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Open Hearths, Ovens and Fireplaces

The story of heating is a story about the ingenuity of people encountering challenging climatic conditions. While Vikings huddled around the long fires, and the French sat with their back to chimneys, the Germans seem to have invented tiled stoves.

Open hearths, ovens, fireplaces and chimneys. The story of the development of the different heating systems, which came to characterise different parts of Medieval Europe is an amazing story about ingenuity and creativity.

Open hearths and long fires


The house from Hedeby – reconstructed at Moesgaard in Århus © Moesgaard

The open hearts and the long fires of the Vikings may be famous for their ability to let flickering light caress the intricate wooden carvings, which decorated the posts, benches and chairs on which people huddled in the cold. But even if we take into account the round fires, which were typically placed in the corners, the early medieval hall with its central hearth was a cold and smoky place; especially, if it was a large communal hall.

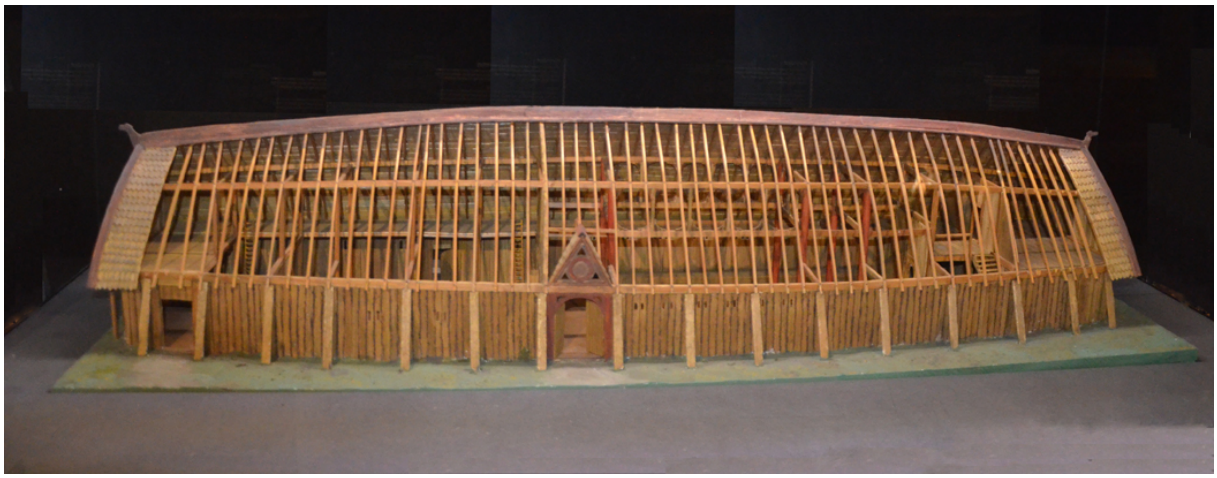
Studies carried out by a group of archaeologists and scientists on oxidative stress and inflammations of the lungs on people, who have experimented with living in reconstructed Viking houses, have amply demonstrated this.

The experimental group consisted of eleven university students, of whom four were smokers and seven non-smokers. All – three men and eleven women – were recruited to take part in the experiment. The group divided into three teams; these stayed in a reconstructed Viking house, three to five persons pr. week, in three consecutive periods. The stay included a switch to the presumed Viking lifestyle, including traditional clothing, food, cooking manners, and handicrafts.

The reconstructed house was at the time of the experiment 38 years old, which means it had basically dried out. It had been reconstructed on the basis of a Viking house from c. 870, excavated at Hedeby (Haithabu). The house consisted of two antechambers and a major room, heated with a central fire. The central room was 53 m3. The study took place in November during near-freezing temperatures. The persons occupied the main room, when they were inside the house. During the day, the house was warmed up with a fire built primarily of beech wood in the central long heath; in the night, however, the fire was allowed to die out.

During the experiment, the subjects recorded their activities when not staying in the main room.

During the experiment the exposure to smoke, CO and NO_2 was measured. The effects on the individuals were measured through blood sampling and related to systemic effects in regard to inflammation, monocyte activations and oxidative stress, such as may be seen in damaged DNA. Although unexpected, the result was that even a high inhalation exposure to wood smoke was not associated with extensive systemic effects on markers of oxidative stress, DNA damage, inflammation and monocyte activation.


Lejre Hall – AD 900 – © Medieval Histories

But was it warm?

Parallel studies have sought to measure how comfortable – warm – it was living in these houses. These experiments took longer as groups of volunteers lived both in the house at Moesgaard for five weeks in 2011 (October and November), and at Bork Viking Harbour in a similar house in 2012 (ten weeks in February to April). The two replica houses were nearly identical. Both had outer walls made of wattle and daub, tamped earth floors, and thatched roofs.

During these two periods, the archaeologists measured temperatures of 17.5 ºC at Moesgaard and 15.0 ºC at Bork Harbour. The temperature at Bork reflected the fact that this experiment partly took place in the coldest month of the year (February); but also that the place suffers from harsh western storms. Outside the mean temperature was app. 10º lower. It took about 50 kg of hardwood to heat the houses up and provide fuel for cooking; but this would vary considerably according to wind and outdoor temperatures. “The termal environment was dominated by radiant heat, but was generally rated as acceptable”, write the archaeologists who led the experiment.

As a supplement, two of the volunteers carried CO sensors, while smoky particles were measured. This took place at Bork. The conclusion here was that the levels found were considerably higher than those reported from modern studies conducted in dwellings using biomass for cooking and heating. Even if the first study did not find evidence of damaged DNA, the archaeologists behind the second study concluded that the levels of smoke would in the long run contribute to health problems. However, they also noted that some of the problems might derive from lack of experience in handling and feeding fires. It is well known that a blazing fire will leave less particles than a smoldering.


Baking Rye Bread at Ribe © Ribe Viking Centre

To this should be added some later studies, where the archaeologist, Elizabeth Rüssel Palm did simulated digital experiments in three Viking houses as part of her MA thesis. One of the calculations, which she carried out was to try and measure how much it would take to warm up the large hall in Lejre. According to her estimates it would take app. ¾ m3 of hardwood to keep the large hall warmed up to 6 -7 ºC on a cold winter day, the equivalent of 55 tons over a season; double that estimate, if you wish for 12 ºC. Just to process this amount of wood with Viking tools would be daunting. When Elizabeth Palm carried out her digital reconstructions, she estimated that it took app. 25,5 kg wood per hour and as she could carry five kg in her arms at a time, she would have to make her trip from woodpile to hearth every 12,5 min![1] This effort might be reduced if the hall was only partly heated, but the figures are still daunting.

And then the hall would not even have felt warm by any standards. It would have been experienced as equivalent to sit around a fire out in the open on a frosty day, she concluded. In her opinion, it is highly unlikely that the great halls were used during winter; a conclusion, which of course raises the question whether the Viking Yule-celebrations took place around winter-solstice and not – as has been suggested and which is more likely – at the autumn equinox. If the hall was ever used as a permanent residence for the chieftain, it must have had a second floor on top, which might be heated from below. [2]

The simulated studies of the great hall at Lejre by Elizabeth Palm shows that these magnificent buildings hardly offered comfortable living quarters; especially as other options were available. In her studies, she also simulated the challenge of heating a Grubenhaus and one of the houses from Haithabu, which figured in the archaeological experiments referred to above. Palm's results show that to heat a so-called Grubenhaus would be very easy, to heat a town house possible, while the hall presented nearly insurmountable challenges. The also showed that give and take some minor differences, the de vivo experiments fitted quite well with those of the simulated tests. But the last demonstrated how difficult it is to reconstruct these houses without considering their more general livability. Should the opening in the roof for instance be placed above the long fire? Or was it better to place the louvers at the gable ends?

Medieval ovens


Viking Oven. Source: Pinterest

Ovens made of clay are known from the Early Middle Ages and the remains have been found in numerous archaeological excavations. In a northern European context such ovens were usually found set apart from the central hearth (the “langild”); either in a separate pit-house (Grubenhaus) or in a corner along the wall. Most ovens would have floors of stones, as this would be the main source for the radiant heath used for cooking.

Such ovens are rather simple to make. They were constructed from branches of willow, which were bent, to look like igloos, covered with clay and perhaps isolated further with turf. When fired up, the branches would burn, turning the clay into brick. When in use, people would light a fire, which would be left to smolder. When reduced to embers, these and ashes would be raked out and the oven was ready for cooking – either potage in clay pots or bread. During baking, the oven would be sealed off, perhaps even by using clay.

To build such an oven you need of course access to clay. This means that further north in Scandinavia and in the Viking diaspora, ovens were often build of stones (granite). But the system was identical. As in later times smoke would just be allowed to circulate in the room until it escaped through an opening in the roof. Sometimes the oven would be fitted with an upper opening, letting the smoke lift itself from the top. But when in use for cooking or baking, the oven would be sealed hermetically.

One of the nicer things about ovens – as opposed to open fires – is the constant heath, which radiates from them. This is one of the reasons a modern Nordic house, which is fired up by a massive oven built of stones may be rather comfortable even if the weather is really cold outside.[3] To get a sense of what it feels like, try a traditional Finnish sauna with their masonry heaters.

Tiled stoves and fireplaces

Warming by the Stove. Bayerische Staatsbibliothek. Cod. lat. 3900 fol. 1v. Source: Pinterest

Further south in Europe, however, granite stones were perhaps not as available and some time in the 11th to 12th people began to experiment by sticking clay pots inside out into the clay shell in order to create a larger surface, from which heat might radiate.

One of the earliest images, which depicts a burgher warming himself in front of such a clay-oven, is found in a manuscript from 13th century Würzburg. Probably drinking “Glühewein” or warm sweetened beer, a man can be seen sitting enjoying the radiating heath, while sipping from a beaker; at the same time the sausages hanging above his head are gently smoked, revealing that this oven is still not fitted with a chimney.

The manuscript, in which this illumination can be seen, has been dated to the mid 13th century, that is, the exact same time as the first remains of fragments of such tiles have been excavated in Hildesheim 1986 – 87. The interesting part of these excavations of a part of the wall around the Domhof is that while the first layer dated to a fire in 1046 did not contain fragments of pots, later layers from the 13th century did. All in all the archaeologists found more than 10.000 fragments of ceramic fragments which could be identified as broken and discarded pots and tiles which had been used in ovens. [4] In the beginning these fragments showed that people had used very simple pots. Later, however, the pots and tiles developed into small pieces of art, some of which functioned as concrete propaganda. During the Reformation, for instance, it became commonplace to fit your oven out with presentations of the reformers, thus signifying your adherence to this new vision for the church.

At this point, though, the ovens had changed character. To put it simply a wall was erected between the place where the fire was fed and the oven itself. On one side of the wall, the opening into the oven was fitted with a stone bench used as kitchen. Partly covered with conical hoods, smoke might be lured upwards from here through either an opening in the roof or – later – a regular chimney. On the other side of the partition, the oven – now turned into a stove – stood as a potted or tiled hollow mass, radiating heath into the new invention: the "stube" (heated living room). It has been speculated that the word "stove" gave its name to this new room in the house, but a German ethnologist, Joachim Hähnel, have argued successfully it was the other way around. The word "stube" derives form the word "stub", which among several things means a square, enclosed chamber constructed as a log house. Known from Southern Germany since the 11th century, such "log-cabins" were probably originally heated by traditional ovens.[5]

"Stube" the beginning of the 16th century from Fränkischer Frelichtmuseum © Medievalhistories

With the introduction of tiled stoves fed from behind, it became possible to construct such "stuben" inside late medieval homes, and fit them out with panels, benches, glazed windows and wooden floors. Such windows of course allowed light into these new interior spaces. But they also made it possible for people to look into the homes of their neighbours. At this point serious interior decoration schemes seems to have gained ground among ordinary burghers and later peasants. Such "chambers" seems to have been an early bourgeois invention, which was only slowly adopted in the countryside.[6]

This shift also carried with it a change in the orientation of houses and their layout. Chances were that people would try to construct the layout of their houses in such a way that people would be able to gaze into the treasure trove of their neighbours' (new) lovely hangings, the softly embroidered cushions and the nice imported maiolica and silverware, which more often than not were exhibited on buffets or crdenzas. To this ensemble also belongs the fashion of covering the floor with wood and perhaps even carpets rather than stamped earth or tiles.

In the early Middle Ages (1000 – 1200) houses in cities and towns in Germany might have been built of stones and in the height. But they were basically still fitted out in the same way as a Lower German Saxon farm, with an entrance or hall used for commercial activities and with a combined living space and kitchen behind; at the back of the house would be the unheated "sal" where the family kept their valuables hidden away in locked-up trunks and chests. In the cellar and the floors above, people would have kept their supplies for winter as well as trade stock. When the new heating arrangements, however, became available, part of the entrance hall or workshop would be portioned off. Here a staircase would be fitted, leading to the first floor where new living quarters might be furnished with glazed windows opening up to the street. Behind a new kitchen would be located, from where the tiled stove might be tended. The old kitchen on the ground floor would typically be kept, but now used as a kitchen hall for the people working as apprentices etc.

Fireplaces and Chimneys


Chimney with a fire. Notice the smoke escaping through the small flue. From the Queen Mar Psalter c. 1310 © British Library, Royal MS 2B, fol 72v.

In Western Europe (France and England) the changes moved in a somewhat other direction. Here in the mid 12th century English and French nobles and burghers began to construct castles and stone-houses while fitting them with fireplaces. Combined with chimneys they would serve to direct smoke away from the room

Basically, there is not much difference between an early medieval oven and these later fireplaces. Main difference was that they became partially built into the wall and that chimneys gradually came into use. But in the initial phase it seems that people experimented with different solutions – with or without louvers at the top, more or less built into the walls etc.

As with the tiled stoves, however, these new types of fireplaces had distinct advantages. As opposed to open fireplaces in the centre of a floor, ceilings could be lowered as the danger from sparks became considerably less. Light might also be reflected better, which made a seat near the fireplace a convenient working space. Conviviality, though, suffered. Formerly, people had gathered around the long fires in the centres of the halls. Now, sitting privately near a fire became a luxury for the few. This of course created the possibility for smaller rooms. The world became fundamentally different: small and intimate. Called “the withdrawing chambers” they cause Piers Plowman to lament the tendency of nobles to partake of their dinners in such private chambers:

Now hath ech riche a rule, to eten by hymselve
In a pryvee parlour for povere mennes sake,
Or in a chambre with a chymenee, and leve the chief ha1le
That was maad for meles, men to eten inne,

Now has each rich a rule: to eat by themselves
In a private parlour, for men's comfort
Or in a chamber with chimney, and leave the main hall
That was made for meals, men to eat inside

From: The vision of Piers Plowman by William Langland
London and New York: J.M. Dent and E.P. Dutton, 1978, X, 98 – 101

As with the tiled stoves, such fireplaces tended to be impressive, bordering on the flamboyant and decadent. Walking around in museums, we cannot help to admire these chimney pieces in the same way as they were meant to be: as fabulously decorated frames showcasing the lord of the manor and his guests, who might be seated next to him; all with their back turned against the radiating heath. Showstoppers, they were; but, alas, never very efficient heating systems.

At first, fireplaces were fitted with hoods and corbels. Later, however, they were built into the wall in the same manner as a cabinet. With a mantel on top ready to exhibit valuables the medieval version did not differ much from the one, which may be admired in the late medieval or Tudor stately homes spread across England. Even though the French were just as magnificent, they tended to protrude slightly more from the wall.

 First scene with a fireplace fitted with a chimney. England c. 1265 – 70 © British Library, Harley MS 50000, fol. 1v


Mary and Joseph in wintertime. The Hours of Catherine of Cleves. Utrecht, ca. 1440. Morgan Library and Museum, MS M 917, fol 151

Summing up

There is no doubt that heating systems in Europe tended to develop in the Middle Ages from c. 500 – 1500; but the shifts taking place obviously differed according to climatic circumstances – and perhaps also changes therein.

In the beginning two systems reigned: in the north and east, open hearths located in the centre of the modest houses and halls of both peasants and lords dominated. In the south, the Romans had invented the system of hypocausts, where warm air was circulated beneath the floors. At the dawn of the Middle Ages (c. 500), however, it seems as if this Roman technologically advanced solution fell into disuse together with the grand villas, of which they had been an important part. It also seems as if the knowledge of how to construct such hypocausts disappeared. At least, there is next to no archaeological evidence indicating that people continued to construct them for instance in episcopal palaces or monasteries until the 13th century, when examples crop up again.

At the same time, climate deteriorated significantly and it is plausible that the use of ovens – not just for baking but also for heating – slowly became more widespread all over Europe.

There was an oven in the house from Haithabu from 820 as can be seen in the reconstruction above. To give another example, the earliest oven excavated in Finland has been dated to c. 800 -1000; the earliest in Estonia to 1000 – 1200. Such ovens where chimney-less smoke-ovens; nevertheless, they probably offered more comfort than the long fires in the halls of the Vikings, who lived further to the west.[7]

Such ovens could of course also be found in the archaeological material in Western Europe. People needed ovens to bake bread. Some of these were naturally communal, while others were built into the walls or corners of their humble abodes.


Tattershal Castle from the 15th century. Source. Pinterest

However, at some point in the south of Germany someone got the idea to fit his clay oven with pots, securing a larger surface from which heat could radiate. It cannot be proven, but seems an enticing hypothesis that this invention was made around the time, when climate became less predictable and gradually cooler (mid 13th century) . Later this invention created vast opportunities to reorganise daily life east of the Rhine. But it must be remembered that this invention did not in itself have a chimney as its precondition. Up until the beginning of the 20th century old people on the Faroe Isles might still live in houses where on room was called the “røgstue” (smoky cabin) from where an oven was heated, which was located in the adjacent room, “glasstuen” (the class cabin).

Concomitantly with this development, Western France and later England exploited another solution to the challenge of warming their homes up while getting rid of the smoke. To this end chimneys were invented. Exactly when this happened, is of course an open question. However, it seems fair to speculate that this invention was in fact a further development of a slightly different version of the oven, namely the Roman.

Some believe that chimneys were very early inventions, as Roman ovens had traditionally been fitted with flues. As Roman cooking – at least partly – continued to make its stamp on diet and food processing in Merovingian Gaul, it is likely that this feature was kept. But it is difficult to find the archaeological evidence. Nevertheless, early medieval archaeologists decided to fit one of the reconstructed houses in the open-air Merovingian museum in Marle (Musée des Temps Barbares) with an indoor oven complete with hood and flute.

While this is contested, the fact remains that archaeologists have found evidence in 1966 that a Carolingian hall (aula) at Doué-la-Fontaine built around 900 probably had been fitted with a chimney, which the excavators concluded belonged to a kitchen. The chimney had been built into the wall, which separated the two chambers in the hall: the large ceremonial aula to the west covering 178 m2 and the smaller "kitchen" to the east, measuring 72 m2. There seem to have been a long fire in the floor in the grand hall; however, it must have been especially nice for Count Robert to sit with his back against the stone-wall, behind which dinner was cooking.[8]

The earliest English chimney was constructed at Conisbrough Keep in Yorkshire around 1185. It is likely that architects building the magnificent Carolingian palaces understood the idea of finding solutions to the problems of heating; and that these solutions were brought along into the first castles. Anyway, at some point between 900 and 1200 chimneys came to play a large role in the princely architecture of that day. Later it became a steadily more prominent element in the homes of the rich and wealthy. But it seems fair to note that both the tiled ovens and the magnificent chimney-pieces were latecomers to the rural countryside.

We may still find illuminations from the 15th and 16th centuries, which show us houses with less than elaborate solutions to keep warm without gasping for air. But there is no doubt: the story of the crafty and creative ways in which medieval solutions were found witness to the Middle Ages being less than technologically stagnant.

Perhaps this inventiveness may also be an inspiration to find solution to heating our homes in world where energy is becoming more and more precious.

Breviary of Queen Isabella of Castile. Bruges 1480.
British Library Egerton MS 1147. January.

NOTES:

[1] Elisabeth Rüssel Palm (2013) p. 63. An intriguing question is whether the typical location of the large "royal" halls near rivers or streams is the need to be able to have access to sourcing firewood from afar?

[2] Studies of Saxon Halls – medieval and postmedieval Saxon farms where animals were stabled at one end, and people lived at the other end huddling around a long fire have shown that temperature here seldom rose more than 4-6 ºC

[3] This is the reason why many ecologically conscientious people living off the grid will build such ovens in present-day Scandinavia.

[4] Henkel, p. 13

[5] Stube. Wort-und sachgeschichtliche Beiträge zur historischen Hausforschung. By Joachim Hähnel. Münster 1975.

[6] The literature is vast. Se for instance (to just cover two regions):
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[7] From cairn to oven: on the use of ethnological documents in interpreting remains of historical structures.
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[8] Architecture, Pouvoir et Répresentation en Milieu Royal et Princier dans la France du Nord aux X et XIe Siècles. By Annie Renoux
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