth.

The Wykehurst site was obviously chosen for its position on the Roman road, and its proximity to the places where bricks and tiles were needed. There is certainly no technical superiority in the site, since clay of the quality necessary for brickmaking could be found anywhere beside the Roman road between Wykehurst and Rowhook.

It is significant that the nearest known Roman building to Wykehurst is on Farley Heath, and furthermore that Wykehurst is the nearest site to Farley Heath on the Roman road where clay is available. It is a fair probability, therefore, that whatever other sites may have been supplied with tiles from Wykehurst, Farley Heath was the main destination of its output.

The building on Farley Heath is of course the Romano-Celtic temple proved by Mr. Winbolt in 1926.¹ Curiously

¹ S.A.C., XXXVII, p. 180.

enough, although Farley Heath has always been termed a "settlement" by virtue of its enclosing banks, no traces of buildings other than the temple have ever been definitely located. Either, presumably, they were of timber and have left no traces in the sandy soil, or else it is not impossible that Farley Heath was in Roman times a sacred site rather than a definite settlement, and that the enclosing banks represent the walls of the temple *temenos*.

Whichever may be the case, it can be stated that the products of the Cranleigh brickworks are not inconsistent with a destination at Farley Heath. It is true that the flue-tiles made at Cranleigh would hardly have been used in the temple, yet the other products (see Appendix I) bear out the hypothesis: for instance, the half-column tiles and "pear-shaped" roof-tiles seem to denote a building of some architectural pretensions. The tesserae, too, may well have been destined for the temple floor, since numerous tesserae have been found among the temple ruins.

With regard to the question of date, we are on even less sure ground. The Holt kilns, which in many points so resemble the Cranleigh specimen, seem to have been constructed about A.D. 90. The almost identical kiln at Hoheneck in Germany (see Appendix II) can be dated about A.D. 100-150.

The substantial, well-made tiles which were produced at Wykehurst also seem to date from the heyday of building in Roman Britain—the late first or early second century. They are in many respects closely analogous to the specimens from the similarly dated site at Ashtead.

These indications, taken together, tempt one to suggest that the Roman Brickworks was established some time at the end of the first century or during the first half of the second century (perhaps during the years of great constructional activity which marked the reign of Hadrian), and that the Romano-Celtic temple on Farley Heath, together with perhaps one or two local villas, was constructed at this time.

Nevertheless, until more reliable dating material is available from Wykehurst, and until some fragments of the characteristic "pear-shaped" roof-tiles are found on Farley Heath (both of which can be effected by a small amount of excavation), these interesting possibilities must remain as pure conjectures.

Finally, it may be said that the topic of Roman brick-making has not received as much attention as it deserves. The manufacture and use of bricks and tiles was so essential a part of the romanization of any province of the Empire that a chronological evolution of kiln types is by no means impossible. If further excavations both at Cranleigh and at Ashstead enable various types of kilns to be dated exactly, these Surrey sites will have an importance which is more than local.

B. THE TILE-KILN AT HORTON, EPSOM.

The kiln which forms the subject of this additional note was discovered in May 1922, during the construction of the West Park Asylum at Green Man Farm, Horton, near Epsom. It appears that a trench for a drain under the forecourt of one of the blocks of buildings cut across the combustion chamber of the kiln, and that the whole structure was subsequently brought to light.

It will be seen from the plans and sections (Fig. 6) that the kiln was of the usual "cross-wall" type with the normal surrounding walls, and was in a good state of preservation. Instead of the more common single main flue, however, it possessed two, side by side, each about 24 inches wide; this unusual arrangement (which seems to have only one parallel—a kiln at Holt) was presumably a method of giving the contents of the oven a speedier and more efficient firing at the cost of additional fuel consumption. Mr. Grimes suggests¹ that the double-flue kiln at Holt was a local experiment with a view to a greater oven capacity, and that it was later abandoned as being uneconomical. The Horton discovery must cause this view to be modified: the double-flue arrangement was obviously an alternative standard design, and since the capacity of the Horton kiln is no more than that of the simpler Cranleigh one, it was efficiency rather than capacity which was desired at Horton.

Unfortunately full details of the arrangement of the sloping cross-flues are not available, nor does it appear that remains of the oven floor were recognized, although the cross-walls themselves seem to have been well-preserved. Herr Oscar

¹ Grimes, *op. cit.*, p. 28.

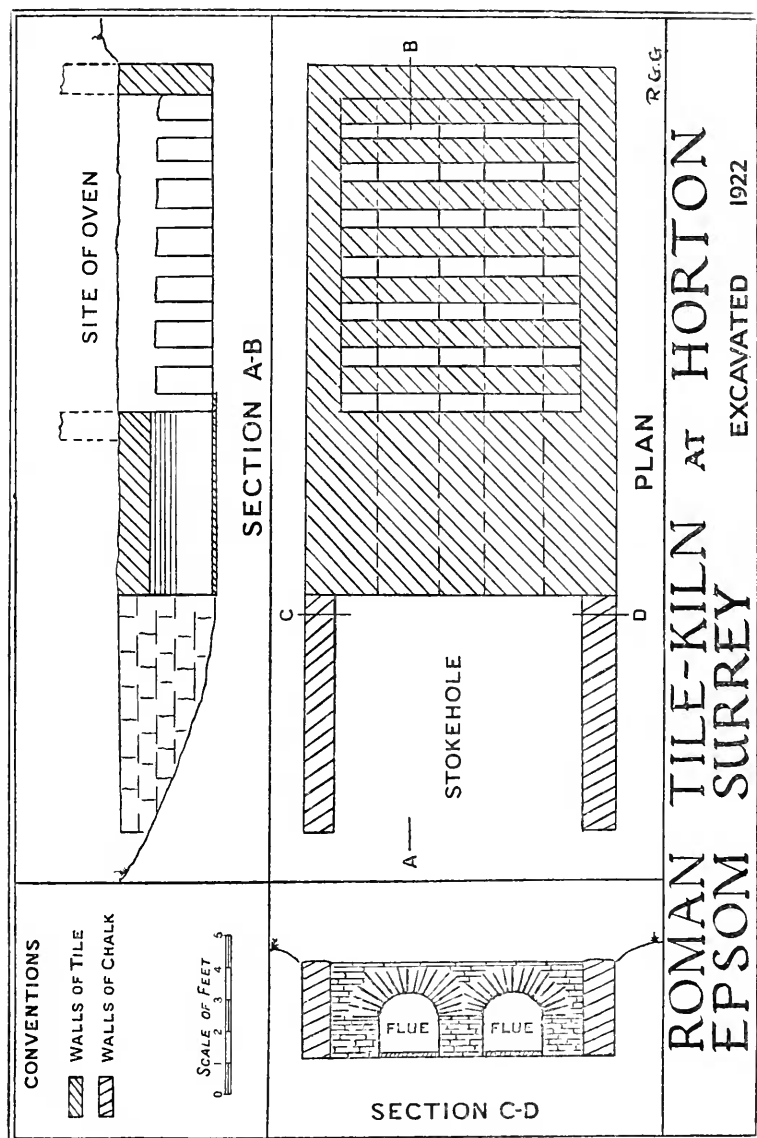


FIG. 6.

Paret has suggested¹ that an oven floor was essential only for the firing of pottery, and could be dispensed with in a tile-kiln, by stacking the tiles on their edges across the sloping flues. Such a method would, however, have resulted in a large proportion of "wasters," and would have been a false economy. Furthermore, although the writer knows of numerous examples of tile-kilns with oven floors, on no occasion have tile-kilns been found which have been proved not to have possessed such a feature. In the doubtful cases, such as Horton and Hoheneck, it is more probable that fragments of the oven floor escaped recognition.

The overall dimensions are much the same at Horton as at Cranleigh, although the proportions of stoking tunnel and oven differ. Similarly the walls of the kiln at Horton were constructed of tiles set in "pink cement" (probably clay daub), although the sloping stokehole had side walls of squared chalk blocks.

No dating material was found at Horton, but since the kiln was obviously part of the widespread Ashted industry, its period of activity was fairly certainly that of the latter, *i.e. circ.* A.D. 70-150. It is interesting to note that the similar double-flue kiln at Holt was working *circ.* A.D. 90-150.

During the excavations on the same estate were found "the wash-pits that had been used in making the slip or puddle from which the tiles were made. These wash-pits were covered throughout with a double layer of Roman brick breaking bond." For this and other information the writer is indebted to Mr. W. J. Pickering of Epsom, who kindly lent a drawing of the kiln made at the time of discovery.

In conclusion, it may be said that the elaborate and efficient nature of the Horton kiln, contrasting as it does with the simpler one at Cranleigh, is striking confirmation of the general remarks made at the beginning of this report. It should be remembered that, in speaking of the "Ashted industry," one is not dealing with a single kiln on a single site, but several kilns—perhaps co-operative or perhaps competitive—spread over a wide area; the Ashted tile industry is indeed analogous to the Farnham potteries, or even to those in the New Forest.

¹ Paret, *Siedlungen des Röm. Württemberg*, p. 144.

APPENDIX I.

Finds, and the Products of the Cranleigh Brickworks.

The Wykehurst Farm site was singularly destitute of small objects. No coins were found, and the pottery was limited to a few sherds of coarse wares, useless as dating material. Possibly the careful clearing-up of the site which manifested itself in the dismantlement of the brickworks resulted in the creation of a rubbish-pit which the scattered trenches across the brickyard failed to locate. A few odd-shaped pieces of clay, cut with a knife, are probably the outcome of the workmen's creative desires: they have no apparent meaning. Finally, one may mention a small rusted wedge-shaped piece of iron, perhaps used as a chisel in the manufacture of tesserae.

A large amount of broken tiles and "wasters" both from the filling of the kiln, and from the brickyard paving, was examined in the hope of detecting tile-stamps, graffiti, or standard tile dimensions. The first two quests were unsuccessful, but it was possible to gain a fair idea of the types and sizes of the tiles manufactured at the brickworks, and these are given below.

A. Roof-tiles.

(a) *Tegula* type.—These common flanged roof-tiles were the chief products of the brickworks. The overall dimensions of all specimens examined were $16\frac{1}{2}$ inches by $12\frac{1}{2}$ inches. The majority had a double semi-circle on the lower edge of the tile (as a "this-side-up" mark for roof-builders); a few specimens had no mark at all, whilst one had a rough cross.

(b) *Imbrex* type.—Many fragments of these curved tiles were found, but the only complete specimens were from the bottom of the kiln drain. They were of normal shape and corresponded in length with the tegulae they had to fit.

(c) "*Pear-shaped*" type.—This type of roof-tile appears to be most uncommon in Britain, if not unique. It is related to the familiar hexagonal stone roofing slabs, and was probably a substitute for the latter in a part of the country which lacked stone suitable for such slabs. That "pear-shaped" roof-tiles were made at Cranleigh in addition to the normal types suggests that they were intended for a building of some architectural pretensions. From a flat top they broaden out and terminate in a semicircle of about 11 inches diameter, being 15 inches long from top to bottom, with a pierced nail-hole at the top. As can be gathered from the reconstruction (Fig. 7) the finished effect of these tiles is rather pleasing.

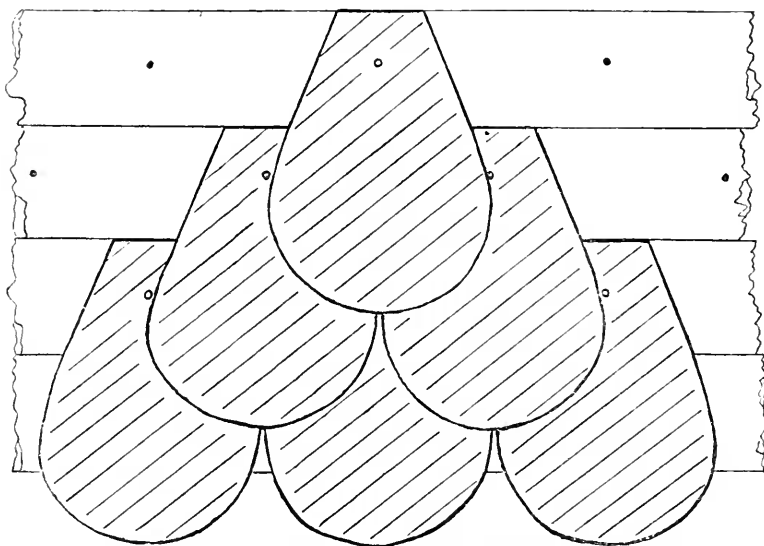
B. Flue-tiles.

The normal type of box flue-tile was manufactured at Cranleigh: the fragments recovered give no indication of the original dimensions. All possess "combed" designs to ensure the adherence of plaster; they are drawn with a three-, four-, five- or six-toothed comb. There appears to have been no standard "combed" design, nor were any fragments of roller-stamped designs (like those from Ashted) found.

C. Building-tiles.

No standard sizes could be identified among the numerous fragments of ordinary flat building- or floor-tiles. They varied in thickness from 1 inch to 2 inches and presumably represented all the normal types.

One complete specimen and several fragments were found of the semicircular tiles used in the construction of engaged columns, of which specimens were also found at Ashted. The complete example was 9 inches in diameter.



Probable Method of Using 'Pear-Shaped'
Roof-Tiles

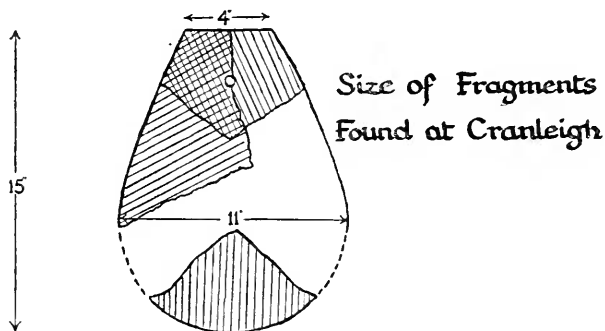


FIG. 7.

D. Tesserae.

The tesserae manufactured at Cranleigh were only such as could be made from tiles: they varied in size, the majority being 1 inch square.

By using the overbaked "wasters," the workmen were able to produce tesserae of deep blue and brown, as well as of the normal red shade.

In summary, one can say that although there was considerable variety in the products of the Cranleigh brickworks, they were essentially of simple workmanship and contrast strongly with such elaborate Ashted products as the "dog and stag" flue tiles.

APPENDIX II.

The Hoheneck Villa and Brickworks.

Excavations in 1911 on the site of a Roman villa at Hoheneck, Ludwigsburg, Germany, brought to light a tile-kiln so strikingly similar to that at Cranleigh that a brief note on it seems desirable.

The excavations were conducted scientifically by Herr Oscar Paret whose report appears in *Fund-Berichte aus Schwaben*, XIX (1911), pp. 90-118. In spite of a comparative paucity of datable finds, the construction of the villa has been fixed at somewhere between A.D. 100 and about A.D. 150; its abandonment was in the middle of the third century. The kiln itself was probably contemporary with the building of the villa: at some later date the brickworks was enlarged by the construction of additional drying-sheds. The Hoheneck kiln, therefore, can safely be dated to the first half of the second century.

In general design this German kiln is identical with that at Cranleigh; the main dimensions are the same to the nearest inch. Two differences only are noteworthy, and they are details of construction, rather than of general arrangement: at Hoheneck (*a*) the cross-walls are four in number, forming five sloping flues each side, wider than those at Cranleigh, and (*b*) these cross-walls are arched over the main flue instead of being corbelled.

Standardization of design is of course common to most Roman works, but standardization of dimensions to the degree of exactness shown in the kilns under discussion is rarely met with, nor can it easily be dismissed as a coincidence. It is tempting, and not unreasonable, to conclude that these two kilns were both constructed with rigid adherence to instructions laid down in a contemporary engineering manual, a handbook after the nature of Vitruvius's work.

As to why these kilns should thus be identical, whilst those at the military works-depôt at Holt and on military sites on the German frontier vary a great deal in dimensions, no definite explanation can be given. The writer would point out, however, that the military kilns in question were constructed by the brickmaking experts which each Legion possessed, whereas at Cranleigh and Hoheneck—both civilian sites—workmen less acquainted with the construction of kilns might have been employed, who would have had cause to adhere slavishly to written instructions and dimensions.

Addendum.—Since Appendix II was written a third example of the Cranleigh type of tile-kiln has come to the writer's notice, namely Kiln XIV of the big potters' works outside Aquincum (Budapest). This kiln possesses four cross-walls and is identical to that at Hoheneck. There was no direct evidence of date, but the industry as a whole seems

to belong to the second half of the second century. (See Prof. Kuzsinszky in *Budapest Regisegei*, Vol. XI, 1932.)

This discovery adds weight to the suggestions outlined above, for the occurrence of identical kilns in places so far apart as Cranleigh, Hohenock and Budapest cannot easily be dismissed as a coincidence.