

CHAPTER 3

REPORT ON THE 1987 EXCAVATIONS
THE POTTERY KILNS IN BUILDING Q48.4

by

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3.1 Introduction

During the course of the 1987 excavations at Building Q48.4 a large ovoid structure, measuring approximately 2.30 m x 1.50 m, was discovered in square G4. It was obvious from the exposed brickwork that the structure had been subjected to considerable heat and this, along with its characteristic shape, led to the suggestion that it might be a kiln. Further excavation revealed the remains not only of more of this feature [2984], but also of a second crescentic structure [3052], as well as a pit of approximately the same size as the latter [2999].

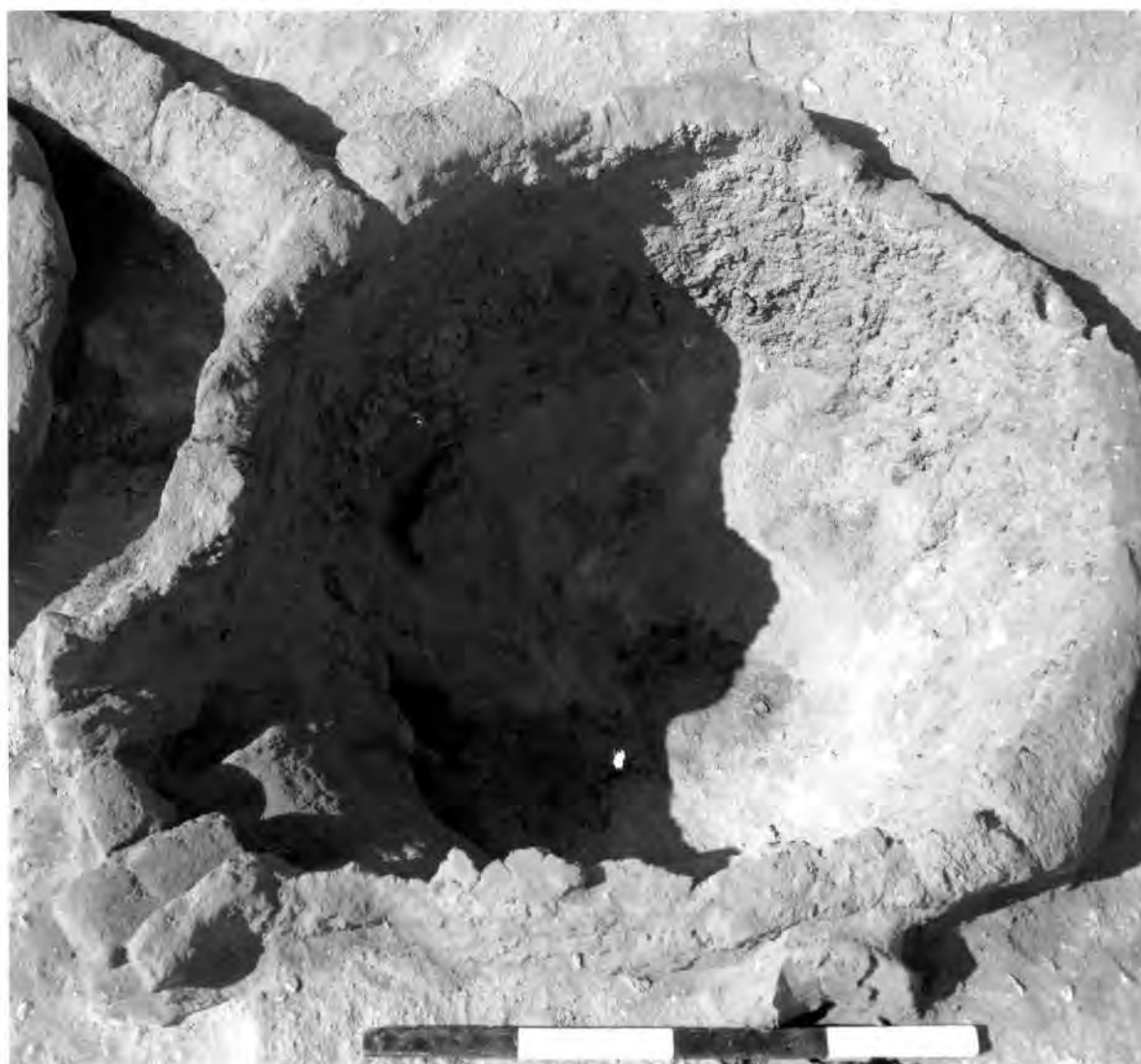


Figure 3.1. View of kiln [2984] after excavation.

3.2 Excavation of structure [2984]

All excavation in G4 was conducted under the supervision of Angela M.J. Tooley, in consultation with whom it was decided that the structure should be half-sectioned so as to provide a diagrammatic representation of the fill (Figure 3.5). The fill was found to consist of clean sand interspersed with occasional lenses of ashy material, and a thick sloping level of decayed brick rubble [2985, 2987]. Most of the rubble was of unfired mud brick containing large pebble inclusions and is consistent with bricks from adjacent buildings, rather than from the kiln itself. The kiln structure, however, was made of bricks heavily tempered with organic materials and a few calcareous pebbles (in contrast to most Amarna bricks which use pebbles in place of straw). These bricks were heavily burned. At the southern end of the kiln a chute-like arrangement [3897] was uncovered, consisting of two bricks laid side by side, their broadest faces uppermost, and sloping downwards into the structure (seen in plan view, Figure 3.2). On the inside, below the chute, the brickwork had been plastered over using mud plaster, again with a straw temper. This whole arrangement, which is evidently the remains of a stoke hole, was covered by a firm ashy deposit, seemingly *in situ*, containing a denser concentration of charcoal than anywhere else in the fill. This deposit included some charcoal fragments of large size which may be suitable for future identification. The lenses of burnt material in the sand fill seem to be the result of later activity, after the kiln had gone out of use, and probably belong to the same phases of activity as produced the brick rubble thrown in from other structures.

Further down on the walls of the kiln the degree of vitrification of the brickwork increased substantially, often all but obscuring the joints between bricks. This slaggy surface varied in colour from a bluish-purple to a dark olive green (colours not determined by reference to Munsell). Below the brickwork was a pit (part of [3051]), its sides plastered with what appears to be gypsum [3683]. Incorporated within this plaster was a small number of sherds and some fragments of bone, as well as the core of a brick, or piece of mud. The unburned appearance of this brick is likely to indicate that the exterior surface was exfoliated from it through the combined effects of heating and later weathering. The gypsum surface slopes down in step fashion into a central depression which contained burned material and small stones and appears to be the base of the fire pit. Just above the bottom of this pit, lying in the ash below rubble from other structures, was a large mud brick or pillar measuring 30 x 16.5 x 13 cm and burned on one face, the end faces being missing.

At the same time as the excavation of this structure was being undertaken, the smaller structure just to the west was also excavated [3052] (Figures 3.3, 3.4). This measured approximately 1.40 m in external diameter and was constructed of unfired bricks, with the exception of one burned brick found in the uppermost course at its eastern extreme. This appears to be a reused brick, probably from the main kiln. The principal points of interest from this structure are that the bricks are, like those in the larger kiln, heavily tempered with organic matter — probably straw — and that the lowermost course was set on end, the broadest faces forming the interior surface of the structure at this level. This drew attention back to the vitrified brickwork at the bottom of the larger structure, and this, too, was then seen to be set on end in this manner (something which had not been immediately obvious, since at the time of initial observation this structure was not fully excavated and the lowermost brick course was barely visible). The undamaged faces of the bricks of the lowest vertical course in [3052] also preserved in each case a single diagonal groove made by drawing the finger across the surface during manufacture (Figure 3.4). In both kilns the courses above the lowermost were laid conventionally as overlapping stretchers (i.e. in “common bond”; see below and elevations, Figures 3.6, 3.8, and 3.10).

Given the uniformity of brickwork, both in terms of the fabric of the bricks and the pattern of laying, it seems reasonable to assume that both structure [2984] and structure [3052] served the same purpose, and that since the larger of the two was heavily vitrified and preserved part of a stoke hole, both were kilns. Furthermore, the presence of the reused brick in structure [3052] and the otherwise unburned nature of the brickwork makes it reasonable to suppose that this structure had been intended to replace [2984] but that it was never finished, perhaps due to the abandonment (albeit temporary) of the site.

A pit [2999] to the east of the large kiln has a diameter of approximately 1.40 m which is similar to that of structure [3052] (Figure 3.7). It may be that this pit was intended for the



Figure 3.2. Stoke hole of kiln [2984], seen from above. The scale is 10 cm.

insertion of a further kiln, or that one had been removed from it. It has been observed ethnographically (Nicholson and Patterson 1985) that potters often rebuild kilns on the site of one already dug out. However, the shallowness of this pit (36 cm below the desert surface), and its unburned appearance argue for the insertion of a brand new kiln. It may have been that these two smaller kilns, if indeed [2999] was intended for such, were to have replaced the larger one. It should be noted that the large kiln was sunk very deeply into the ground, only 2–3 courses of the surviving brickwork protruding above the old ground surface, though originally there would have been considerably more. The fire pit in this structure may well have become deeper over time through use and the new, smaller, kiln would have begun life not only with a proportionally smaller pit but also one not yet eroded through use. The sinking of kilns into the ground, or into piles of rubbish, is well known and serves not only to buttress the submerged part of the structure, but also to conserve heat.

3.3 Function of the kiln

There are several possibilities as to the function of the principal kiln, and thus, by implication, of both kilns. Of these the three most likely are metal working, faience making, and pottery making. The first option for a kiln of this type was suggested by Emery (1963; Emery, *et al.*



Figure 3.3. Kiln [3052], showing section through lowest brickwork, looking north. The scale is 15 cm.

1979) for not dissimilar kilns found at Buhen (Nubia), though this interpretation has now been challenged by others (cf. Adams 1977: 172 n. 20; Hope: forthcoming) who have preferred to see them as pottery kilns. In the case of the Amama kiln there are no traces of metal-working debris, nor of lumps of ore in the vicinity, and — unless analysis of the slaggy vitrified brick surfaces proves otherwise — it seems reasonable to discount this option.

The possibility that the kilns served as faience-glazing ovens raises technical questions which are summarized in Chapter 8. Since no traces of dripped faience were encountered on their own or attached to pottery vessels we can probably exclude the firing of faience vessels or manufacture of frit, but not necessarily on simple negative grounds the firing of small moulded glazed objects. For these, however, the large size of the main kiln would seem unnecessary for such small objects on anything but a massive scale.

The most positive case that can be made is that the kilns were for the firing of pottery. This is founded not only on the shape of the kilns, but also on the quantities of unfired sherds from squares D5, E4, F3, G3, and G4, the discovery of a potter's wheel in E6, and various other features which collectively can be interpreted as the remains of a small potting industry (see Chapter 4).

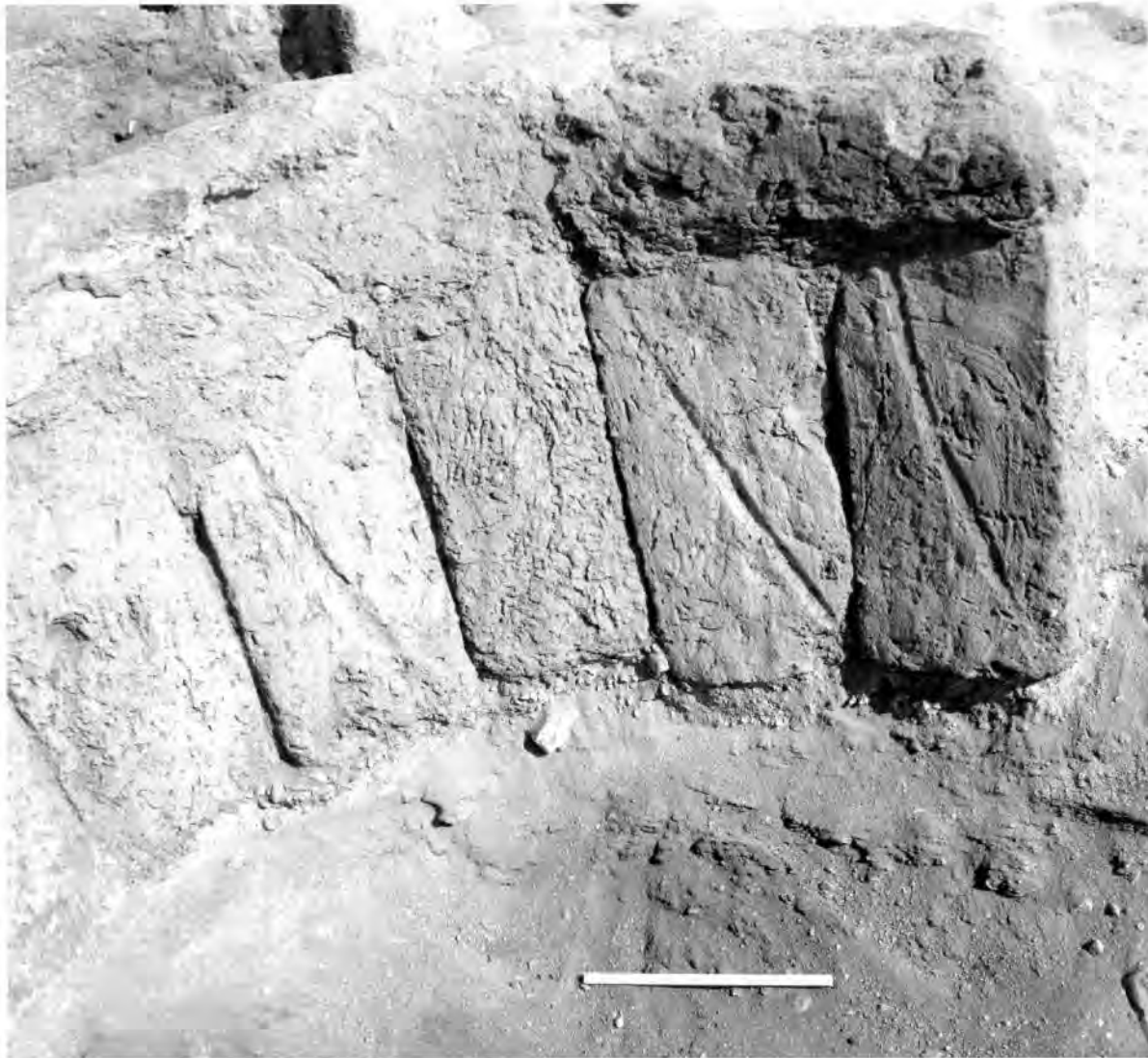


Figure 3.4. Kiln [3052], looking east.

The size of the kiln itself suggests the production of larger rather than smaller items, and this makes pottery more probable than faience. By the same token the smaller kiln which seems to have replaced [2984] is not too small for the firing of pottery. The squares around G4 contain a thick deposit of blackened debris which may be related to the use of a potters' kiln in the area, though there did not appear to be any notable quantity of waster sherds (i.e. misfirings). One could also argue that the location of the kilns at the edge of the city would be well suited for an industry producing a large amount of debris, dirt, and smoke, and that pottery-making is one industry known to occupy such locations (Peacock 1982). However, our subsequent realization that pottery kilns were to be found within the grounds of houses in the main city reduces the force of this argument.

3.4 Kiln [2984]: preserved structure and original appearance

It has already been noted that the greater portion of that part of the kiln which remains is sunk into a large pit in the old ground surface, which is here a hard *gebel* of marl and stones (Figures 3.6 and 3.7). The upper lip of the pit is between 10 and 20 cm back from the kiln walls, and the pit itself seems to have had fairly steeply sloping sides. Around them, at the lowest level,

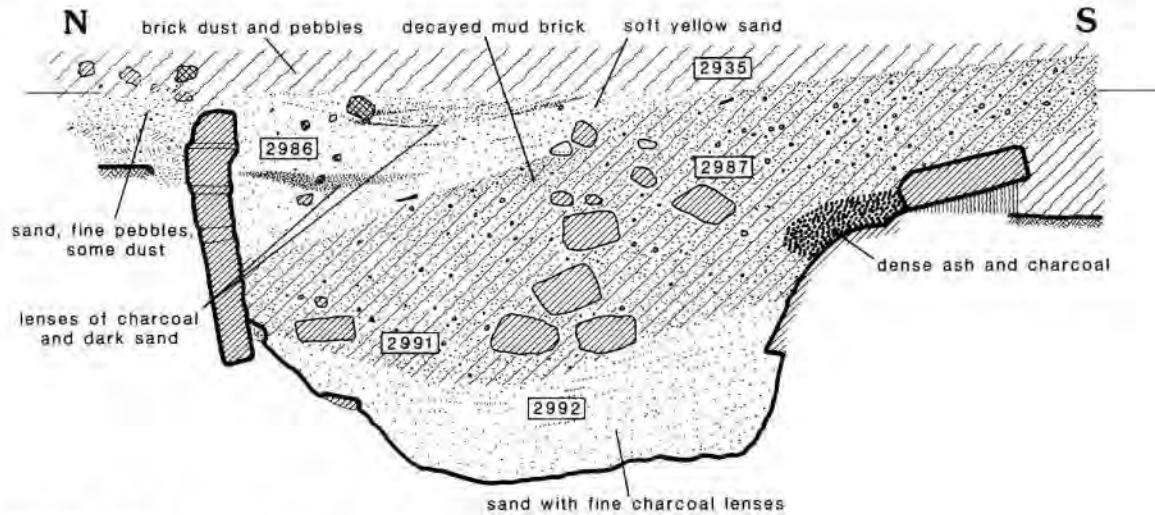


Figure 3.5. Stratigraphic section through the fill of kiln [2984].

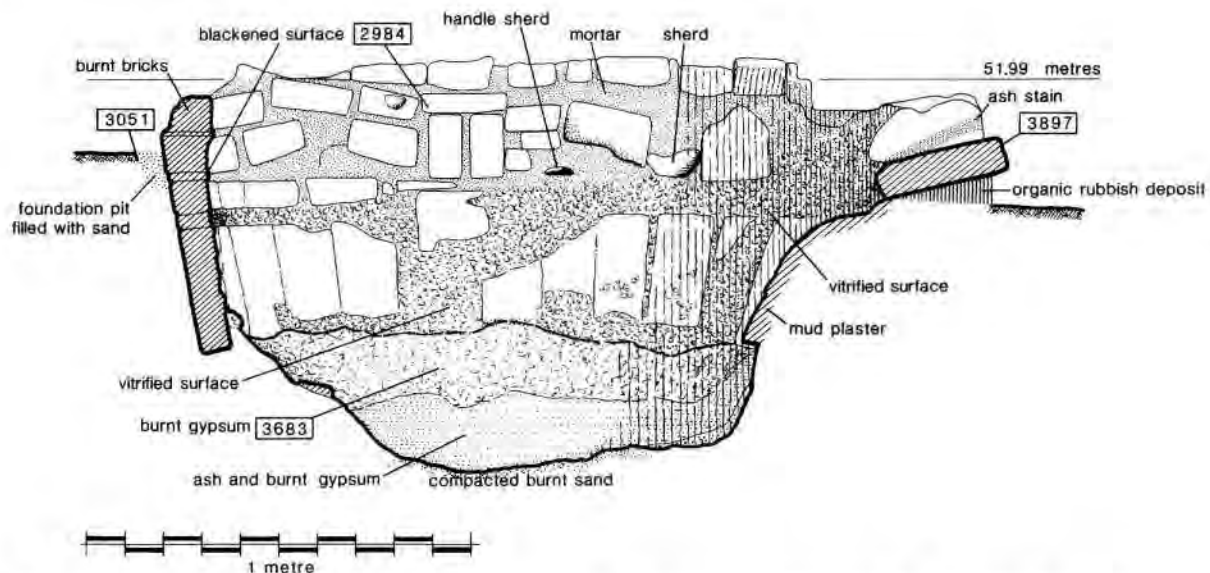


Figure 3.6. Section and elevation of kiln [2984] after excavation (original by Angela Tooley).

were placed twenty-seven bricks measuring approximately 32 x 16 x 8 cm (the thickness was measured from bricks under the stoke hole, whose width had been exposed through the erosion of the gypsum plaster at this point).¹ These bricks were arranged all around the structure, their broadest faces outermost, and sloping back against the walls of the pit, to give an appearance resembling that of the staves of a barrel. The gaps between the bricks were filled with mortar of a composition resembling that of the bricks, though with rather more pebble inclusions. The degradation of the outer surface of this course of bricks had made it impossible to judge if they had been marked with a single finger groove as was the case with the lowest bricks in the adjacent unused kiln [3052].

Above these up-ended bricks came four (in places five) courses of bricks laid in common bond. These measured approximately 35 x 10 cm and were joined by mortar varying in thickness

¹ Some bricks measured elsewhere in the kiln were 31 x 15 x 9 cms.

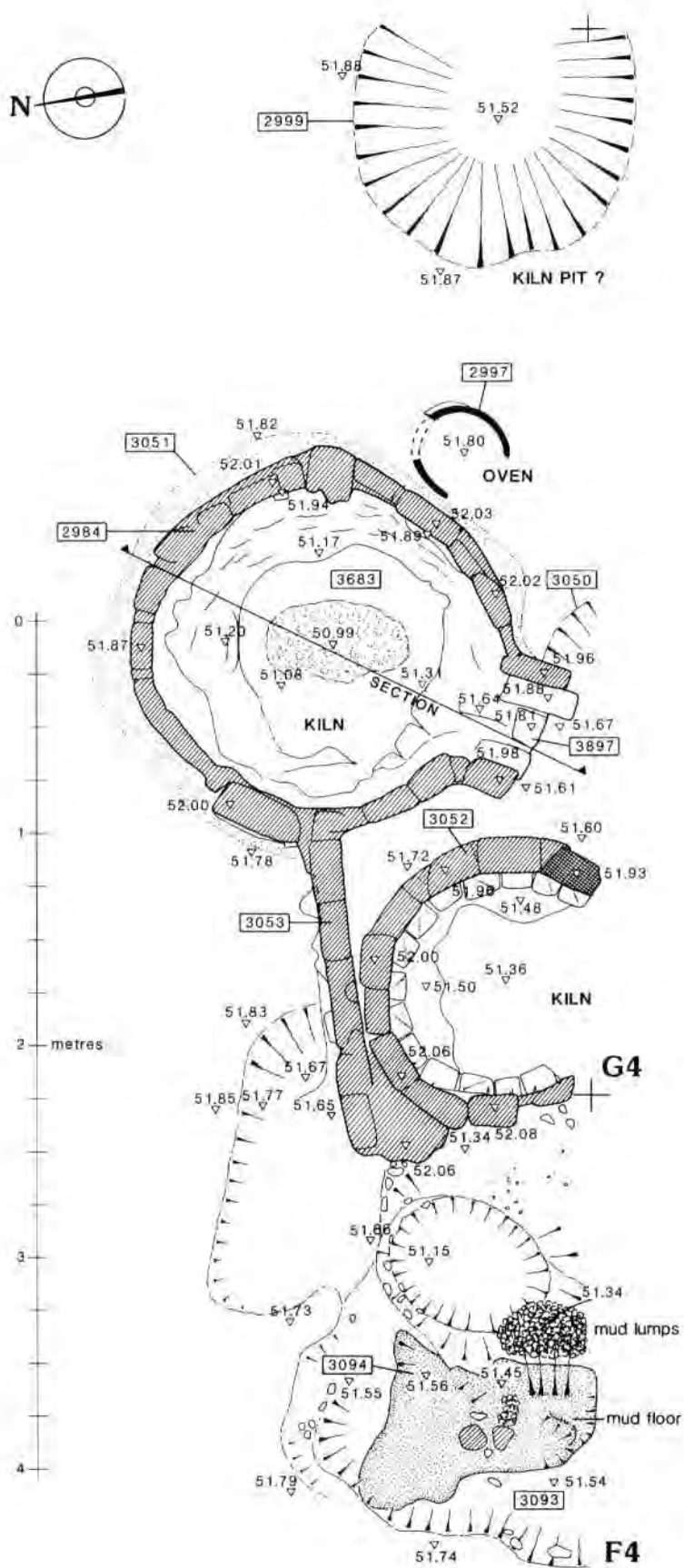


Figure 3.7. Plan of kilns [2984] and [3052] (original by Angela Tooley).

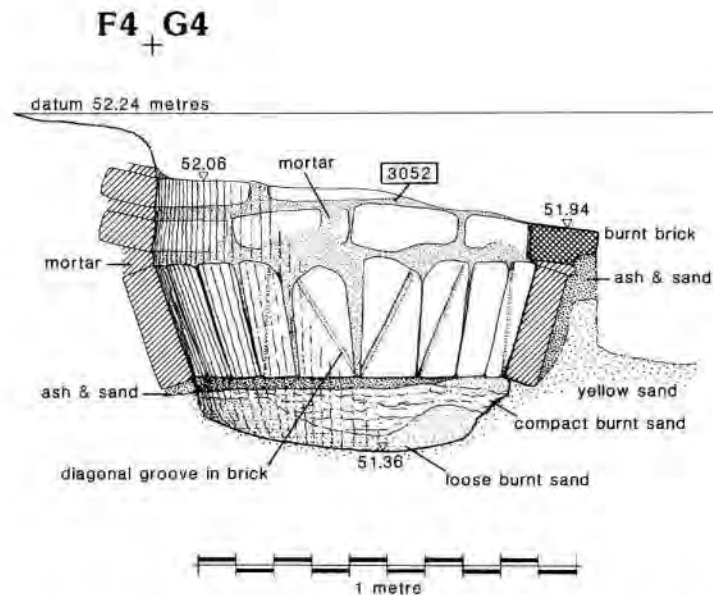


Figure 3.8. Section and elevation of kiln [3052] (original by Angela Tooley).

between 0.5 and 4 cm, the average being about 2 cm. The bricks seem to have been deliberately pan-bedded. Some evidence that the brickwork was carefully constructed may be seen in the replication of one particular feature at both sides of the kiln, in approximately the same position. Just below the uppermost course of horizontal brickwork, approximately in the middle of each wall, two bricks have been placed together on end, their longest narrow face being that exposed (Figure 3.6). These bricks measure approximately 16/17 x 8/9 cm. Also visible on the eastern side of the kiln in the uppermost courses of brickwork are two large blocks near the south end. These measure, in so far as vitrification allows measurements to be taken, 29 x 14 and 20 x 35 cm respectively. The peculiarities of the upper part of this brickwork will be examined below, but first something should be said as to the nature of the bottom of the structure.

Below the lowest course of brickwork (the up-ended series of twenty-seven bricks) is the gypsum-plastered slope of the pit. We consider that this part of the pit was originally quite shallow and unplastered, perhaps only slightly deeper in proportion than that in the unfinished kiln [3052]. This might then have become deeper through cleaning out the ash from the kiln, and through the action of intense heat on the underlying natural surface. It was in an attempt to prevent this, we suggest, that the pit was plastered.

If this structure was a pottery kiln then it is to be assumed that the vessels were stacked in some way separate from the fire. There are several possible methods of doing this. One is that suggested by Hoffman (1982) for the so-called kiln at Hierakonpolis. This involves setting the vessels on stone supports above the level of the fire, perhaps with the vessels partially enclosed by larger ones. However, since the Old Kingdom kilns at Buhen (as well as another of Old Kingdom date at Dahshur, Stadelmann 1983: 228–230, Abb. 3, Taf. 66) had a more sophisticated arrangement, consisting of a perforated floor, there seems little need to postulate this very crude arrangement of supports here. Similarly, the pottery kilns from Mirgissa (Vercoutter 1970: Figures 24 and 57) both show traces of internal buttresses, almost certainly the support for a perforated floor, as do kilns from Dakhla which preserved brick supports for such flooring (Posener-Kriéger 1986: Pl. LXVII.B; Soukiassian, Ballet, Pantalacci, and Wuttman 1984–1985: 153–154, Fig. 3, Pls. I, II). Far closer in date to our kiln is a pair from the New Kingdom Egyptian site at Haruba in North Sinai (Oren 1987: 99–106). In each the floor seems to have differed. In the smaller, as is often the case, the floor was not preserved, but “appears to have been supported by brick ‘brackets’, judging from the brick remains jutting out from the inside of the wall”. In the larger, part of a brick floor was actually preserved *in situ*, and is described as a “fired brick floor, or grating, ...pierced by a network of small holes, each about 0.10 m wide, designed to allow hot air into the firing chamber above. The grate was 0.20–25 m thick and covered on either side with a thick layer of plaster. It was supported in a somewhat unusual manner: it did not rest on a central

column, rather its convex shape distributed its weight evenly down the walls". This leaves several options to consider for what kind of perforated floor was used in our Amarna kiln. No fragment of a convex one-piece fired floor with holes of the Haruba type has been found, either within the kiln or in the surrounding debris, so that we are not justified in looking to this design for an answer. A simple arrangement intermediate between a true floor and the supports would be to use ledges projecting from the sides of the kiln, but, since this would waste much space, one should for preference envisage a floor right the way across the kiln. This floor could then have been supported by a central pillar which came from the flatter part of the floor of the pit (as at Buhen and Dakhla). It may be that the large block found in the fill (see above) was part of this or was part of the floor itself. Some support for this argument is to be found in the condition of the gypsum floor of the kiln. This was least worn at the point diametrically opposite the stoke hole, a point which it would have been impossible to reach with the poker were a pillar to have been at the centre of the kiln. Those points most readily accessible with a poker were most eroded, along with the floor below the stoke hole.

It seems likely that the floor projected from a point just above the level of the old ground surface. Two strands of evidence lead one to this conclusion: firstly, the presence of large blocks and of the two bricks standing on end in the east and west walls of the structure near the level of the old ground surface; secondly, had the floor been any lower it would have interfered with the stoke hole, already made chute-like to overcome the position of the floor. Also, had it been lower one would have expected to find evidence for it in the lower courses of brickwork. It seems that the floor was supported from a combination of protruding bricks, the remains of which are to be seen on the eastern and western walls, and protruding blocks, visible only on the eastern side. There is good evidence for the use of projecting bricks, presumably as floor supports, from the kiln excavated by Borchardt in house P47.20 Raum 10 (Borchardt and Rieke 1980: Abb. 17, reproduced here as Figure 3.9). However, the use of the block (visible only on the eastern wall) for this purpose, is less certain. It may be that its presence and apparent projection are fortuitous and that the floor at this point was supported at some higher level. The thickness of the floor bars, and whether they were single lengths of stone or mud, or of mud bricks joined together, is unknown. Whatever their material and means of support at the sides, the bars of the floor would then have projected on to the central pillar.

Support for this interpretation is to be found in the reconstruction of what Borchardt believed to be a "Backofen" in house P47.20 (Borchardt 1933: Taf. IV — here Figure 3.9; cf. Borchardt and Rieke 1980: 129, Abb. 17) which can now be seen to be a pottery kiln.² Though the perforated floor itself was not preserved, its supports were, and these are clearly two bricks set on end as in the example under discussion here. The floor in the P47.20 kiln would also have been at a level two-thirds of the way up the stoke hole, suggesting that this was a standard arrangement, and may have served as a "spy-hole" allowing the potter to observe the condition of the vessels during firing. However, no central pillar was discovered in this kiln, nor does Borchardt postulate one, and in this he is almost certainly correct. Kilns of much larger size, for example, those currently in use at Deir el-Gharbi (Nicholson and Patterson 1985) require no such support, and certainly a small kiln such as this would need none. Kiln [2984], however, is larger than P47.20, and the condition of the pit floor suggests that a central pillar may have been used, and has been shown in the reconstruction. Alternatively, the condition of the pit floor may be fortuitous and the large block (below) found in the fill would then become one of the bars of the perforated floor. Re-excavation of some of the other kilns found (though misidentified) by Borchardt's team may well clarify this matter, and it is quite possible that his original reconstruction (if not his interpretation) is correct.

The bars may have been fixed or loose, simply resting on the pillar at one side and on the projection at the other. This arrangement would make them more easily replaceable when they decayed through use. It would also mean that they could be removed when occasion demanded to clear out accumulations of ash, or to (re-)plaster the floor of the kiln where it was becoming eroded. Obviously, if the floor were allowed to erode, the distance between the fire and the floor would be increased and the pillar would be eroded around, making it unstable.

² This kiln was re-excavated in the 1988 season. A report will appear in *Amarna Reports VI*.

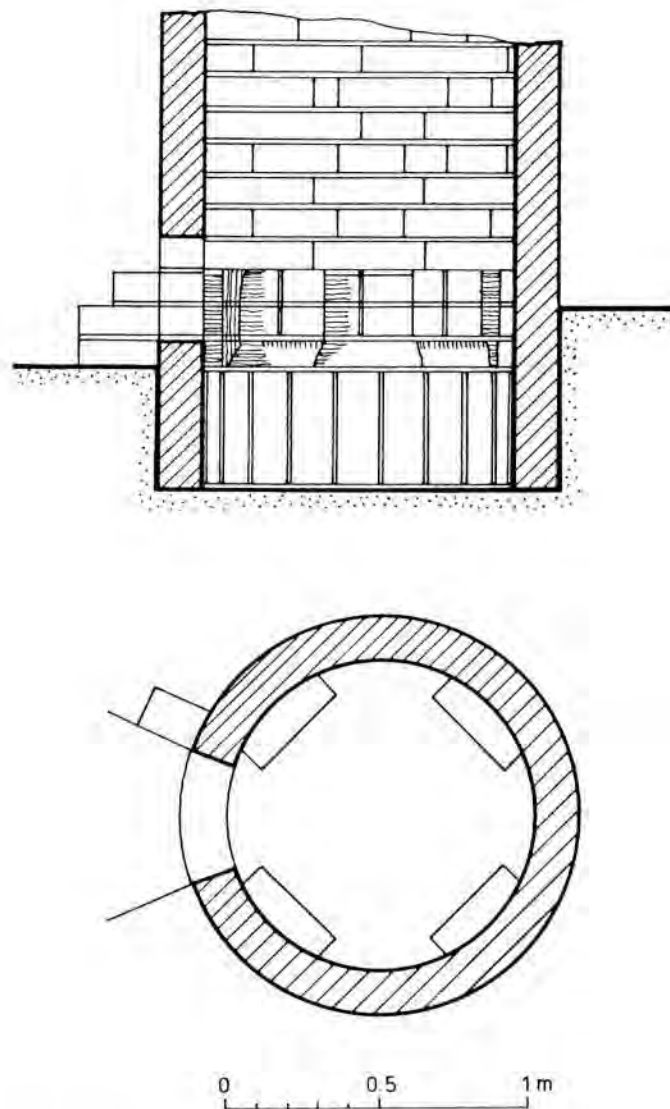


Figure 3.9. Kiln from house P47.20, after Borchardt 1932.

The large block found in the fill of the kiln was not complete, having lost the end faces, and must once have been at least slightly longer. If it were a total of 35 cm long it would still fit easily into the relatively flat portion of the base of the kiln; two such blocks could be fitted into this space side by side, and these could then be built on to form a pier approximately 35 cm square. This would account for the burning on the recovered block being confined to one face only. Even if the projections from the wall of the kiln were as little as 10 cm the distance from the sides of the kiln to the centre pillar would be approximately 50 cm, easily spanned by a block of, say, 65 cm in length to allow for overlap. There is, of course, no reason why such a gap should be spanned by a single block. In some contemporary kilns the floor is made of smaller blocks heavily plastered together, and no central support is used. Nor need such blocks necessarily have been of mud brick, they could have been of stone and so have been removed for re-use elsewhere. At the southern end of the kiln the floor probably ceased or was raised by a step, to allow more space around the stoke hole, so that the floor level would have been visible through the stoke hole, probably coming at about half its height (see above). Above the floor level it is likely that the kiln rose at least as high as the submerged portion, so a height of about 1.0 m can reasonably be suggested (Figures 3.10–3.12).

1987 excavation

It is not known whether the structure would have had a temporary dome as a cover. Many contemporary potters cover much larger kilns than this with sherds during the firing and these provide quite adequate insulation and are more easily removed than a clay covering. Nonetheless there is some evidence to suggest that the smaller kiln [3896], discovered by the Borchardt expedition (see Appendix), had such a clay dome.

In its original form, then, the kiln seems to have been of updraught type, a fire being set below a perforated floor on which stood the vessels to be fired. Hot gases from the fire, fed via a stoke hole, rose up through the floor into the firing chamber so firing the vessels. The vessels themselves would be loaded and unloaded through the top of the kiln. Updraught kilns are able to reach a maximum temperature of about 1100°C, though it is possible to fire vessels at much lower temperatures, and it is quite possible that 800°C would have been sufficient.

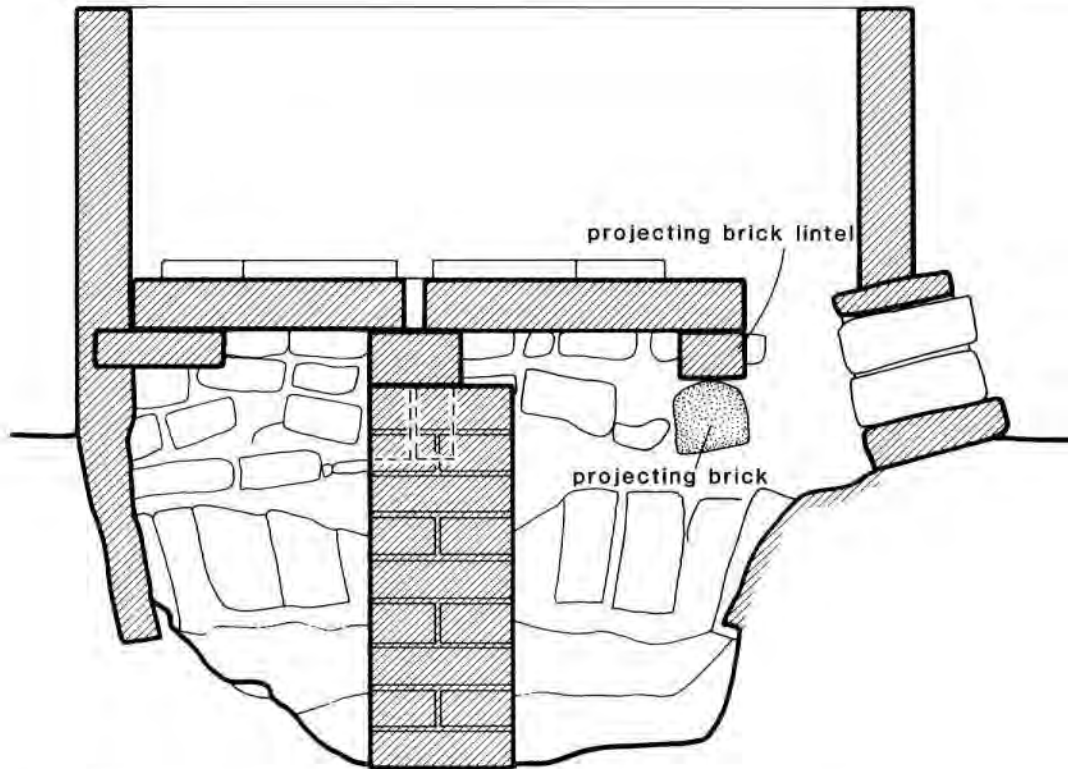


Figure 3.10. Reconstructed section of kiln [2984], based on Figure 3.6.

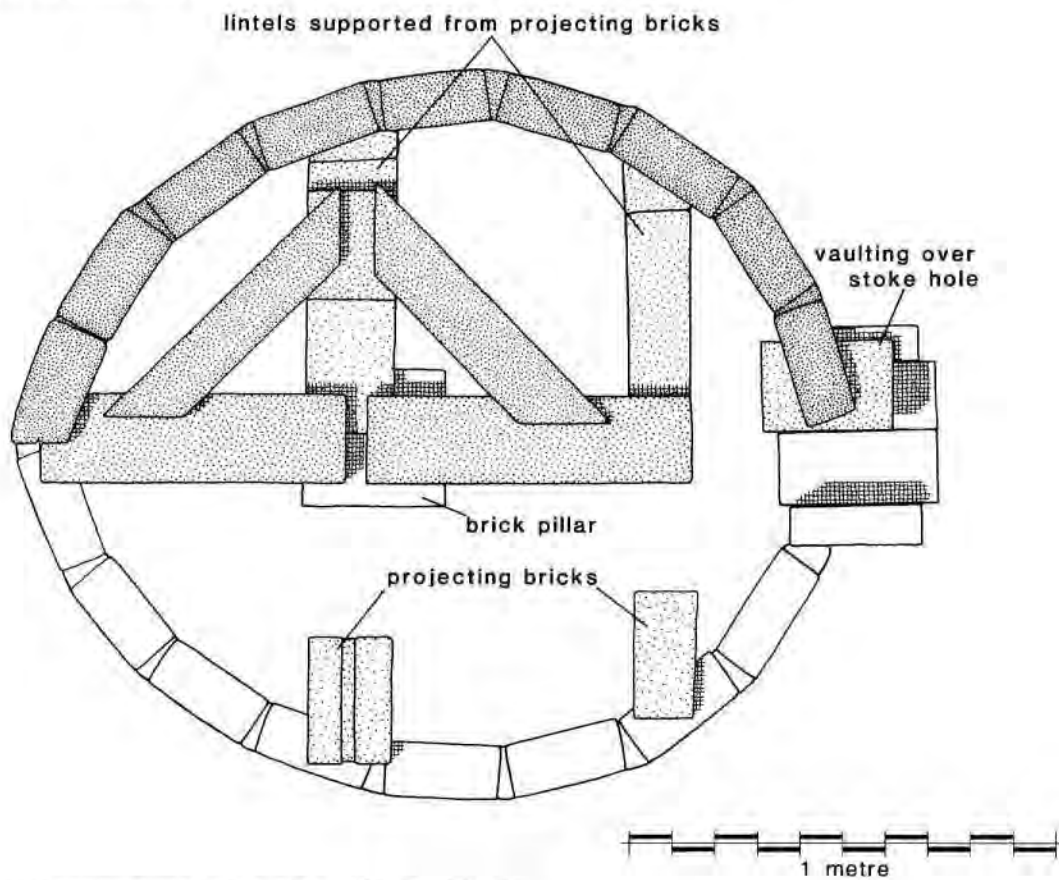


Figure 3.11. Reconstructed plan view of kiln [2984].

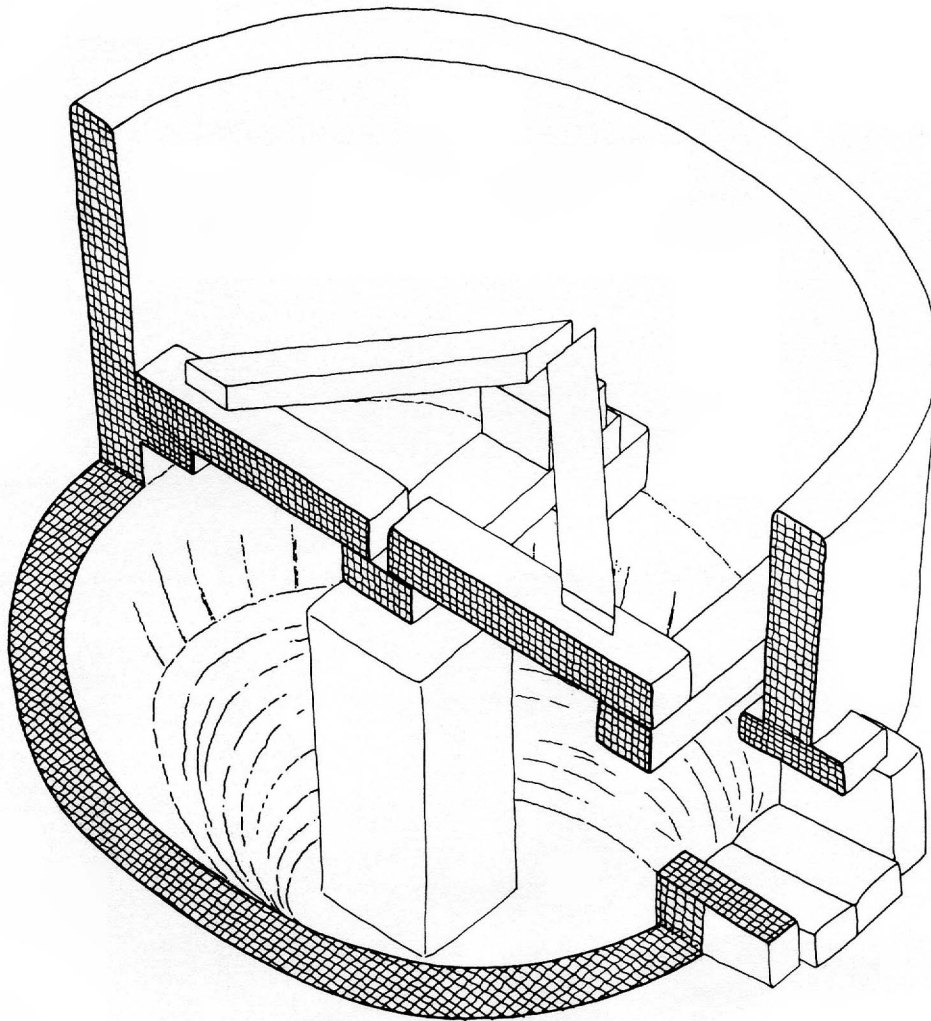


Figure 3.12. Perspective reconstruction of kiln [2984].

3.5 Appendix: excavation of the kiln [3896] in house P47.22

The discovery of the kilns in square G4 of the 1987 excavations made it profitable to look afresh at the plans of earlier excavations, to see if similar structures had been found before but without their true meaning being appreciated. One such example, described on the published plans as an "Ofen", was discovered in the south-east corner of P47.22 of the Main City, a house excavated by the D.O.G. in 1914 (Figure 3.16; Borchardt and Ricke 1980: 131–33, and Plan 32). We cannot be entirely certain whether in this case "Ofen" was synonymous with the English "oven" or kiln, since the precise German term "Topferofen" is not always used for the latter, but in a subsequent article Borchardt himself published an account of a very similar construction from a nearby house, P47.20, and identified it as a bread-oven (Borchardt 1932: 74, Plate IV, top right; Borchardt and Ricke 1980: 128–129, Abb. 17). This is re-drawn here as Figure 3.9.

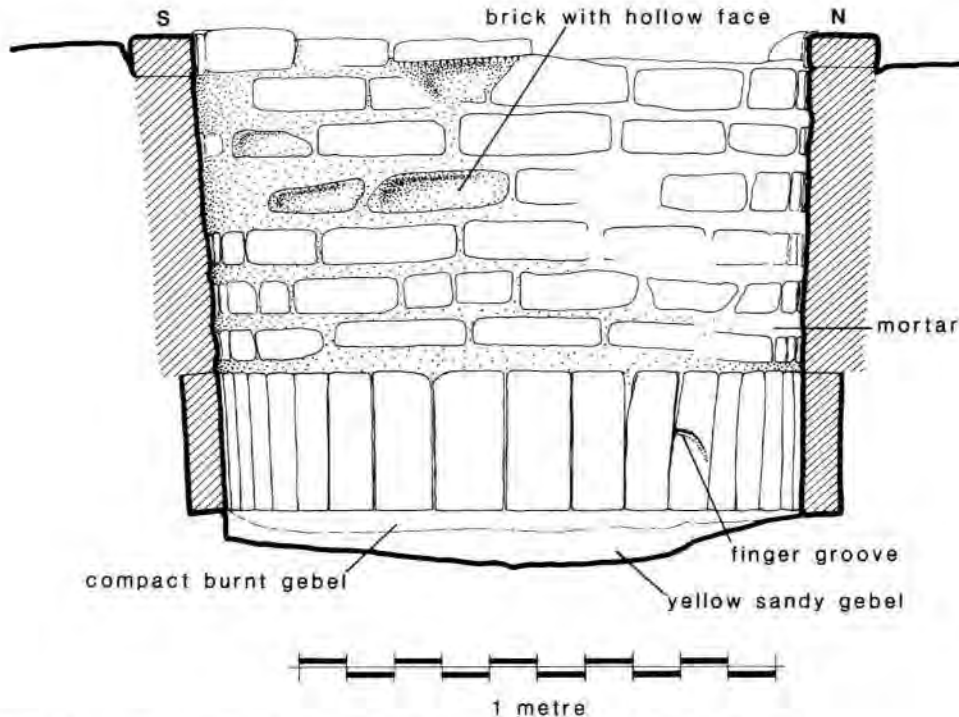


Figure 3.13. Excavated section of kiln [3896] (original by P.T. Nicholson).

It was decided to re-excavate it to determine its function, and to see if it might shed new light on the features from G4. It became apparent on cleaning the drift sand [3158] that the structure had not been fully excavated by the D.O.G., merely exposed and its rim cleaned, so that they can have had no certainty as to what type of "Ofen" it might have been.

The structure was oval in plan with external measurements of 1.58m north-south and 1.50 m east-west. The upper fill [3159] of the structure, to a depth of 0.5 metres, consisted of quite densely packed brick rubble, which may have come from the upper part of the structure, pebbles (probably derived from eroded bricks), and sand. Below this [3160] was a layer of very fine grey ash with occasional fragments of rubble and some animal bone. Underlying this in the southern half of the structure was a rather darker, more compacted grey ash, fibrous in appearance [3241], into which was cut, on the northern side, a layer of dark ash [3225] with large patches of charcoal containing quite large fragments of wood like those recovered in the vicinity of the stoke hole of kiln [2984]. Unit [3241] continued beneath this. The bottom of the structure consisted of compacted burned sand which had formed a floor [3242] now badly eroded over most of its surface so that it was not possible to see whether there might have originally been a central pillar arrangement.

The brickwork showed what must now be regarded as the common features of kilns at Amarna (Figures 3.13 and 3.14). The lowermost course of brickwork consisted of twenty-five



Figure 3.14. View of kiln [3896] in the grounds of house P47.22, looking south.

bricks set on end with their broadest faces outermost, save for one which was set with its narrow side face outermost. These bricks measured 15 x 32 x 7 cm, though most were at least partially obscured by the edge of the compacted sand floor of the kiln, or by thick mortar forming the bond between them. Unlike the arrangement in the G4 kilns these bricks were set almost vertically. Other and earlier Egyptian kilns display a similar arrangement of bricks, e.g. at Mirgissa (Vercoutter 1970: Fig. 18), so that it might be regarded as the typical arrangement for those kilns partially sunk into the ground surface.

Above these vertical bricks, laid in common bond, were seven courses of bricks which measured 15/16 x 30/32 x 6/8 cm. Many were at least partially obscured by mortar or had been badly eroded. The brickwork in this kiln, though of the same type as that used in G4, was less well executed and had very thickly mortared joints. In places the lowermost course of horizontal bricks protruded slightly over the up-ended bricks emphasizing that some of these latter were set wholly vertically. In two cases on the western side of the kiln these upright bricks actually sloped the wrong way, the tops projecting inwards. Although one of the up-ended bricks in the north-western quadrant of the kiln bore a crescentic mark made with the finger, there was no trace of the diagonal finger-incised lines seen on the corresponding bricks in kiln [3052].

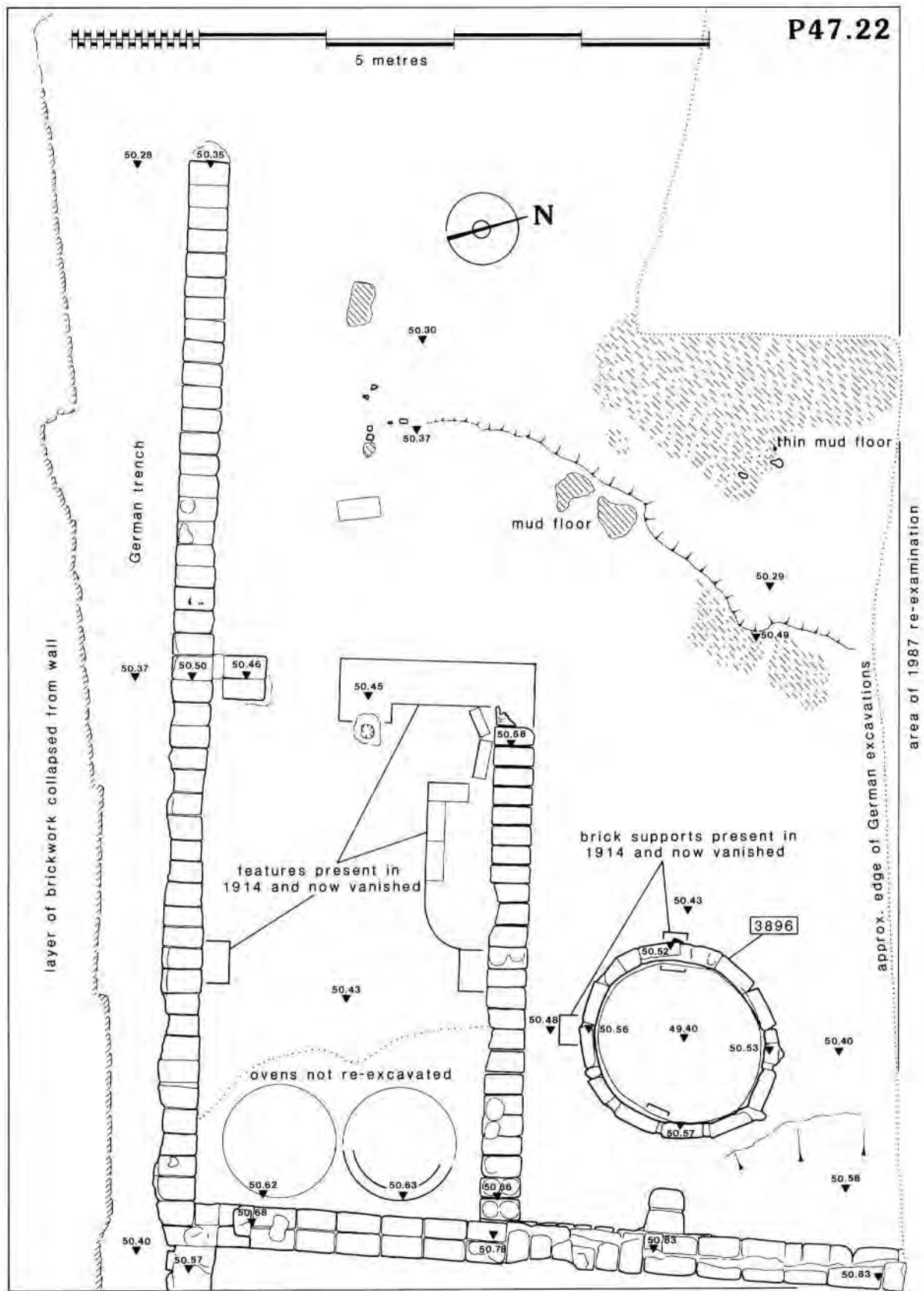


Figure 3.15. Plan of kiln [3896] and immediately adjacent ground, as excavated in 1987.

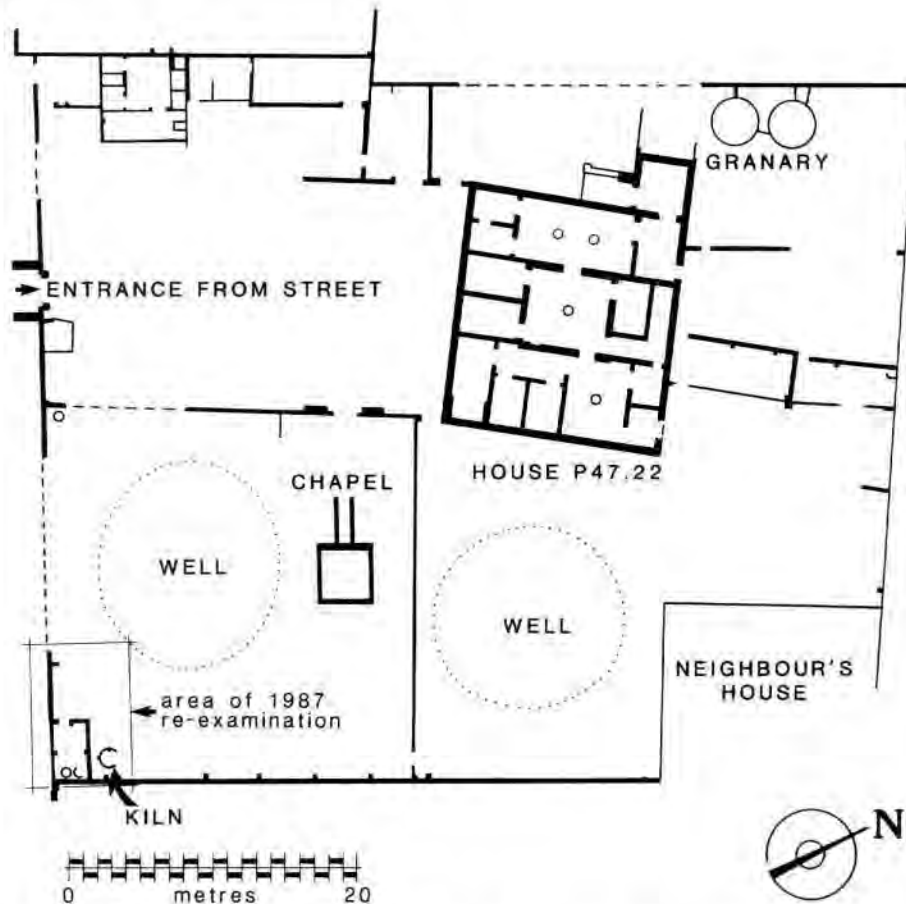


Figure 3.16. General plan of the house P47.22 and its grounds, showing the location of the 1987 kiln re-examination.

Enigmatically, there was no trace of a stoke hole in the structure in spite of its considerable depth of c. 1.15 m, almost all of which was sunk into the ground, only a part of the uppermost course protruding above. The stoke hole must have been one or two courses further above the preserved height of the structure. This would mean that the kiln was very deep in relation to its diameter, and that the angle made between the stoke hole and the floor of the fire pit when using a rake or poker would be a very steep and awkward one, the more so if a central support were used for the perforated floor. It is therefore possible that the perforated floor of this kiln was small enough in diameter to require no central support, or had only a small pillar for this function.

That the charcoal-rich deposit is from the northern side of the kiln might suggest that it was in this direction that the stoke hole faced, the opposite of that in [2984]. If so, then this might be accounted for by the location of this kiln in a courtyard of a private house which might be expected to have had a high surrounding wall, acting as a wind break.

From the fill of the kiln came several pieces of very porous, straw-tempered, mud-plaster material. One of these preserved a trace of an edge, part of the circumference of a circle. It can be suggested that these pieces may have formed part of a mud dome used as a temporary covering when firing vessels. This, if true, is something of a surprise, since many contemporary potters prefer to use sherds for this purpose. It may be that if this kiln served only the domestic needs of the house owner it was used only infrequently so that there was no ready supply of waster sherds to use as a kiln covering. Also, the small size of the structure might lend itself to a mud rather than sherd covering, it being less laborious to build and remove such a cover on a small structure. The possible removal of sherds or of a mud covering can be seen in the tomb of

Khnumhotep II (Beni Hasan tomb 3, Twelfth Dynasty: *Denk.* II, 126; also Newberry 1893: Pl. XXIX) and that of Kenamūn (Thebes, tomb 93, Eighteenth Dynasty: Davies 1930). A possibility suggested by the Haruba kiln in North Sinai is that these pieces could derive from a concave pierced firing floor (Oren 1987: 100–101), but the material probably has insufficient strength for this. Also from the fill of the kiln came sherds which had barely been exposed to heat and were not ceramic, thus confirming that this was probably a potter's kiln like the others.

It is interesting to note the location of the structure in the courtyard garden of a large private house, not far from the shrine (Figure 3.16). This might argue either for a second phase of use of the house, or for the irregular use of the kiln. The kiln stands next to a small building which contains two domestic ovens, and which uses the southern and eastern walls of the courtyard as two of its exterior walls. This building also appears to be a later insertion since it lies adjacent to a wall buttress, whereas, had it been part of the original conception, the buttress would have been rendered unnecessary by the northern wall of the building. It is possible, therefore, that the kiln and small building represent a secondary phase of activity at the house, one in which there was an increased emphasis on industrial and domestic activities.

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