

# Medieval English Inlaid Ceramic Floor Tiles



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## Overview

There are many techniques and variations of medieval ceramic tiles: inlaid, relief/counter-relief, incised, mosaic, line-impressed and painted. The distinctive high-contrast yellow and red of inlaid tiles, also called two-color tiles, drew me to their recreation.

Inlaid tiles are made by making a shallow design impression in clay and filling that design with a contrasting color of clay. In England, the tiles are generally red with white inlay, although there are a few examples of white tiles with red inlay (or where the tile is made in such a way to give this appearance). I was surprised to learn that these tiles are made with red and white clay, and it is the lead glazes used in period which give the tiles their yellowish cast.

No one is quite sure when and where the two-color process began but these tiles started appearing in England and Europe in the 2nd quarter of the 13th century. (Van Lemmen: 21) Although the majority of two-color tiles have been found at churches and abbeys, the technique is not confined to ecclesiastic venues. Clarendon Palace had inlaid tiles installed in the mid-13th century and Westminster Palace had them installed between 1238-1250. (Van Lemmen: 27) Square tiles are easier to produce than arc-shaped tiles, so as the arc-shaped tiles went out of fashion the increase of production in square tiles and the subsequent drop in prices meant merchant/upper-middle classes could now afford two-color square tiles. (Van Lemmen: 27) [see figure 1]

Individual tile designs that were popular include: heraldry, birds, animals, monsters, stars, flowers, and geometric designs. Designs reproduced in groups of four to form a larger radial pattern were also popular, and in later period sixteen tile design patterns become common. **Figure 2** shows alternating lions and griffins. **Figure 3** shows many different patterns together on a floor, note especially the red on white tile next to the white of red of the same pattern.

There are no extant period works on English tilemaking. Only two works on pottery in general, the 1301 writings of Abulqasim (Persia) and Piccolpasso's Three Books of the Potter's Art (Italy) in 1556 have survived. (Berendsen: 241) Much of what we know about English tilemaking is based on archeological digs, close inspection of extant pieces, some manuscript illumination clues, and the continuation of this art well into the 17th century in the Netherlands. A look at the closely related technology of brick-making gives clues regarding tile production. (Eames, 1992: 2-3)

## Workflow of the Tile Makers

Workflow of the of the typical English medieval floor tile workshop (Eames, 1980: 17-19):

- Dig clay in fall; let it sit out until spring (weathering washes out the icky bits). Turn over pile at least once.
- Bring clay into workshop; add sand and organic materials until proper consistency.
- Put clay in forms (frames).
- Add decoration (stamping, incising, inlay, etc.) For inlay decoration:
  - Take clay in frame, place it on sanded table
  - Take stamp, place it on clay
  - Pound with mallet until design is set (an expert tiler could probably do it in one stroke)
  - Fill inlay with slip
  - Let dry to leatherhard
  - Scrape to reveal design
  - Cover with another board (called a "striker") and pound to produce smooth flat tile

- Let air dry (sometimes the back had scoops or “keys” of clay removed to improve drying and adhesion with the mortar).
- Glaze (if required for design/function, some tiles were left unglazed).
- Fire (this is a single fire process).

## Supplies Needed for Making the Tiles

Items needed for inlaid tile making:

- Clay: red and white grogged earthenware (low-fire)
- Work boards
- Clay tools & brushes
- Carved stamps (stamps themselves take wood, carving tools, and sharpening strop/rouge)
- Extra boards as “strickers” (striking boards need to be smooth)
- Mallet for striking (wood, rawhide, or rubber)
- Container for slip & mixing utensils
- Cheese slicer/knife/putty knife/scraping tool
- Glaze & brushes

## My Tile Recreation Process

### Research and Design Choice

The main period of inlaid tile work in England are the 13th through 16th centuries and was common all over England. [see figure 4] A literature survey established that Elizabeth Eames is the acknowledged expert in this field. She has written widely on the topic through her work at the British Museum. Her [English Tilers](#) book is part of the Medieval Craftsmen series, and is a good general overview. Her two volume work, [English Medieval Tiles](#), catalogs the tile collection of the British Museum in both statistical and visual formats. This proved most useful as it gives the sizes for height, width, and depth, as well as faithful scaled visual reproductions of the tile designs in black and white.

### Carve Tile Stamps

The design of my quarter-round tile pattern is based on the photo found in Eames’s [English Tilers](#) book, p. 55 (figure 64). It is a photo of four of these tiles arranged in a radial display and the caption reads:

“Four tiles from St Albans Abbey, Hertfordshire, early 14<sup>th</sup> century; part of a distinctive series in the county. Probably made by tilers who had worked in Essex, some of whom seem later to have moved on to Penn, Buckinghamshire. Each tile approx. 125 mm square.” [see figure 5]

**Figure 6** shows how tiles might be set in a floor with plain and other inlaid tiles.

The single star of eight points with center pierced hole design is based on tile #1099 from Eames’s catalog (1980, vol. 1, #1099). The statistical information given about the tile states that it is from Buckfast Abbey, 13<sup>th</sup> century and its dimensions are 140mm x 85mm x 36mm (deep). [see figure 7]

There are no existing clay tile stamps left to us from before 1600. In 1906, the British Museum was given the only existing tile stamp which is a relief tile stamp with a fleur-de-lis design on it. We do not know from which wood it was carved. The stamp was found in North Walk Pottery, Barnstaple where tilers were working from late 1500s to the early 1700s. (Eames, 1992: 21-26) Experts in the field believe that tiles were made with either wood or lead tile stamps, this is based on examination of tile pieces and markings left behind in the support clay (wood grain patterns for example). (Eames, 1992: 29, 35)

Two years ago I took a wood block carving class from Lord Gordon Redthorn at the Kingdom A&S Ithra. At that time I learned to carve lino-block and when I first became interested in inlaid tiles I made my stamps from lino-block as it is easy to carve, the tools are relatively cheap, and the depth of the lino on the block is controlled. This technique produced some nice pieces though the inlay is a little shallow.

When I started preparing for this project, I invested in wood carving tools and did some research on period woods. Linden is a wood known to medieval English craftsmen. It's closest equivalent is basswood in the U.S. and basswood is readily available in woodcrafting stores as an easy carving medium. (Halstead: "Linden") Linden/basswood would probably not be used in period for stamp carving as it is too soft and could not take the constant abuse of wet clay and mallet, but it is perfect for the non-production recreationist. I was unable to find good documentation on period carving tools though I did find class notes from other SCAdians who claim that tools have changed little since the medieval period. I had some difficulty finding small enough tools and would have liked to find a 1/16th straight chisel for cleaning up the bottom of the stamp.

The friendly (but few planks short of a cord) gentleman at the woodcrafters store ripped basswood lumber into 4" squares for me. When creating a tile stamp, one needs to plan for the finished tile size by knowing the shrink factor of the clay one is going to use. The earthenware clay from my local vendor has an 8% shrinkage so the 4" square tile stamp would yield an approximate finished tile size of 3.7" square, slightly small but within the range of period floor tile sizes. (3.7" = 95mm, in the Eames catalog #221 is 55mm square. #1093 is 205mm x 170mm. The average depth of a finished tile is between 20-30mm thick.)

I laid out both patterns using a compass and ruler. I then made a depth mark on the sides of the wood blocks. I used a depth of 5mm, thinking I had seen a finished depth of 3-5mm in my research (which of course I could not find at the time of writing.) If the inlay is too shallow then the clay will pop off the tile, if it is too deep it may not cure flush with the top of the tile. Eames says that she now considers thinner inlay to be better, especially when strikers are properly applied for adhesion. (Eames, 1980: 46)

I quickly learned that Roy Underhill (star of the PBS show [The Woodwright's Shop](#)) was correct about carving across the grain. When carving, it is easy to carve too far, or have a piece chip out of its own accord when the cut follows the grain. Fine detail areas and sharp corners, like the ends of the star points, were also a challenge. I learned that you can fix minor errors with wood glue or by slightly adjusting the pattern. I'm firmly convinced this is why so many of the patterns are slightly irregular in period -- the woodcarver adjusted the pattern due to carving error.

This style of carving is also difficult because one is making a stamp and not a relief carving. Close attention must be paid to the sides of the carved pattern, that they be crisp and perpendicular to the floor depth of the pattern. Undercuts or other flaws could trap clay and ruin the impression.

## Form Clay Tiles

Once the stamps were finished I could start on actual tile production. Experts believe that tilers used wooden box frames to form the initial tile. (Eames and Berendsen) If used, these also have not survived. As Eames states, "I know of no contemporary English document or picture which tells use how they [the tiles] were shaped but it may be assumed that they were shaped in a 'form' on a sanded board or table." (1980: 17) [see figure 8] I chose not to use a form because Eames goes on to describe how the edges were finished off after the tile was removed from the form. I chose not to work on a sanded board as I did not know how the sand would react in the kiln and I have my items fired commercially (they don't take kindly to having too much experimentation in their kilns).

I bought grogged clay from my vendor in both red and white low-fire earthenware. The red has a shrink rate of 8% and the white 9%, so the two clays are compatible when doing the inlay process. If one uses a white clay with a much higher shrink rate than the red, the inlay could simply pop out during the drying or firing process. Grogging (the addition of organic particulates to the clay) helps adhesion of clay (holding it to itself) especially for drying and firing of very thick tile using a single-fire process like these inlaid tiles. The grogging also substitutes for some of the sand that would have been used on the forming table in period.

I prepared the white slip the day before using the white clay, water, and vinegar. This is a slip-patching formula given to me by Mistress Morgaina of the Woodlands. As I understand it, the vinegar helps break down the organic bits in the clay and helps the clay bond together when used as a patching medium. With inlay adhesion being an issue in this context, I reasoned a slight vinegar solution couldn't hurt. I worked

the clay/water/vinegar into a stiff paste (about the consistency of good decorating cake frosting). When I tried this tile technique last summer I used a very thin slip and the difference in water content between the red clay and the white clay caused the pattern to smear in the scraping process. I hoped the drier slip would resolve some of these issues.

I cut the pre-wedged clay off the block and using a rolling pin rolled it out to the depth of the basswood blocks (approximately 1 inch). The tiles could have been a little thicker as the finished product would shrink as discussed previously. I then took a knife and cut the tiles to 4" square following the exterior of a plain basswood block. The tiles were a little too wet still so I set them aside to dry for a bit on a cloth covered workboard.

### **Add Inlay Decoration**

I purchased a 2-pound rubber sledge hammer at the hardware store. In period, they might have used a wooden mallet but we don't know as there are none that have been found in tiliary excavations. The extant Barnstable tile stamp shows dishing on its back from being used so the mallets must have been reasonably heavy to cause this kind of wear. (Eames, 1992: 29)

Taking the formed tile, I put it on the workboard in front of me. I centered the stamp upside down on the clay then attempted to land the mallet solidly in the center of the tile, trying to maintain straight down pressure and avoid side to side movement. I imagine an expert tiler could set a tile in a single stroke, it generally took me 2-5 whacks. The tiles were firm enough (what's referred to as "leatherhard") that the sides didn't malform much when whacked.

Next I took the stiff white slip and using a knife pushed it into the inlay areas with a motion like frosting a cake. It is important to get into all the cracks and crevices of a design without trapping air bubbles. One must be careful -- I learned it is fairly easy to warp the design of the tile by pressing too hard on the inlay. This is shown in the oval qualities of some of the circles on my quarter round tiles. At this point I trimmed edges if needed and took scoops out of the back side of the tiles with a loop tool. Eames says most scoops (also called "keys") would have been removed with a knife. (1980: 19) These depressions help the drying process and also help adhesion when the tile is set in mortar.

After inlay with the slip the tiles are set aside to dry further. During the slip process water is reintroduced to the leatherhard red clay and if the design is scraped at this point the two colors of clay will mush together and warp the design. I hurried along the drying process of my tiles by putting them in a low temperature oven (200F) for two hours with the door open. This got them a little drier than I would have liked, but the stiffness of the clay was appropriate for scraping. My other option would have been to let them sit overnight and they might have been even more dry at that point. I don't know how they worked this timing process in period. Maybe apprentices did their scraping in the wee hours of the morning when the clay firmness was right.

I took the same knife I used for slip "frosting" (which had a fairly straight profile) and scraped at the tiles until they were flat and the design was revealed. The grogging caused many scrape marks to form across the face of the tile. Small inlay parts also broke off but were easily patched with more slip (some of these did not take in the firing process though the appeared to work in the dry state). I did not do a final "striking" (surface smoothing) process as the tiles were too dry at this point. Instead, I used a fine mesh finishing tool from the pottery store that removed many of the scrape and scratch marks from the surface of the tile. The tiles were allowed to air dry until they reached greenware stage.

I left the majority of the tiles as square as I could get them. Some tiles experienced warping during the drying process. I did round off the corners of one tile as evidenced in some pictures of period tiles just to see if it influenced the drying or firing process at all. It seemed to have no effect, I imagine the rounding off is due to centuries of wear and tear rather than a deliberate design choice.

## Glaze and Fire

In period these tiles would have been single-fired, which means they only get placed in the kiln and fired once. Most modern ceramic firings use a two step process where the piece is fired to bisque stage, then glazed, then refired to set the glaze. I really wanted the opportunity to see what a single-fired tile would look like so I called my vendor where I get items fired and they were more than willing to do a single fire for me.

The period glaze used on this type of tile was a simple lead-glaze consisting of a mixture of clay and lead sulphide suspended in water. The lead glaze is transparent but usually has a yellow cast due to impurities in the glaze, usually due to iron. (Berendsen: 250) (Eames, 1992: 13) Perhaps another method of glaze application was powdered lead glaze applied using a loose-weave pouch in “pounce” fashion so when the tile was slightly damp the powder would adhere (Wood, “Glazes...”: 7) (Gordon: 2 referencing Wight: 45) [I’m not crazy about this reference but I couldn’t lay my hands on a whole copy of Wight and the copies I do have from the book do not include p. 45; Morgaina does not cite where she got this information but I trust her research.] Surprisingly Eames doesn’t mention this method, though in her catalog book, 1980, p. 21, she discusses that a liquid medium is not necessary for ash lead glaze application, hinting at some method of dry powder application.]. A 13<sup>th</sup> century addition to a manuscript by Theophilus Presbyter gives directions on the making of a lead glaze. (Eames, 1980: 21) This is a rare find, especially as it specifically discusses the making of the glaze for tiles.

Lead is a toxic compound that is still used in some commercial glaze applications. I choose not to have lead in my studio, although some artists choose to work with these glazes. The great majority of my pottery recreations are feast gear and lead leaches through glaze, especially in the presence of acidic foods (citrus, vinegar, etc.) so I don’t want it in my house if I can at all avoid it. I found many good resources available through the National Institute of Environmental Health Sciences, National Institutes of Health regarding the toxicity of lead (see Bibliography).

I used a lead-free commercial glaze from Spectrum Glazes, #807 Clear Yellow, hoping to get that same yellow over the white slip look seen on period tiles. Ken Adamson at Spectrum was kind enough to provide the ingredients list for this glaze. He states:

“These glazes contain: suspenders (i.e. cmc or veegum), kaolin, opacifier (zirconium silicate), ceramic pigments made from metal oxides (i.e. praseodymium for yellow), wollastinite, silica, and a combination of leadless frits that use various fluxes to replace lead. (i.e. boron)”

I don’t have the chemistry or glaze background to really understand this recipe, but I was happy to have confirmation that the glaze was lead-free. I applied three coats of glaze to the green tiles as directed on the instructions.

The tiles were single-fired in a cone 04 bisque fire at my pottery vendor (Georgie’s in Portland, OR). This is the correct temperature for the clays which I also purchased from the same vendor.

In period tiles would have been fired on their sides. According to Eames,

“The unfired tiles were stood on edge in rows on the oven floor, placed so that the glazed face of one was towards the unglazed base of the next, and with a space between them so that they did not touch each other. The tiles in the second tier were placed on edge across the top of the tiles in the bottom tier obliquely, not at rightangles. This method of stacking was continued until the top of the stacks was level with [the] top of the walls of the oven.”

If your glaze mixture was too runny it would run down the tiles and cause them to stick to each other. This is seen in waster piles that formed behind kilns. (1980: 25)

The shape of the kiln matched the shape of the objects being fired. Pottery kilns were round and tile kilns were square or rectangular. The kilns used wood for fuel. Firing the kiln was a summer activity and generally was done in week-long cycles as the kiln would slowly be brought up to temperature and then allowed to cool off again and be unloaded. (Eames, 1980: 30) **[see figure 9]**

## Final Product

In general I am pleased with the tile results. They lay relatively flat and did not cup or warp too much either horizontally or vertically. The inlay looks great, though one or two patched areas did pop out during firing. From the side, the depth of the white inlay can be clearly seen. I am especially proud of the way the 4 quarter-round pattern tiles fit together to form a single unit.

I wasn't prepared for the high amount of gassing out that occurred, causing much bubbling on the tops of some tiles, though this is probably due to three layers of glaze. The puddling near the outside edge of the tiles is due to shrinkage and also due to the tiles being fired flat in the kiln. In period these tiles probably would have stuck to the next layer of tiles down. Perhaps one glaze layer would give a more period effect and reduce the amount of bubbling that occurred after the tiles were removed from the kiln. This would also reduce the yellow opaqueness that occurs over the red clay. In viewing the crackling of the glaze, I suspect the tiles were removed too soon from the kiln and should have cooled off further and more slowly, this is the disadvantage of not owning one's own kiln.

It is important to view these tiles from their proper perspective on the floor. It provides just enough distance to almost see into the past.

## Glossary

- Bisque:** Refers to both a preparation firing process and the pottery piece that has undergone the firing. The firing is to a temperature that brings about a physical and chemical change to clay. Atomically attached molecules of water are driven off the individual clay particles and they are fused together transforming them into one piece. This intermediate step in glazed ceramics gives bisque ware the ability to absorb water of the glaze solution causing the glaze materials to adhere to the piece while it maintains its shape. Considered to be in the "low-fire" range, some pieces are never fired above this and are therefore usually less durable. (Pottery.com)
- Cones:** Small, elongated, three sided pyramids made of materials designed to melt at a specific temperature. Designed to melt at the same temperature as the glazes used. Cones indicate the progress of the melting. Cones are placed just inside the kiln during a firing so they can be seen through a peephole. They are numbered according to the temperature at which they melt. When discussing the temperature to which a piece/glaze is fired, reference is usually made to the cone used. The low fire range usually includes cones 06 through 01, intermediate fire includes cones 1 through 6, and high-fire includes cones 7 and up. (Pottery.com)
- Firing:** The process of exposing ceramic pieces to high heat in order to convert them into durable finished pieces. During firing, the clay and/or glaze goes through a transformation whereby it is fused together into a solid piece. Unfired clay will dissolve in water, but the clay becomes impervious to water after firing. (Pottery.com)
- Greenware:** A stage in the production of pottery where a vessel and been from and is going through the drying process necessary before it can be safely fired. (Pottery.com)
- Grog:** A sand-like substance that is added to a claybody to add workability and strength to the clay. Grog is actually high-fired clay that has been ground down to a granular state. Because it has already gone through the firing process, it lessens the shrinkage of the claybody. In clays that require great resistance to thermal shock, such as Raku and flameware, large amounts of grog are usually present. (Pottery.com)
- Incised Tiles:** Tiles where design is hand-applied with an incising tool. Sometimes called sgraffito.
- Inlaid Tiles:** Tiles where stamped inlay area is filled with a contrasting clay color to produce the design.
- Leatherhard:** A stage in the drying process when a clay object can be carefully handled without danger of the shape being deformed, but the clay is still pliable enough so alterations can be made if desired. (Pottery.com)
- Line-Imprinted Tiles:** Tiles where design is made with shallow stamps that form a very low raised line on the finished tile.
- Mosaic Tiles:** Generally plainly glazed tiles in shapes that fit together to make a pattern.
- Painted Tiles:** Form of decorated tiles where the designs are hand-applied using a brush to add colored pigments and glazes in designs or pictures.
- Relief/Counter-Relief Tiles:** Tiles formed by stamping the design onto clay. Relief produces patterns that sit above the flat area of the tile, counter-relief produces patterns which sit into the body of the tile.
- Slip:** A mixture of clay and water usually with coloring agents in the form of metallic oxides. Mostly seen as brushwork, slips are best applied during the greenware stage of drying. There is also a process of creating pottery from slip called casting slip, or slip casting. (Pottery.com)

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## Further Reading and Online Places to Visit

Chertsey Abbey: The New Tiles, <http://public.logica.com/~whiskerp/ca2.htm>  
Discovery of 13<sup>th</sup> c. floor tiles at Chertsey Abbey in 1996. Color pix.

Emden, A.B. Medieval Decorated Tiles In Dorset. Phillimore &Co., Sussex, 1977.

Medieval Gallery, WWW Tile Image Gallery, <http://www.derbycity.com/michael/medieval.html>

Medieval Tiles, <http://fp.stmarys.plus.com/pages/medeveltiles.htm>  
Color pix of extant tiles found at St Mary's Priory Church, Monmouth, England.

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