Sigginstown Castle Medieval Tile Making Summary
2020-2025
Wexford, Ireland
Elizabeth Jones

A fascination with inlaid medieval tiles led to this obsessive 6 year project! It was the hardest one of all, because we had no one toehold our hand the whole way through. People we worked with had done a piece of the process, but not all of it. We had to trade off experts for various parts of the project and then wing it ourselves if no one was available to help.

We always admired the terra cotta tiles from the Middle Ages in Europe. We purchased some replicas long ago for our house in the USA. Once we learned the castle was on clay, and there were historical sites around Wexford with these tiles, Liz wanted to recreate them onsite. There is no evidence that Sigginstown Castle had inlaid tiles, although they were still being made in the 16th century. There were handmade terracotta tiles in the Big House north corner, and the house bricks were likely made onsite. The big difference in this project was that we dug local clay and fired in a medieval-style kiln. Most people making reproduction tiles control the process by using commercially bought clay and glaze, and fire in a modern kiln. We had no such controls!

From our medieval reenactment events, we had met Jim Mowry, an art teacher and potter who has made these tiles for some time. There are others in the world too. We met Jim in 2016 after purchasing the castle and told him about this idea. He was intrigued, but it was not until 2019 when we contacted him again and said "we're serious"!

At the same time we worked with friend Liz Popiel, also in the USA to do a test of the clay to see how it would hold up under firing. She gave us a nifty set of samples with the information it would typically fire to Cone 04. At this time we knew virtually nothing about making ceramics, only shopping for them! We learned a lot more but our knowledge is still rudimentary compared to a modern ceramicist.

We also heavily researched other sites and experiments in medieval tile making including at Guedelon Castle in France where we went to see them make their roof tiles. Ours were fancier but the same concept applied. We watched videos, compiled notes and photos.

In 2020 during the pandemic we chose a number of historical designs to start creating tiles. Several were uniquely Irish including a winged horse, Carrigfergus 1615 (became Sigginstown 2020), and the Wexford Man - a crowned figure from St. Mary's Church in New Ross. Jim created a set of stamps for us and Liz brought them over to try.

The clay we had was removed from the field during our septic system excavation and had been already monitored for archeological content. It was basically a huge pile in the back. Digging it was very hard, and we had to mix it with water into slurry using a cement mixer. Then we poured it through three large sieves to remove the grit and stones.

Early on we worked with a local Irish potter who did some test firings of the tiles. We were happy with the results until a few days later when the tiles crumbled to dust! we were all shocked and it took some digging in online ceramic forums to discover the culprit - too many lime particles still remained in the clay. A remediation was soaking them immediately after firing, but we added one more sieve layer through window screen mesh which made the clay usable long term. So four layers of sieving were used.

We did a second series of test firings in a modern kiln, and decided we were ready for larger scale production.

Jim came over in summer 2021 to help us with a series of workshops to produce tiles. we laid out a fancy plan for the 800 tiles that would be needed for the lower hearth room, and then realized we would not be able

to make so many inlaid tiles, especially with volunteers. So we also created plain tiles which participants marked with their own "makers mark". It was delightful to have all the help including the Siggins clan!

Once we had tested the tiles we decided to work on glaze. In hindsight this created any number of problems for us! Medieval tiles were fired with lead glaze, which is still available but we were concerned with safety and thought it would be better to use a modern glaze. We sourced some we thought would work.

In August 2021 we had obtained the glaze, made about 450 tiles and needed a kiln. We had researched the construction of medieval kilns through archeological work done by David Dawson in the USA and UK. We contacted him, and decided to build an updraft kiln from his excavations and a smaller one from that built at Guedelon. Mick Carroll volunteered to build it, and we sourced regular bricks and made some clay mortar (more digging and mixing!)

The kiln was ready in September and we organized a party to do the firing which would take about 12 hours. Liz had a video call with David Dawson beforehand, to glean whatever knowledge he could provide about this process. We also watched videos of Guedelon again. We needed to figure out a complicated stacking pattern based on David Dawson's archeological research, and Tom Justin and Nick Fondiller worked a long anxious day to stack the kiln. Since the kiln is an updraft, the flames eventually shoot out the top, and it is so hot in front of the two firing chambers that one cannot get too close. Hoses were nearby and we regularly sprayed down the grass around us.

The firing progressed from larger timber dimensions to smaller in order to get a higher heat progressively. The kiln needed to reach Cone 04 or about 900C to make the tiles hard. Aha!!! But what about the glaze? (Stay tuned). We fired until the eleventh hour (literally), and in the middle of a lovely song, the top part of the kiln collapsed and all the tiles tumbled out! Horror! We all stood in shock. Nothing to be done as the tiles and kiln were red hot. A slightly subdued party continued, and we resolved to evaluate and learn once the tiles had cooled.

It turned out that the ware chamber we had made around the tiles was only one brick thick, and this did not withstand the expanding heat of the kiln, thus pushing the walls out. Fortunately, almost all tiles were intact. The glaze had not melted, but we had gained a bisque firing, which in theory reduced risk when firing again.. David told us we didn't get up to temperature and would have to get hotter the next time. In order to melt the modern glaze we would have to fire to 1100C, more than what was needed for the terracotta alone

Yes there was a next time! In July of 2022 we resolved to try again. Liz got some pyrometric cones to see if they would help gauge the temperature afterwards. A huge amount of work to split all the wood. Thanks to Jazmine Carroll for most of that effort! We organized another party to tend the fire, play music and general camaraderie. This time Anthony Bates and Jasmine had the task of the complex tile stacking challenge. We knew what to expect now and Liz was determined not to under-fire. We had a surplus of firebrick left from our masonry stove project and used them to surround the ware chamber, plus a second layer around to prevent the wall collapse. Much sturdier! We worked through the 12 hours and knew that the flames shooting out of the top of the kiln needed to be yellow in color. We maintained that for two hours and then declared finish. Later the next day the kiln was cool enough to uncover and see what happened. This time we were hopeful, and achieved partial success in some nicely fired tiles, and a good deal of failure in ones that were burnt, congealed and melted into a huge unwieldy mass. It was clear we had overfilled in our enthusiasm to reach the glaze temperature and surpass it. Most people were disappointed, but once again we learned. Unloading the kiln we had about 200 useful tiles and the rest were too warped or fused to put on our tower floor.

The year prior we had already realized that we couldn't make all 800 tiles by hand, so thankfully had ordered some plain terracotta tiles from Spain that were the same dimensions as the ones we made.This was a saving grace, and partially funded by our BIM Fisheries Local Action Group grant (thank you!). In the fall of 2022, Liz resolved to lay the tiles as planned, using as many of the handmade tiles as possible. First we had to level the floor better with some lime mortar, since the underlying LECA (clay vermiculite) was very rough. Next we needed to lay the tiles in a bed of NHL 5 lime mortar. The tiles need to be soaked in water, else they absorb the lime mortar too quickly and don't set properly. On this project, Jazmine and Anthony helped lay the tiles and it took three days. The tiles need to set for a while, and then Liz mixed NHL 3.5 and added some red and orange oxide pigment to color the mortar. This would not have been a general period practice, but we knew the grout would have a lot of foot traffic and this would help it not appear too dirty. Once they were grouted they needed to dry again, and then sealant containing beeswax was applied. The tiles got a bit of a patchy appearance, whether from sealant or lime mortar absorption was not clear. Over the past three years there

has been some damp and water in the tower. Initially it was difficult to clean the tiles, but we have learned that a little vinegar in the water really helps bring the brightness back. We wouldn't bother trying to seal or polish them again.

BUT, we still had a 150 unfired tiles in a tub, and could not accept leaving them in a raw clay state - over time they would melt back to clay with any damp, and too much work had been done by too many people. So in May of 2024, we did it again - three women and a kiln finished them off! This time it was very low key. Liz and friend Gari Garrity repaired the kiln - the clay mortar crumbles after firing, and especially the arches were fragile. We wiped and scraped off the glaze. The variable of the higher temperature needed and the glaze melding all the tiles together was too much risk. We decided to accept the unglazed tiles as a safer approach. So once again, we preheated the kiln with coal in the evening, and the next morning went to firing. Gari and Liz took turns feeding the fire, and in the afternoon Veda Crewe arrived from the USA - our artist friend from painting the tower. Veda cheerfully joined in, so we spend the day and evening tending the flames. This time Liz knew we couldn't fire too long. Better to accept intact tiles at a bisque level than an over-fired mess. Later in the evening Gordon came out and we had a celebratory beer by the kiln. No singing, no party, just DONE.

Another reason for getting the tiles finished was that we wanted to turn the kiln and clay pile into an outdoor medieval kitchen area, and the kiln would end up being used as a hearth, but probably covered. This would limit the use as a kiln in the future. Thankfully (to the high heavens) the tiles came out perfectly - a little light but bisque fired at least. We were not planning to put them on the floor, and in 2025 Liz placed the remainder off all good (and some not so good) on the wall of the lower hearth room garderobe so it can be a melange of medieval patterns, similar to various churches.

After three firings we learned that the darker, higher fired tiles bonded better with the inlaid (white) slip of exact unknown origin. It was donated by a local Wexford potter. -Apparently the white clay preferred a higher temperature. The darker tiles will naturally be stronger. Broken bits of tiles were incorporated into the new brick oven built near the kiln, and we plan to make the fused tile sculpture into a centerpiece. It is awfully heavy, so will likely stay outside. Air Water, Earth and Fire, as well as human and organic matter went into this project, so we call the sculpture "Energy"

Additional Notes & References

Tile Designs considered:
From Irish Medieval Tiles Book, Elizabeth Eames:

- TM 1,2,3 some Tile Mosaic as *squares* to complement T61?
- T61 Man w/crown - New Ross, unique to Wexford
- T64 Double Eagle (Siggins heraldry)
- T67 Griffin - on cover
- T68 Dragons 4 tile circles - Welsh dragon
- T103 Vesica with dots -
- T121 & L34 Fleur De Lis Ferns,
- T204 Circle w/flower/leaves - 4 tiles at Ferns -
- T196 (similar but complete design)
- T208/9 Diagonal Stripes
- T212 Dots in Circles- 4 tiles
- L1 Boar & Acorn
- L4 Lion Trim castle
- L10 Vine Trim castle and Clonmines
- L64 Clonmines, Tintern, Dunbrody
- L78 Roundel
- R50 Carrickfergus late period 1615 tile - modify design for Sigginstown
- Hare/Rabbit

From English Medieval Tiles Book, Elizabeth Eames

- Maunche tile - page 26; make a laurel tile too
- Ship motif - page 38
- Westminster Fiddle & Harp Player page 43
- Lion & Griffin page 48
- Clarendon Palace Circle (how to set in a square?) page 49

Period designs not shown in Ireland but appropriate to tower age (1500s)

- Canynges Floor from Bristol page 64 - 15-16th century - appropriate for tower age- 16 tiles set diagonally alternate w groups of 4, surrounded by 12 plain black (have Canynges design in CT house)
- Ended up painting Canynges design on Coach House floor
- Stafford 16 tile design Hailes Abbey - page 66 - 2nd quarter of 16th century - appropriate for tower age - Tudor rose, pomegranate, double headed eagle (Siggins), dragon (Wales?) do different letters or date, and simplified curlicues etc,
- 16th century tile designs page 67
- Melton, Abbot of Hailes 16 tile design ~1525 page 11
- Stafford 4 tile design ~1520 page 64

Disintigrating Clay problem: Seems to be lime burst, resulting from lime in the clay. This could be from seaweed being spread over the Wexford fields with shell, or lime deliberately added to soil for farming. Other countries seem to also see this problem (Spain, Italy, Mexico). Soaking the tiles in water within 24 hours after firing for 5+ minutes solved the problem, but we eventually resorted to using finer window screen for filtering out the white flecked particles. See also https://community.ceramicartsdaily.org/topic/77-disintigrating-clay/

Tile Kiln References

- Building A medieval Tile Kiln - Experimental Archeo

https://exarc.net/issue-2013-2/ea/lets-build-medieval-tile-kiln-introducing-experimental-archaeology-university-curriculum

- Pottery Blog - Supplies medieval pottery to Weald and Downland museum UK-including notes on backyard pottery kilns: https://selsdonceramics.wordpress.com/page/2/

Tile Kiln Notes from *Irish Medieval Tiles* and *English Medieval Tiles*

- Clay work was seasonal: clay dug in autumn, left in heaps in open air. Turned over at Xmas .
- Thickness is 20-25mm; 100-125mm square usually (Jim's thickness of ¾ should be okay)
- Danbury UK kilns may have had drying sheds with low heat
- Extant Medieval Tile kilns at:
    - Chelmsford, Essex
    - Clarendon Palace in British Museum
    - Tyler Hill, Cantebury (1 fire box, 2 chambers)
- See diagram page 8 Irish tile book
- Typically made for roof tiles, and decorated ones would be fired also
- Furnace was 2 arched parallel chambers 6' long x 2.5'wide, separated by spinewall, gap between could be 2"-7". Arches built up at sides to provide a flat top.
- Oven span about 6' square, height 4' giving capacity of 4 cubic meters (# of tiles capacity? Size of guedelon kiln?)
- Oven floor was created usually: 3 layers of roof tile, plus slabs spaced apart
- Sides Built of tiles incl. roof tiles, specially fabricated blocks and voussoirs for furnace, bonded with well-prepared pugged clay
- Kiln was backed in stone, gravel, sand, earth (dump gravel around and then use it for driveway? Or just use the existing clay mound)
- Has to be very solidly packed to withstand pressures in the furnace
- Furnace usually sunk into earth for stability, preferably on a slope with stoke pit at low end for access. (No real existing slope, unless we dig one end lower near driveway, etc.
- Stacked tiles in a lattice, crossing on top
- Lowest level of stacked tiles usually stuck to the floor due to glaze running. Clarendon had permanent slabs on floor to deal with this.
- No permanent roof - Top of kiln was always built to cover the kiln each time - prefab tiles (large?) bonded with clay. Use large size modern floor tiles? Ask JP for scraps if we don't have enough
- Brick Kiln - Clamp Kiln - only firebox and floor were permanent,
- Medieval LEAD glazes need temp over 900C to melt and 1000 to fuse, over 1100 and body of tiles begin to vitrify
- All tiles earthenware, shaped in form on sanded board, originally with lead glaze (applied before firing)

Updraft and Medieval Tile Kilns – from David Dawson (davidp@dawsonheritage.co.uk)

17th century updraught Kiln created at Little Woodham UK in 2015

https://drojkent.wordpress.com/2015/08/25/17th-century-kiln-reconstruction-at-little-woodham-hampshire/

Bickley Updraft Kiln Additional Photos: http://www.flickr.com/photos/bickley-photos2/

Comment on updraft kilns and an 18th century version: T*he purpose of the cone is to act as a chimney which increases the draw of air though the kiln. Given that the ware chamber at Dunster is lined and vaulted with ordinary brick, not high-firing firebrick, the normal ceiling temperature cannot have been higher than about 1000C, a temperature more than adequate for firing glazed red earthenware. The fireboxes are grated, that is designed to burn coal, presumably the 'Welch coal' referred to in the advertisement. Updraught kilns are difficult to heat evenly, cooling towards the top and limited in width by the reach of the flame into the centre. This tends to result in a preference for small designs, their internal width approximately equal to their height. The increased draw induced by the chimney would encourage flame and heat through a suitable network of flues under the ware chamber floor and through to the top of the ware chamber to produce a more even distribution of heat.*

The Packing of medieval floor tile kilns - Oliver Kent and David Dawson

Addresses glazing problem in a kiln and also dimensions of a smaller kiln. Simulated tiles found at Cleeve Abbey. Built a tile kiln for English Heritage at Cleeve Abbey. (Also other medieval kilns at other sites) Designed from excavated examples such as Tittenhanger and built on a square plan with a double firebox extending under the ware chamber. Discovered the square shape was important in facilitating loading.

https://archaeologydataservice.ac.uk/archiveDS/archiveDownload?t=arch-769-1/dissemination/pdf/vol42/42_045_053.pdf

Bickley Ceramics Project looked at the technology of medieval floor tile production. Children from three schools produced approximately 280 decorated tiles. All tiles were 150 mm square (6") and approximately 25 mm (1") thick with the sides bevelled back so that the upper surface overhung the lower. The backs were cut out to leave four circular depressions. Clay was Valentine's Sanded Red body; the white decoration inlaid with Potclays' White Earthenware. The tiles were raw·glazed either with white lead or with litharge.

A brick two-firebox rectangular kiln was built. (similar to Guedelon, but smaller) The ware chamber had a floor area of 800 mm x 900 mm. (32" x 36") The height of the chamber should have been similar, giving a capacity of 400 tiles, but was left lower to accommodate the smaller number actually produced. The kiln was open topped, capped prior to firing with broken 19th-century clay double·roman roof tiles. Firing was with pallet wood over eleven and a half hours to 950°C, the kiln having been preheated gently overnight.

Stacking Diagrams from David and Oliver article:

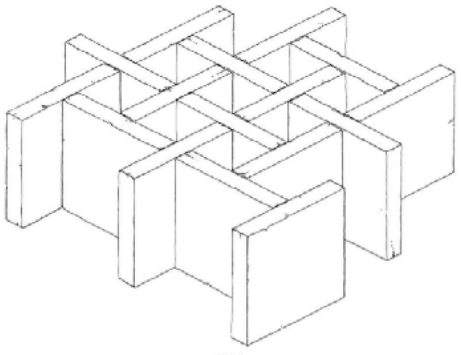

FIG. 3
Lattice tile-drying pattern from a 15th-century Flemish drawing.

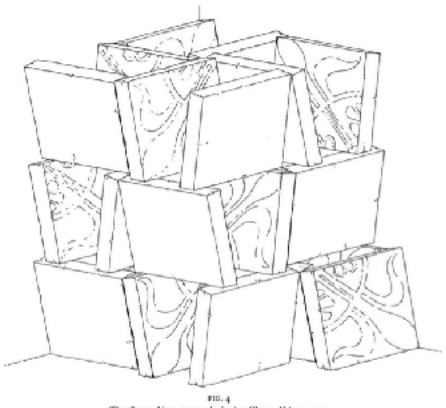

FIG. 4
The tile-stacking pattern devised at Cleeve Abbey, 1997.

David Dawson advice & tips for our Sigginstown Tile Making Project (via email and video)

Tiles:

- Make sure the tiles are well made, as thick as the Med originals, the slip well pressed into the impressed pattern, and reasonably dry. His tiles were 25mm thick with scoops out of the rear. Medieval range was 20-25mm. Jim makes 20mm thick – quicker to dry?
- Loading tiles – stacked pattern per diagram is robust – one could stand on it. Use the packing pattern starting in one corner of the ware chamber.
- Make sure you have enough tiles made 300-400 for a modest size kiln.
- Tiles beveled, else edges will crumble when you come to put weight on them.
- They used commercial clay – Valentine's sanded red or grogged red will do. Do some test firings of your natural clay in an electric kiln – the standard tablet tests. (Done)
- See whether the pebbles interfere with impressing the design at the same time. If they do they will need sieving or levigation might be easier with so much clay to process.

Glaze:

- Use a fritted lead glaze if you can. It is safer than the raw lead glazes we were using but still needs to be used with safety precautions, masks, goggles, gloves, overalls, etc. Lead oxide is not easy to get hold of. Solargil used to supply it. Other glazes will react differently so be prepared to experiment and many need similar precautions.

Kiln:

- Pallet load of new ordinary house bricks for construction & load of large pieces of reclaimed ceramic roof tile. Many Medieval kilns were constructed of brick. Temperatures needed do not need firebrick. Dismantle the kiln and build another with relative ease. Kiln will be fine to also fire reconstructed medieval pottery.
- Dig fireboxes and combustion chamber into the ground (our Sigginstown clay pile?) and that the ground does not contain too much organic material that will bur away.
- Start preparing the fuel now – cut to length suggest about 2 feet – stored to dry. Logs to start getting smaller but use pieces about the thickness of your thumb for the stages above 500C.
- Preheat the kiln overnight – a coal or peat fire that will sit and sulk (Fri 3 July campfire)
- Don't rush the firing – 100C an hour will do but do make sure the fuel (wood) is thoroughly dry.
- Do not worry about reduction, the kiln will do it automatically – but to modern potters it is anathema – you need it to get nice green glazes. Have a look at our paper in Post-Med Arch 1999 or if you have not got access to it I can send by we transfer.

Guedelon Medieval Tile Kiln Notes from Filming The Fires of Guedelon) (heated to 1100 c)

- **Episode 11** (till 3:00 minutes)
- https://www.guedelon.fr/en/the-fires-of-guedelon-episode-11_270.html
- Built kiln in 2009, built 4 or 5 before - they repair the base shelf after every firing with clay and sand

- **Episode 12**
- https://www.guedelon.fr/en/the-fires-of-guedelon-episode-12_273.html
- Clay pugged/kneaded to remove air pockets
- Drying time: 4-5 days in high summer (France) (I read 4-5 weeks in England mid-winter!)
- Tilers mark on back
- Straw for sun dried bricks - sand, clay, straw unfired

- **Episode 13**: Loading the Kiln:
- https://www.guedelon.fr/en/the-fires-of-guedelon-episode-13_276.html
- Load roof and floor tiles at same time in lattice pattern on edge
- ~10 in each lattice, about 6 rows across x 8 wide, x 6 tall - roof nib on each tile acts as a spacer, they stack it to about 2/3 of the height - capacity is 3000 roof tiles and 4000 floor
- They leave a gap around the stacks of tile for heat and flames to rise
- About 14-16 hours in total to get orange, not white (overfired)
- Light fire at 7 am , done around 10 pm

- See **Secrets of the Castle episode 3** for scenes :
- https://youtu.be/GZmpn3nn2qE

- At 13:00 min, mixing the clay with shovel then kneading it
- At 17:15 taking grease and lubricating wooden form so tiles come out easily
- At 26:00 putting tiles in kiln: offcuts from timbers, fire hose? tiles carried in baskets (square would be best) reinforced with cross at bottom ; tiles placed on edge but staggered a bit to allow gaps
- Firing in May, kiln gets wet, wood gets wet, corrugated iron as rain covering on top open tiles in 2014.
- 49:00 Kiln takes longer to get to temperature. After 2 hours they will stop it up, and then?
- Several days later unload kiln, hear ringing when tiles are clinked, spit on tiles should not absorb

- **Episode 14 Firing the kiln**:
- https://www.guedelon.fr/en/the-fires-of-guedelon-episode-14_278.html
- Wood lengths get pushed in to right then left for equal amounts in each chamber
- Wooden rakes/poles to push in embers, much lighter than a metal one - he made 50!
- Fire gets to 1100C
- Kiln is open at top and around stacks- roof tiles (already fired) go on top to cover the tiles being fired, but no real "roof"
- When is it done? Fire arches are orange, flames coming out across surface of kiln
- Levels all have to be same color - leave for 2 hours with flame then stop firing
- Takes 1 week to cool! (Smaller kiln built at Norton Priory took 12 hours to cool)