

# The York Medieval Tile-Making Project — A Potter's Tale

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## SUMMARY

*A request for ridge tiles and a louver for the restoration of a medieval house in York led to a project to manufacture 6000 roof tiles for the house, based on medieval finds from York and Essex, and using medieval methods and local clays. The project took place on a site near York from June 17th to August 8th 1988, when some 3822 peg-tiles were made and fired in an experimental multi-flued kiln. The results and problems encountered are described and discussed from a potter's perspective.*

## INTRODUCTION

The project began in January 1988 with a request to make some crested ridge-tiles for a house in Coffee Yard, York, which was to be restored to its 'original' medieval state. The architect also asked if I could make both flat roof tiles and a roof louver for the house. The latter posed no problem but the 5000–6000 flat tiles needed formed too large a number for me to cope with in my own pottery at Mirfield, and initially I declined this part of the scheme. However, I formulated a scheme to manufacture the tiles using medieval methods, possibly on a site at either York or Leeds University, thereby allowing a first hand opportunity for archaeology students to understand exactly (or nearly so) the processes which had taken place on such sites they may dig or study later in their careers.

### **Manufacture of ridge tiles and louver.**

My visit to Bishopthorpe, York, to examine the original ridge tile (Fig. 1) and propose the project resulted in support from the York Archaeological Trust (Y.A.T.), and I returned home to Mirfield to think more of the project and to make the ridge tiles and louver. As these are all part of the same scheme I will give a brief description of their manufacture.

The mould and formers for the tiles were made from mahogany and plywood, cannibalized from a post-war 'utility' wardrobe (Fig. 2). The mould was  $14\frac{1}{2} \times 10 \times \frac{7}{8}$  ins ( $36.9 \times 23.4 \times 2.2$  cm) and the formers were 6 ft (1.83 m) long with sides  $5 \times 5$  ins ( $12.7 \times 12.7$  cm). They were somewhat more elaborate than those used by the medieval tilers, for it was obvious on examining the original tile that it had been merely draped over some sort of pole or straight branch to give it the required shape.

I used my own 'Toff-Tom' coal-measures clay to manufacture both the ridge tiles and the roof louver. This clay was pressed into the sanded tile moulds and

the excess removed with a wire. The mould was then lifted, and the rectangular clay slab carefully draped over the forms to ensure a symmetrical tile (Fig. 3). A large coil of clay was luted to the apex and pulled into a continuous comb. The comb former was held against this and a small wire harp drawn around it to give the final shape. This had been done on the original tile: the wire marks appeared as fresh as the day they were made.

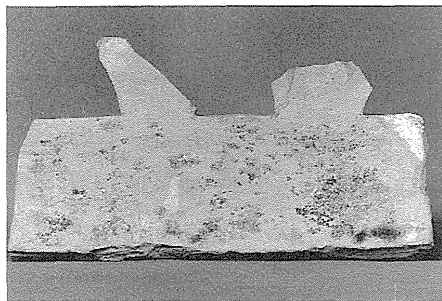
As the tiles dried they were carefully eased from their forms in order to stop them splitting. When leather hard, they were placed on edge to dry evenly, and then fired to  $1060^{\circ}\text{C}$ .

The roof louver (Fig. 4), based on that from Great Easton, Essex (Dunning 1966, 74f), was a simple throwing job made in two pieces. The body was thrown from twenty-five pounds of clay and the top was thrown as an inverted cone, from ten pounds of clay. This was luted to the body when stiff enough and thrown to its final shape. The 'minarets' were also thrown and luted to the body when leather hard, as were the rolled cowls. This was also fired to  $1060^{\circ}\text{C}$ . Two louvers were made, but one collapsed during manufacture.

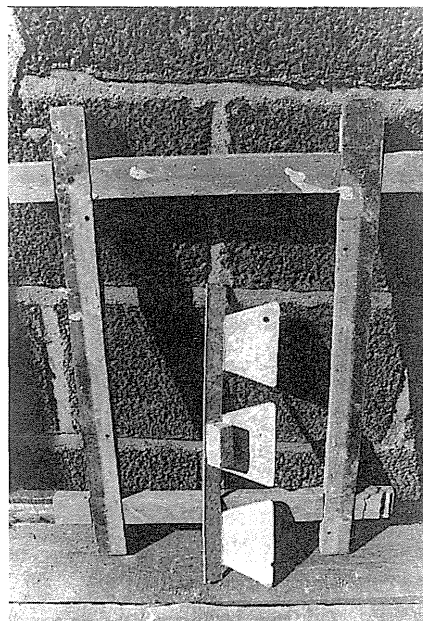
A total of forty ridge tiles were needed. Forty six were made with only a loss rate of one or two — very good indeed.

### **The project develops.**

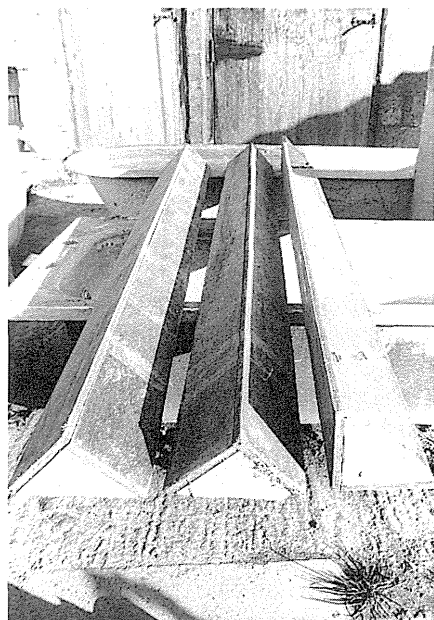
During the manufacture of the above items, Russell Wright, the architect for the Coffee Yard restoration, had obtained permission from 'Persimmon Homes' to obtain clay from their Acomb site to the west of York. This was part of the original concept of using the Vale of York boulder clay for the tiles. A site for the manufacture at one of the Universities was not possible but negotiations took place for one at Pigeon Cote Farm near New Earswick, two miles north of York.



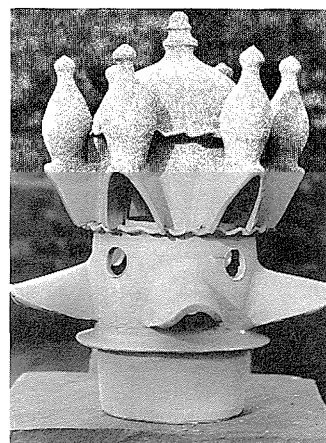
*Fig. 1. A medieval ridge tile from York. Photo courtesy of N. Dobson (Y.A.T.).*



*Fig. 2. Tile mould for ridge tiles and comb former.*



*Fig. 3. Ridge tile moulds.*



*Fig. 4. Roof louver for the house in Coffee Yard, based on that from Great Easton, Essex. Photo courtesy of N. Dobson (Y.A.T.).*

I took approximately one hundred-weight of clay from Acomb back to Mirfield to test for plasticity and shrinkage rate. Plasticity was good and the clay proved good for throwing. When fired to 1100°C, there was a shrinkage rate of 11% — fairly average for such clays. This clay was washed and sieved before use, but I did make a tile from clay which was cleaned by slicing it and removing any large stones (of which there seemed to be few) by hand. Having made this sufficiently plastic by the addition of water, the tile was rolled and cut, dried and fired to 1100°C. The shrinkage rate was the same.

By May the Y.A.T. had secured the site for the 'tilery' at Pigeon Cote Farm and on 25th May I went to York to see if it would be suitable. I met Kevin Selwood of Cultural Resource Management Ltd. and we visited the site, which was to be developed as a

sports and shopping mall. It proved ideal and was donated free of charge for the period needed by David Sherry, the owner. We then revisited Acomb and arranged with the building site manager, Mr Walkington, to have twenty tons of clay dug and delivered to the site. He was very helpful, and whilst we were there had the site JCB dig me a further specimen of clay; it was the same as before, a good open sandy body with few stones — ideal.

I returned once more to Mirfield. Having visited Stephen Moorhouse in April and discussed at some length medieval kilns and tileries, and having also now at hand the details of the site, the number of tiles needed (6000), the performance of the clay, and books and articles on the relevant tile making techniques, I began to work out the exact details of the project.

**Parameters.**

The most important item would be the kiln, and after much thought I decided on a clamp-kiln, this being possible as there was a huge pile of rubble near to the site. As can be seen there were to be three long fire-trenches, and two tile placing areas. The walls could be rapidly constructed from the rubble and I envisaged a roof of suitable rubble and broken tiles. However, in the final analysis this was not possible and we used corrugated iron sheeting. The whole kiln would be rendered with spare clay. The flue or outlet was to be above the central trench in the middle of the kiln, and all the work would be done by the four outer fires, the two fires at the ends of the central trench pulling the hot gases through the stacked tiles and exhausting from the vent. I had no definite idea of how to stack the tiles, but some sort of 'house of cards' system seemed best (Fig. 6a); I decided that an easy way of doing this could be found once on site, as indeed it was.

Fuel for the kiln would have to be wood, coming from either woodyard scantlings, or forestry off-cuts or demolition timber. Unfortunately demolition timber in and around York seemed to be at a premium, and we decided to use cheaper forestry off-cuts from the Forest of Dalby, North Yorkshire. I have fired many wood-fired kilns, and I knew that a large amount, around 15–20 tons, would be needed.

The quantity of clay having been arranged and the body tested, I needed now a system for processing. The clay which I had seen on May 25th was fairly clean, and it seemed that all that would be needed was for it to be broken down, wetted and homogenised by treading. Documentary sources indicate that clay had to be dug in autumn, and then by law left to weather and be turned during the winter months. This would allow the tilers to homogenise the clay and easily remove stones, roots and other matter. They would then be able to use the clay immediately in spring when the tiling (and potting) season recommenced. Potters will tell you that weathering improves clay-plasticity (which it does), and that this is why an over-wintering period is necessary (which it is if one is to use the clay for throwing). However, for tile making, stone removal and homogenisation is more important than ultimate plasticity. Consequently I decided that as the clay was reasonably clean and plastic, and as we had to make the tiles before the end of the summer, overwintering could be dispensed with.

For the actual tile manufacturing, a simple mould was needed, similar to that used for the ridge tiles, with a device for accurately positioning the peg hole in the centre of the tile. The tile moulds (Fig. 5a) were made from oak laths with internal dimensions  $14 \times 9 \times \frac{1}{2}$  ins ( $35.5 \times 22.9 \times 1.2$  cm) giving a tile of roughly the right size,  $12\frac{1}{2} \times 8 \times \frac{3}{8}$  ins ( $31.7 \times 20.3 \times 1$  cm).

The following buildings were needed on site:- open-sided, roofed scaffolding shelters to protect dry tiles

from adverse weather conditions; a tent or preferably a caravan for me to live in for the duration; one portaloos (very important); and two site huts, one for the team and one for the equipment. Of supreme importance was water. Fortunately there was a large supply pipe going to the neighbouring concrete works which could be tapped and metered easily.

As stated above, I had wanted students to help on the site and hoped this could still be possible for the fortnight required. This may seem a short time, but the project was to take place in mid summer, and good, or at least reasonable weather and long day light hours could be guaranteed.

Armed with all these ideas I went to Bishopthorpe again to meet Martin Stockwell, in charge of the project for the Trust. To my pleasure and surprise, my lists and ideas were accepted. Costs were estimated (Appendix) and four to six helpers were found from the York Community Programme. The project was underway, and a starting date, June 20th, was fixed.

## TILE PRODUCTION AND FIRING

**Preparations.**

So far it may seem as if I lived in 'cloud cuckoo land', having not allowed for any misgivings or disasters. This is not true. I was terrified of such things. Twenty two years of being a potter, fifteen of them full-time in ceramics, shows that this happens all too often. When I went to the site on June 17th it was with a mixture of excitement and trepidation. My fears were immediately realised: the caravan I was to live in had not arrived, and I had to return to Mirfield. At least the weather was good — hot and dry. The rest of the equipment, two site huts and contents, one portaloos, and a superb scaffold shelter were all there along with a huge pile of clay.

I returned the following day with two friends and we had a trial run of breaking, wetting and treading the clay, followed by tile making. The latter proved not too difficult and my idea of making 1000 tiles a day seemed reasonable. Still no caravan, so I returned home again. On Sunday morning I went back to York by train; Russell Wright met me at the station and took me to the site. The caravan was there! I installed my kit and prepared for the task in hand. Clay found during the excavation of a ditch in a neighbouring field was collected, and as it was plastic, I made very quickly about a dozen tiles. The clay was very good and clean. The evening was fine and sunny; everything seemed to bode reasonably well and I retired earlier than usual.

## Day 1.

I am not the best early riser in the world, but there was an excellent alarm clock every day — the arrival of two 38 ton cement wagons at the neighbouring concrete works at 6.00 am. By 7.30 am I was ready for the first day, fine sunny and warm — all seemed well. The

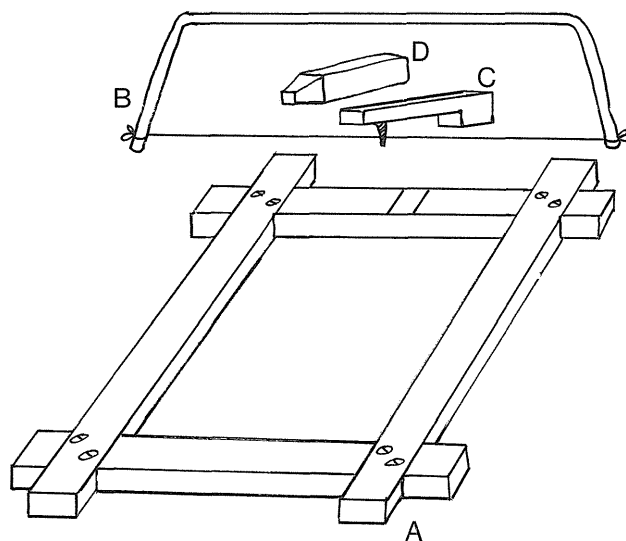


Fig. 5. A: tile mould made of oak strips  $1\frac{3}{4} \times \frac{1}{2}$  ins ( $14.5 \times 1.3$  cms) screwed together at the joints; the internal dimensions are  $14 \times 9$  ins ( $35.5 \times 22.9$  cms). The frame was placed on a moulding table, sanded and wedged clay was beaten into it.

B: harp made from a steel bar  $\frac{1}{4}$  in (6 mm) in diameter, with heavy-weight 'Laystrate' model aeroplane wire. Size c. 18 ins (45.7 cm) wide and 6 in (15.3 cms) deep. Drawn across the mould to remove surplus clay.

C: hardwood positioning pin  $2\frac{1}{2}$  ins (6.4 cms) from the screw to the rear step. Placed between the parallel lines on the mould to mark the position of peg-holes on the tile after removal of excess clay.

D: hardwood hole-maker with square sharpened end, pushed through at mark made by 'C'. Mould was then lifted and tile moved to drying boards; all tiles were cleaned or fettled with a fettling pin.

volunteers arrived at 9.30 am, and we set to work with a will. In spite of the very hot weather, by the time they left at 3.40 pm we had broken down seven to eight tons of clay. During the day, mould sand, building blocks (for the moulding tables) and polythene sheeting arrived. In the evening I spent over half an hour wetting down and covering the clay we had broken down.

#### Day 2.

The second day was a little cooler, and I began by experimenting with schemes for stacking the tiles in the kiln. The one which proved most stable was a 'house of cards' style made rigid with bobs of soft clay (Fig. 6b). By placing tiles flat on top of the tiers of tiles I could build up a very strong stack. During the day we broke down a further four to five tons of clay and built the moulding tables.

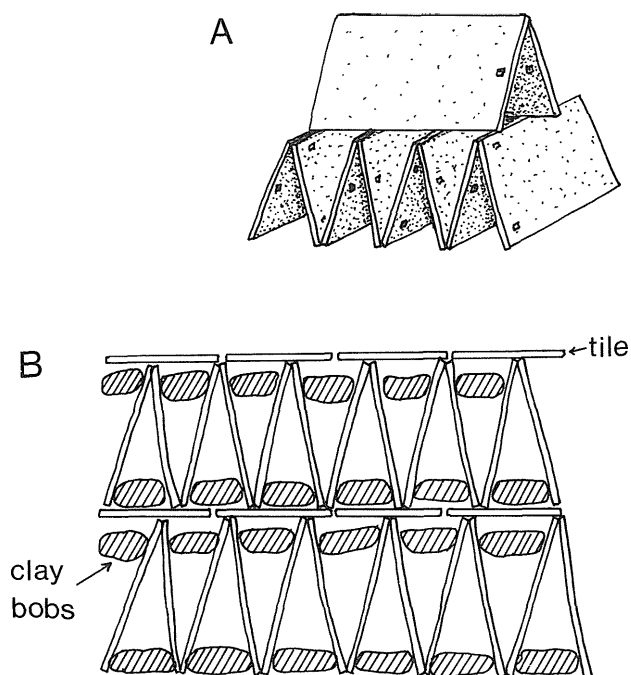


Fig. 6. A: Original idea for tile stacking in the kiln.

B: Final stacking system.

#### Day 3.

On the third day the clay was soft enough to tread and homogenise, which we did, but during the making of the first tiles we hit our first real problem.

The manufacturing sequence was as follows: the moulds were placed flat on the tables, a handful of dry sand applied to the sides and to the table, and a large piece of wedged clay was then hammered into the mould with flat hands and fists. The excess clay was removed with a wire harp (Fig. 5b) and lifted off; the peg hole was marked using a piece of wood with a screw in it placed between two parallel lines (Fig. 5c). The peg hole was made with a tapered, square, hardwood stick (Fig. 5d), and the mould removed. The tiles were then removed from the table and placed on long scaffolding planks to dry. When the planks were full they were set in the sun.

We soon discovered that the clay contained a large number of stones. This seriously hampered production since the stones tended to rip the tile apart as the wire harp was drawn across the top of the mould. Consequently I began to remove stones from the clay by hand, slicing through it with a cheese-wire and removing the stones it snagged against. This proved to be an almost impossible task as the tilers soon outstripped my efforts. This was not the only problem which we encountered, for the tiles we had set to dry were starting to split and crack. Despite moving them into the shade of the scaffold shelter, the cracking and splitting continued and of the 136 tiles produced about 71 split — a great worry.

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### Day 4.

The following day 269 tiles were produced after we had all first de-stoned a large amount of clay. A more thorough wedging and beating of clay into moulds plus placing them under cover to dry resulted in only a small proportion being lost. That evening a medieval roof-tile from the excavations on the Stakis site in York was brought up to the site and proved identical to those we had made, and our spirits, which had fallen the day before, were raised.

### Day 5.

The final day of the first week saw only 193 tiles made. Once again de-stoning could not keep up with the production. I resolved that the following week we would spend the whole of the first day de-stoning and wedging clay. Two of the tile moulds had split, but were easily repaired and two of the wire harps had broken 'strings'. The wire wearing out proved to be a constant problem and posed several questions: how did medieval tilers cope with this, and where did their wire come from?

like that from the ditch, was almost stoneless, very similar to that used at Curtis' pottery at Littlethorpe, near Ripon. This is typical of boulder clay, laid down in random pockets. The medieval tilers would have known exactly where to get the best clay, which in the Vale of York I did not. The plan of the kiln is shown in Fig. 7a.

### Day 7–day 10.

The weather worsened and on Tuesday of the second week we trod, de-stoned and wedged more clay, about an extra ton and a half of clean material being added to the pile completed the previous day. On the following day, 314 tiles were made, and we were at last working up a production rhythm. On Thursday 364 more tiles were made but the weather was becoming even bleaker.

That evening an almighty thunder storm shattered the peace and an evening monsoon converted the site into a quagmire. The rain continued for most of the project, with falling temperatures, and the trenches of the kiln were soon flooded. Fortunately the central trench had a land drain in it and the water quickly drained away from it. We dug lateral trenches across

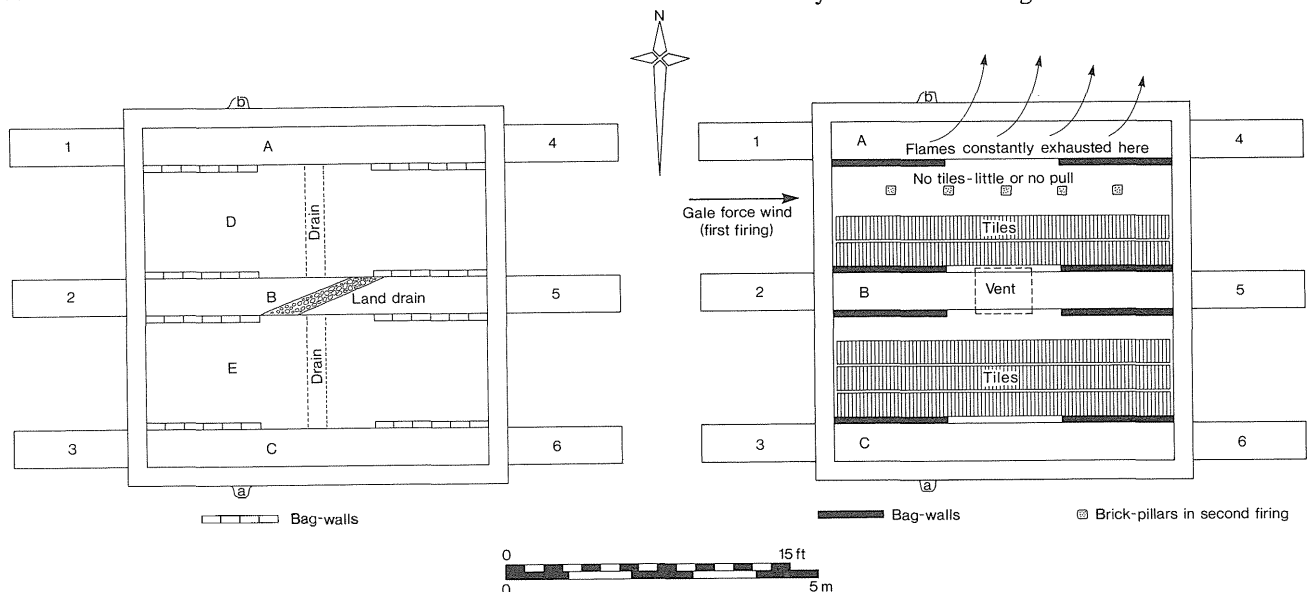


Fig. 7. Left: Kiln plan. Right: Kiln as packed. Drawn by Michael Jones.

I was very impressed by my helpers who continued to work hard and with enthusiasm. Though they were only available from 9.30 am to 3.30 pm, by the end of the project they had become excellent tile makers.

### Day 6.

On the following Monday the problems began in earnest. The weather had changed, and it seemed as if winter had begun five months early. We managed to de-stone two or three tons of clay, but some of the temporary helpers were not too enthusiastic; I couldn't blame them.

I decided to make the kiln a pit type and for it to be machine dug due to the hard rubble topsoil. This took three hours. Irony of ironies, the clay from the kiln-pit,

the placing areas to drain water away from the side trenches, but the rain was so heavy over the following weeks that the land drain could not cope. The water backed-up and filled all the trenches, which still contained water when we finally fired the kiln (Fig. 9). The rain continued on the tenth day and we de-stoned and wedged clay between the long heavy showers. Again, as throughout the project, once the team left, the weather dried up.

Once the tiles had dried sufficiently they were stacked and left to dry out thoroughly under the shelter, being covered with polythene to protect them. I also had to stand some of the large corrugated sheets around the open shelter to give more protection, these being held in place by some of the larger tree trunks which were to act

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as kiln fuel. One night I had to get up in the early hours, during a gale and rain storm, to replace these sheets and polythene — a comical figure in wellies, underpants and cagoul, frantically rushing round like a headless chicken. After about an hour I had things under control and returned to bed exhausted. In the eastern sky appeared a long orange light which later I found out was a comet. I must have been one of few who saw it: again, was it a bad omen?

That was the end of the second week and we had only produced 1,275 tiles — 4,725 short of the total. It was clear that I had badly underestimated the time needed, the weather, the amount of foreign matter in the clay, and the number of tiles, which under our limited circumstances, we could produce in a day.

### Week 3—week 8.

So far I have given daily details of the first two weeks work, because it was the total time I had allowed for the job. However it went on for a further five weeks with one extra for a second kiln firing. I will deal with these further five weeks in general terms and only detail the two firings.

As I have been at great pains to state, the weather was dreadful, being the coldest and wettest summer on record. Consequently most of the tile making had to take place in the scaffolding shelter. By the fourth week we were falling behind again, despite the arrival of reinforcements (sixteen men for three days), so I decided

to use the virtually stone-free site clay. Using a large tractor and rotavator we completed three days of clay breaking in three minutes. This increased production, and on July 20th we made a record 406 tiles with three teams of makers, and a wedger and de-stoner. On average we made 250–300 tiles on making days, even the 406 falling well short of my 1000 per day, but as stated above, hours were limited to six per day and team members were not always allowed to come every day.

Tile production went on until two days before firing took place. In all we made 3,822 tiles. Each weighed four to five pounds and was fettled with my own fettler and hole maker after drying out. In total we had used some eight to nine tons of clay, all of it cleaned and wedged by hand. Around four to five hundred tiles were lost in drying and in kiln packing, which took place on the Wednesday and Thursday before the firing on Friday and Saturday, July 29–30th.

I had been building the kiln in the evenings of production weeks. The placing areas were made level and the edges squared off; the walls around the top were completed, levelled and rendered, and a large amount of bricks were sorted from the rubble we had acquired and were made into bag-walls. Kathy Batt from Sheffield University set up archaeo-magnetic experiments in the kiln. The day before firing the York City Volunteer Services Community Programme (Y.C.V.S.C.P.) arranged for some of the six foot



*Fig. 8. Phil Dunwell and author packing both the placing areas simultaneously, showing the method of stacking.  
Photo courtesy of Michael Andrews.*



(1.83 m) lengths of timber to be cut up, whilst Phil Dunwell and myself completed the kiln packing in frequent rain squalls (Figs. 7b, 8). The rest of the team chopped and sorted wood into piles at each of the six fire-mouths. A severe rain storm in mid afternoon put paid to any further work, and the tiles and kiln were well covered with polythene sheeting.

### The firing.

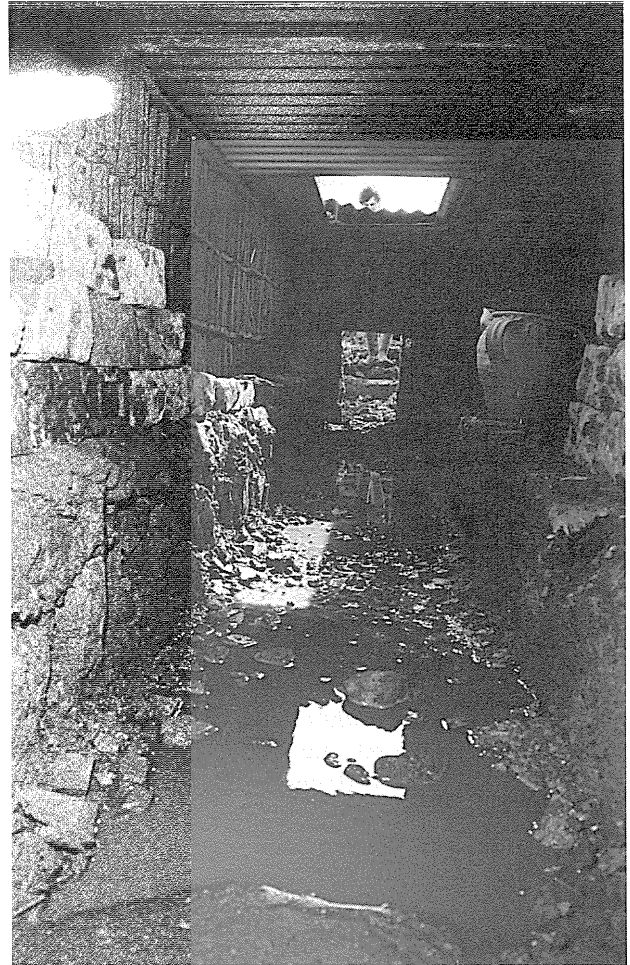
The day of the firing dawned bright, but with very strong winds. During the night the polythene sheets had gathered gallons of water in the almost continuous rain. These were carefully removed and the corrugated iron sheets were put into place with many of the broken tile sherds as insulation, and then rendered to the walls with soft clay. Excitement mounted and the media arrived; in spite of the gale now blowing I saw, at last, some light at the end of the tunnel. But as I remarked in my diary 'it is daylight or an oncoming train?'

At 2.00 pm everything was ready and the kiln was 'lit-off'. By 6.00 pm there had been no collapse of the kiln and even though a gale force wind was causing the fires at the easterly end to fire mostly fresh air, things seemed to be going very well indeed. At 10.00 pm the wind had dropped and the fires were working well, although because the northern placing area was only half full, the fires in this trench were not being pulled through the tiles like those in the southern trench, but were exhausting through the edges of the corrugated sheets (I will explain this later). By 2.00 am only seven people were left around the kiln, but the fires were roaring and the whole of the inside had a comforting glow showing temperatures between 700°–800°C. Flames in the order of six to eight feet were issuing from the central vent and stoking was at a very sharp rate. It seemed the firing would end around 8.00 am, but at about 5.00 am disaster struck.

The loss of much thin timber in the early part of the firing, due to the gale, had left us with only very large logs. Despite our efforts, the temperature refused to climb above 950°C and at 7.15 am I had to admit defeat. Every one went home absolutely dejected and I retired to the caravan and tried to get some sleep. This proved almost fruitless and by 11.00 am I got up and tried to occupy my time around the site. However, late in the afternoon the weather worsened again, the wind strengthened and the rain bucketed down. The one consolation was that we had started to fire the kiln the day before.

Sunday saw a great revelation: although the tiles were fired, they were too soft. I thought that another firing might succeed in completing the job. With the support of the architect and Y.A.T. it was agreed we could get more wood from Dalby Forest and try again.

In the afternoon we began to repair the kiln. The roof over the half-packed part had bent inwards rather badly, having no tiles to support it, and we so removed the corrugated iron sheets and straightened them in the



*Fig. 9. Kiln immediately before firing, showing water still in the trenches and central vent. Photo courtesy of Michael Andrews.*

time honoured way of jumping on them. Brick pillars were built as supports and the sheets replaced. Arrangements were made for a further firing on the following Saturday, August 6th, and 'flashing timber' was collected from Dalby Forest on August 1st. Another 15 tons of assorted six foot logs (1.83 m) were delivered during the week.

On Friday August 5th I returned early to York and was on site by about 8.30 am. By 9.00 am team members had arrived and we began sawing and chopping the wood which had been delivered during the week. By 4.30 pm everything was ready for the refiring on the next day.

### The second firing.

The weather of Saturday August 6th was gloriously sunny and hot, but with a brisk westerly wind. The fires were lit around 8.00 am and by midday were roaring along the full length of the trenches. The kiln was pulling well but still with the flames exhausting from the gaps between the wall and the sheeting on the northern edge. At 4.00 pm the kiln was glowing and flames were issuing from the vent; by 6.00 pm we had started to use the flashing timber, hoping to reach a

temperature of around  $1000^{\circ}$ – $1060^{\circ}\text{C}$  by 8.00 pm. Unfortunately the kiln began behaving in the same way as the first firing and the temperature stuck around  $950^{\circ}\text{C}$ . My heart sank, but Graham Rae, God bless him, suggested closing the central vent. I assured him that this would have no effect and furiously stoked the fires with both flashing and thicker timber. At around 8.00 pm most of the helpers had to leave and in great desperation, with the spectre of another failure looming, I closed the central vent by a few feet. This was about eight feet by four feet, and had a piece of corrugated sheeting which could be pushed backwards and forwards over it. To my amazement those people who were stoking were almost sucked into the kiln as the fires roared away, a tongue of flame about sixteen feet long issuing from the vent. Spirits rose instantly as did the temperature, and by about 9.30 I could see some  $1000^{\circ}\text{C}$  pyrometric cones beginning to bend, but unfortunately due to enthusiastic stoking, those and the others were knocked over. By 10.15 pm, or so, the colour inside the kiln looked as if a temperature of  $1020^{\circ}$ – $1050^{\circ}\text{C}$  had been reached and at around 10.30 pm we shut the vent completely and blocked off the fire mouths. I returned to York that evening, sunburnt, exhausted and somewhat happier than the week before.

We returned on Sunday morning but the kiln was still too hot to draw, and some tiles still seemed soft although some seemed to be fired properly. We decided to draw the contents on the next day. This was the final anti-climax. Only 347 tiles were fired and fit to use. Many more were hard enough but because they had not matured sufficiently in the firing the week before, they had dunted; these dunts had opened to form very large cracks and so the tiles were useless. About 1700 useless tiles were left in the kiln or cast around its edges along with all the placing bobs, but about another 1200 were brought back to my pottery in Mirfield to be fired again. After taking a valedictory look at the kiln, I left the site for good.

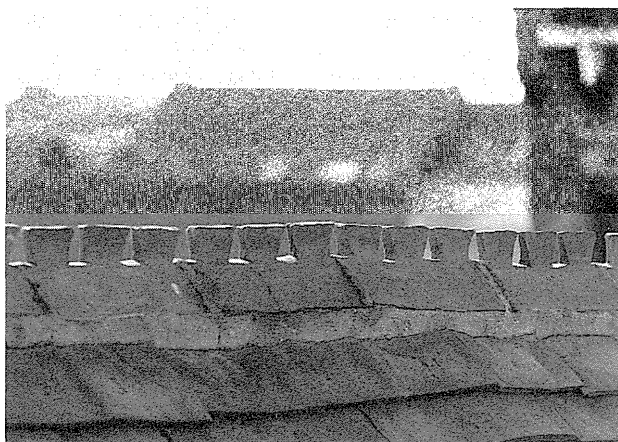


Fig. 10. Roof louver in position on the roof in Coffee Yard, York. Photo courtesy of K. Buck (Y.A.T.).

The tiles were fired again, but I lost around 400 more. Bad luck had struck again as a lot of these tiles had spalled and are not up to modern building standards. However, the Coffee Yard house roof has now been tiled with hand made tiles from Doncaster, and the ridge tiles and roof louver are in place (Figs. 10, 11). The project tiles have been stacked in the house for use in some less weather affected position.

Thus, as I stated at the outset, I failed to produce usable tiles, but I gained an enormous amount of knowledge in the process.

## CONCLUSIONS

Many of the parameters affecting this project, such as the tight schedule, and experimentation would not have existed for the medieval tiler. With time to remedy all the mistakes, a permanent tilery and unlimited fuel, production would have been easier. The time factor was almost as ruinous in this project as the weather, and their combination accounts for my failure.

**1. The kiln and fuel.** The design of the kiln was sound and had it been fully laden I am sure it would have worked perfectly. The southern placing area was

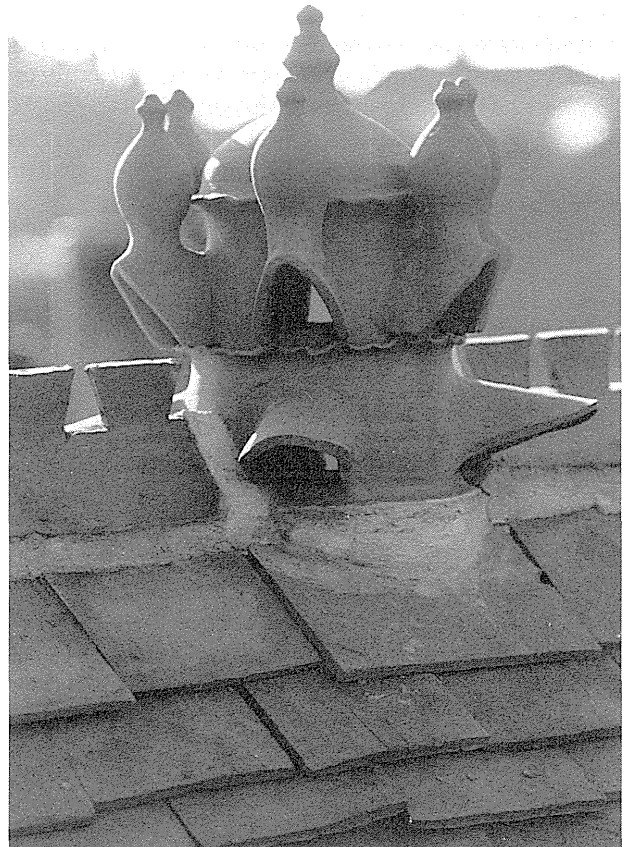


Fig. 11. Ridge tiles in place on the roof in Coffee Yard, York. Photo courtesy of K. Buck (Y.A.T.).



three quarters full, and the northern side only half full. With hindsight we could have put all the tiles in one or other placing area and built a new wall along the edge of the central trench and thus used four and not six fire mouths. Time was against us and we had to pack the two areas simultaneously.

The belief that the hot gases would be dragged through the tiles by the central fires was well founded, and on the southern side during the firing, flames could be seen shooting through the gaps between them. However, because there was a large gap between the 'wall' of tiles and the fire trench on the northern side (Fig. 7b), an area of dead air prevented gases being sucked towards the vent. The gases exhausted between the kiln walls and covering, the area becoming blackened and burnt.

The strong winds experienced in the first firing resulted in an inefficient use of fuel. Had conditions been calm, or had I closed the vent as in the second firing then we might have succeeded straightaway.

The time allowed for the firing, 24 hours, was more than adequate as was shown in both firings, the second only taking fourteen hours. The fifteen tons of timber was also adequate. The six foot (1.83 m) lengths of the timber, with diameters varying from one and a half inches to one foot (3.8–30.5 cm) were ideal. A good fire can only be maintained without firebars by using thick logs which create space for oxygen to be sucked into the centre to give good combustion and long flames. Too many small pieces of wood of the faggot type lead to lots of ash and a dead fire. When the firings were over, only about two bucketfuls of ash were left of the twenty five to thirty tons of wood used.

In both firings, smoke was only produced for approximately twenty minutes at the outset, and the thick black stuff associated with reduction or over-stoking did not occur at all. However, the glaze on some pots I had placed in the kiln was beginning to turn green, which will occur on raw glazed wares in such a kiln, the reduction coming mostly from carbon burning out of the body.

The kiln stood up well to the firings and could have been used many times with only simple running repairs, provided that vast amounts of timber could have been found.

**2. The clay.** Why did I use the York boulder clay and not my own Toff-Tom potting clay? It seemed to be more 'authentic' and I know that the Toff-Tom contains a lot of stones, while the York clay first seen was much cleaner and thus easier to use.

Two types of clay were used, the sandy and stony Acomb-type and the site clay with a tight fine-particled but clean body. Of the two, the Acomb clay made the best tiles, once clean, i.e. little warping and a low shrinkage rate, but the site clay fired better — harder at lower temperatures. With hindsight and more time, a mixture of the two clays would have been ideal. Both seemed to stand up well to fast firing, but the Acomb

clay, of which a good 80% of the tiles were made, needs a fairly high temperature to mature, and because of this many of the tiles dunted upon cooling which caused such a high loss rate in the second firing.

**3. Production methods.** Very adequate, and had the weather been good and more time available for making, then perhaps 6000 tiles could have been made and fired in about three and not the two weeks I had allowed.

**4. Personnel and production.** As I have stated on numerous occasions my helpers were first class, and I can only praise their efforts. However, to run a full time tiliary on such a site, four to six people could make vast amounts of tiles in the production season i.e. Easter to October, even if the weather was bad. We were unlucky in the fact that the time we spent making our tiles was the worst weather of the summer; both before and after the weather had been reasonable to good.

In the tile making it became obvious as we went along, that the most important things needed besides clay, sand and wood (always readily available), were water and wire, vast amounts of each being necessary. The wire on the harps wore out at a phenomenal rate and in spite of all the rain, the clay pile seemed to need constant wetting to give the correct consistency for use. Modern technology gave us polythene sheeting, constant water on tap and yards of laystrate model aeroplane wire — but how did medieval tilers and potters manage? How did they live on site? What did they eat? Management has a great bearing on production.

#### Postscript

After the project was over, and indeed before, I determined never to do such a fool-hardy thing again, but as time passes I realise that the failure of the project was not due to my planning, lack of effort or to any real lack of support or backing, but due to bad luck in the period we chose to do it. Had it been this recent summer (1989), one of the best summers on record, then I am sure it would have been a great success. Thus at this moment in time, if someone were to say "here's a chance to do it again, incorporating all you know" — then I must admit that I'd be there like a shot. A second opportunity to succeed would be a great tonic.

For those who read this article and find that it asks more questions than it answers, then I will be only too pleased to provide further information on request.

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## A POTTER'S TALE

### APPENDIX 1

#### Equipment used during the project.

1. 20 tons of clay (Acomb Persimmon Homes site)
2. 1 ton fine sand
3. 15 tons of wood in 6' lengths seasoned dry
4. 11.5 tons demolition rubble
5. 5 tons old tiles or slates
6. One 30' × 30' scaffolding shelter with roof only
7. 1 roll of heavyweight polythene sheeting (4 metres wide × 25 metres long)
8. 6' × 6' × 1' round BMS for harps
9. Six 6'6" × 2'6" × 1" heavy boards for tile making tables  
Thirty concrete blocks.
10. 6 tile moulds as per Fig. 3.
11. 6 hole locators.
12. Thirty-six 12" × 8" × 1" tile boards
13. Six 3 sided boxes for sand (orange boxes) with 1/8 holes drilled across c1/4" from ends
14. 2 dozen tapered pegs for tile-holes
15. 10 stout poles 1 1/2" × 6'6"
16. 2 site huts with locks — one for tilemakers, one for equipment storage
17. Accommodation — 3 berth caravan with all facilities
18. 1 portalo  
First Aid Kit
19. 10 pairs of industrial gloves
20. 10 pairs rubberised gloves
21. 6 leather foundry aprons for kiln firing
22. 6 pairs of heavy duty leather gauntlets for firing
23. Suitable head gear for firing
24. 1 box (50) pyro-cones  
Eight 8" × 1" metal pokers
25. 3 wheelbarrows
26. 6 Bushman's saws
27. Felling axes
28. 6 spades
29. 6 shovels
30. 6 mattocks

31. 6 plastic buckets
32. Rags and 5 Gal paraffin
33. Six 40 Gal drums for water
34. Old corrugated sheeting (steel)
35. Staffing Arrangements: John Hudson  
+ Assistant + 4 volunteers (YCVSCP)

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#### Resumé

Besoin de tuiles faitières et d'un abat-vent lors de la restaurations d'une demeure médiévale à York a engendré le projet de fabrication de 6000 tuiles, techniques médiévales connues par les fouilles menées en Essex et à York, et à partir des argiles locales. L'expérience a eu lieu près d'York du 17 juin au 8 août 1989, où quelques 3822 tuiles chevillères ont été confectionnées et cuites dans un four expérimental à circulation multiple. Les résultats et les difficultés rencontrées sont décrits et commentés du point de vue du potier.

#### Zusammenfassung

1989 wurde Dachmaterial für ein mittelalterlichen Haus im "Coffee House Yard" in York, mit mittelalterlichen Methoden hergestellt. Firstziegeln und Dachluken wurden nach Funden in York und die Dachluke aus Great Easton, Essex, nachgeahnt. 3,882 Hohlziegeln wurden innerhalb von 4 Wochen hergestellt und versuchsweise in einem Ofen mit mehreren Abzügen gebrannt. Die damit verbundenen Probleme und Ergebnisse werden aus der Sicht eines Töpfers beschrieben und diskutiert.