Estonian Journal of Archaeology, 2013, **17**, 2, 139–156 doi: 10.3176/arch.2013.2.03

Rivo Bernotas

BRICK-MAKING IN MEDIEVAL LIVONIA – THE ESTONIAN EXAMPLE

In the area that makes up modern-day Estonia, medieval brick buildings have been found in several different towns. Despite this fact, medieval brick-making has still not yet been specifically studied. As the production of bricks as a field of research on its own has been somewhat neglected, even less attention has been given to its different aspects, which bear witness to brick-making. In this article, I am summarizing the material considering brick-making in the medieval Estonian area. Using the historical-comparative method and a comparison of the dates of other brick sites in Europe, whether and how the existing data about brick-making in what is today Estonia correlates with the so-called construction boom in the 14th century in the same area will be analysed. Based on the research in the current article, it might be suggested that the beginning of brick-making clearly correlates with the beginning of the construction boom in the Estonian area in the 14th century. The presented dates support the hypothesis that the construction of the town wall of Tartu began in the first half of the 14th century. Brick-making was essential for the development of the medieval urban townscape. There have been found only a limited number of archaeological evidence of medieval brick-making from Estonian towns besides Tartu. It might be suggested that brick was a rather expensive building material in Estonia, limited only to castles and buildings in the townscape such as fortifications, ecclesiastical buildings and private houses. Even though there is little information preserved about brick-making workers, it seems probable that the brick-masters were often foreigners who worked outside their hometown and country boundaries.

Rivo Bernotas, University of Turku, 2 Henrikinkatu St., FI-20014 Turku, Finland; rivobernotas@gmail.com

Introduction

In the area that makes up modern-day Estonia, medieval brick buildings have been found in several different towns. Despite this fact, medieval brick-making has still not yet been specifically studied. As the production of bricks as a field of research on its own has been somewhat neglected, even less attention has been given to its different aspects, which bear witness to brick-making, such as for example the waste-bricks.

Through archaeology, we can detect a revival of brick production in Lombardy, northern Italy, shortly before the middle of the 12th century. In the middle of the 12th century the use of this technique spread to northern Europe, to both Germany and Denmark (Kristensen 2007, 230). During the late 12th and the first half of 13th century the use of brick technology spread quickly over the territories of Poland, Pomerania and Prussia (Herrmann 2012, 266), and to many other parts of Europe, particularly to places which lacked good building stone (Kristensen 2007, 230). The brick building has been noted to arrive in the present day Swedish and Baltic region in the 13th century (Ratilainen 2012a, 15 f., and references therein). In the northern Baltic, masonry skills along with brick building supposedly arrived in Finland in the late 13th century (Drake 2007, 115; see also Harjula & Immonen 2012, 184). From the 13th century, brick became prevalent in ambitious architecture in Pomerania (Biermann 2012, 266). The most important creators of early brick architecture in these regions were monastic orders and orders of knights (Herrmann 2012, 266). The oldest brickyards in Prussia, which belonged to the Dominican Order, emerged in Kulm and in Elbing. Whether they provided the material only for the construction of the respective monasteries or also for the other urban construction companies is uncertain (Torbus 1998, 316). It is worth mentioning that many of the earliest examples of brick buildings represent the highest quality of brick production and building techniques (Herrmann 2012, 266).

Brick-making (Fig. 1) was one of the prerequisites for the implementation of various construction projects which were run by noblemen. Aristocracy was

Fig. 1. Brick-making in the Netherlands (Binding 2004, 83).

responsible for remodelling the landscape in addition to creating designed landscapes. Noblemen were involved in planning and re-planning villages and open fields, markets and boroughs, in founding and remodelling churches and monasteries, and so on (Hansson 2006, 20). The creation of monuments was thus a way for local communities to gain prestige, but also a way of showing a new attitude towards nature. Castles, churches, monasteries, towns and manors all gave the places where they were situated a special meaning in the local society, often of different kinds of power (op. cit., 39).

Brick-making strongly depends on the availability of clay. Once appropriate clay is located to make brick, there are six basic steps in brick-making: (1) mining, or "winning"; (2) preparation; (3) moulding, or "forming"; (4) drying; (5) firing, or "burning"; and (6) grading, or sorting of finished products for sale (Peres & Connaster 2008, 106; see also Smith 2004, 259 f.; 1985). The bricks were produced by pressing well-kneaded clay, sand and water into a form and thus, with the removal of surplus clay, a regular block was produced. Afterwards a raw brick was knocked out of the form and transported to a drying ground, where they hardened ready for firing (Kristensen 2007, 231).

In the cities of Prussia several brickyards usually existed, which satisfied the demand of different builders. These brickyards were probably operated by different organizations. There were municipal, private, as well as specific church building-oriented brickyards. The urban brickyards were usually under the control of the town councils, which could operate it themselves or lease it to different people. In smaller towns, the number of brickyards was much lower (Herrmann 2007, 136 f.).

The building work itself was seasonal – in the winter the walls were capped with straw or rush thatching to keep out the rain and frost while lime mortar slowly cured (Binding 2004, 7). Studies have shown that brick involved a new way of building. A brick is a modular unit which is easy to combine and vary, and it is easy to handle. Building became rational and presumably efficient, yet production had to be planned and organized. The production of brick required extensive organization which can, to some extent, be compared to the manufacture of ashlar (Sundnér 1997, 81 f.).

According to my research (e.g. Bernotas 2011; 2012; 2013a; 2013b), it appears that in the 14th century radical changes took place in the townscapes in the Estonian area and active construction began, including the start of building stone defensive walls and stone houses. In this article, I am summarizing the material about brick-making in medieval Estonia. Using the historical-comparative method and a comparison of the dates of other brick sites in Europe, whether and how the existing data about brick-making in Estonia correlates with the so-called construction boom in the 14th century in the same area will be analysed. Also various examples of the brick application in buildings will be discussed. Since several results of the archaeological research presented in this article are still unpublished, the current paper also serves the purpose of a source publication.

Traces of brick-making in Estonia

Written sources

The first written record of the brick-making site in Tallinn derives from 1365, from a note about the town mint. There it was noted that in the 4th years of the reign of the mintmaster[1] Peeter Stockelstorp, the revenue of the mint was 885 Rigan marks, of which 75 marks were allocated to brickworks. The mentioned brickyard was located in the Telliskopli Peninsula, in the area of the current Tallinn ceramics factory, on the corner of contemporary Kopli and Maleva streets (Figs 2, 3). There are several maps known of this area, but none of those have so far been published.[2] The exact time of the establishment of the brickyard is not known, but the oldest town council account books give some information about its founding. The brickyard was established as a joint venture at the expense of the town and the three members of the town council. The town council transferred the co-partners rights gradually to the town by paying them a certain

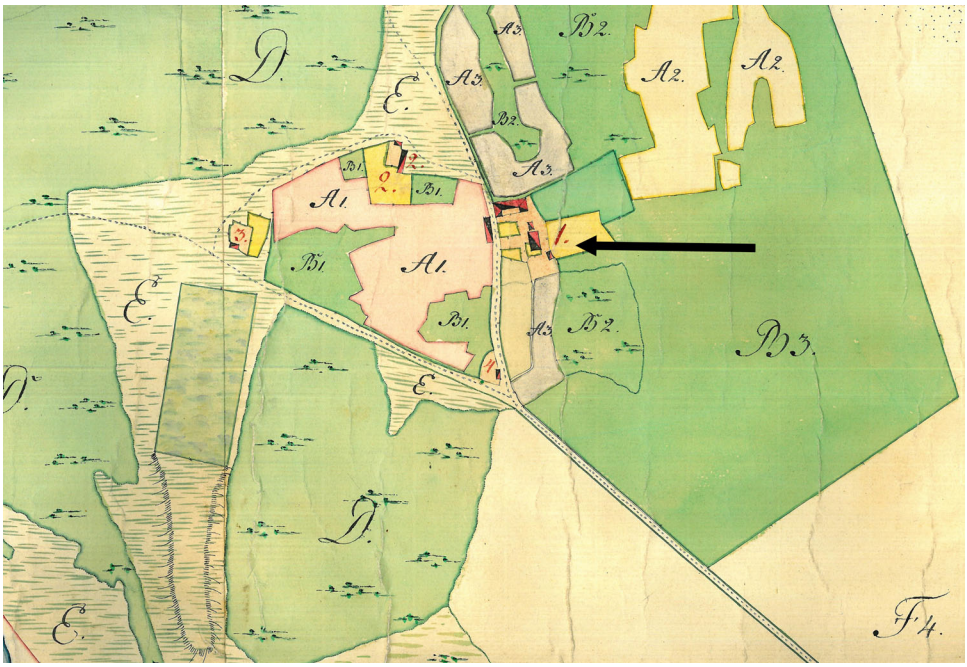

Fig. 2. The alleged location of the Kopli brickyard on the map of 1820 (Geometrische Charte von Ziegelkoppel und den dazu gehörien Inseln Gross- und Klein Carls, 1820. M. J. Stroch, TLA 149-4-246). Part of the map. Modified by Rivo Bernotas.

[1] The member of a town council who was responsible for the management of the mint.

[2] The oldest preserved map is "Geometrische Karte von Ziegelskoppel gemessen im Jahr 1819. M. J. Stroch" (TLA 149-5-2187) and it has been reproduced in a manuscript (Kivi 1966).

Fig. 3. Location of the brickyard and surroundings on the contemporary map of Tallinn. Map from the Estonian Land Board website www.maaamet.ee. Map modified by Rivo Bernotas.

amount from the town's funds each year until the contribution was expunged. It seems that the rights to the brickyard had been redeemed by the town by 1370 as there are no bills of payments in the town account books for the following years (Kivi 1966, 143 f.).

In the established brickyard, bricks and roof tiles were fired. The brick-making process was overseen by the brickmaster (*tegelmester*), who was paid by the town. The management of the brickworks was the responsibility of two members of the town council. Brickmasters were imported from Germany and they received a salary from the town in money and downs (Kivi 1966, 144).

The firewood necessary for burning bricks was brought from Naissaar and Aegna islands (Kivi 1966, 145; see Fig. 3). The cutting of the logs and the firewood was organized by the town council of Tallinn (Kivi 1966, 123). The firewood was brought by waterway, by rafts, fishing boats, and the vessels belonging to the town and the boatmen (Kivi 1966, 145). Logging was usually done in winter and in spring, after the icebreaking logs and firewood were transported to the beach (Kivi 1966, 126). The wood was unloaded at the beach of Kopli Bay, from where it was transported by horse and oxen to the brickyard. The brickyard was financed on the account of the town's chest for a long period (Kivi 1966, 145).

Archaeological research

In the course of rescue excavations, the brick-making complex from the southern suburban area of Tartu was found. This complex consisted of several different elements (Fig. 5). The brick kiln found from 1 Kitsas St. (Figs 4, 5: a) had a stove which was partly sunk into the original sand layer that stood on the slope.

Fig. 4. Brick kiln from 1 Kitsas St. View from north. Photo by Rünno Vissak.

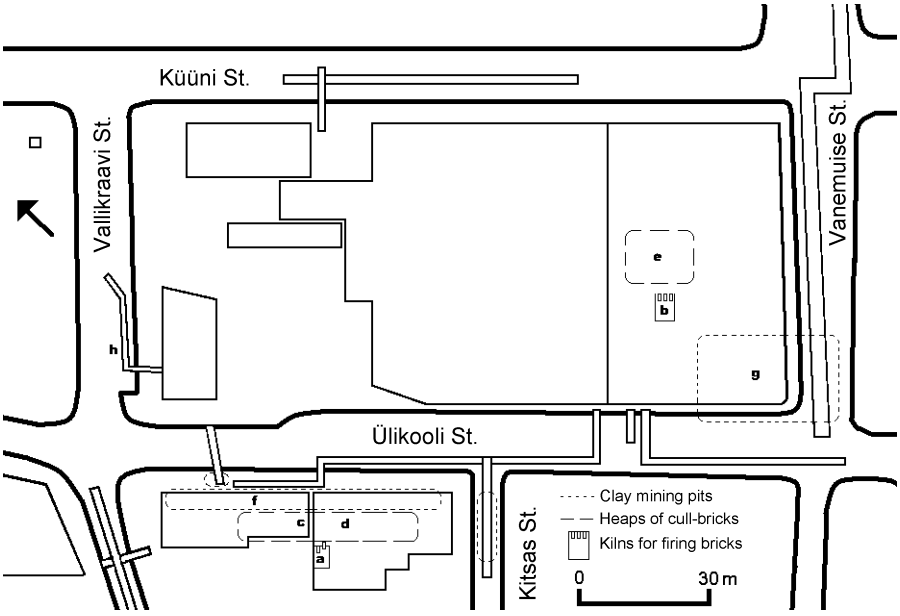

Fig. 5. The brick-making complex in the southern suburban area of Tartu (Heinloo 2006, 87; Fig. 3).

The brick base was laid upon the smoothed but undisturbed natural clay layer. The longitudinal axis of the stove was, like the slope, east–west oriented. In the eastern wall there were two burning chambers and beside them an opening which was probably used for filling and cleaning the stove. During the period of use, the walls of the burning chambers and the vault covering them had been repaired at least once. While the front of the kiln, with the burning chambers and the opening, was laid of burnt bricks, the other two excavated walls were mostly laid of unburned bricks. The measurements of the kiln, taken at the outer sides of the walls, were the following: the length of the burning chamber, 2.5 m; the width, narrowing towards the kiln, 1–0.5 m; the range of the brick burning chamber, 6.2 m; the width observed in the excavation was up to 4 m. The walls were sporadically preserved up to a height of 1.5 m. The kiln is dated to the end of the 13th – beginning of the 14th century (Vissak 2000, 118 ff.).

A second brick kiln with a similar construction came to light in the excavation at the plot of 7 Vanemuise St. (Fig. 5: b), nearly 100 m south-east of the previously mentioned kiln on Kitsas Street. In this area, some timber structures have been excavated with the clay deposits near them indicating that they belonged to a complex of brickyards (Vissak 2000, 118 f.). As a layer was found where there were both clay mining pits and thick waste-bricks, in addition to the structural similarity with the kiln from the plot of 1 Kitsas St., it has been assumed that these remains belong to the same period and were used for the same purposes. The descriptions of the kiln are absent, but the excavation plan and published photographs reveal that the kiln consisted of a large brick-burning chamber (size approximately 5 × 6 m) and multiple chambers in the frontal part (approximately 0.5 × 2 m) (Heinloo 2006, 36). In the same plot, the remains of a wooden building measuring approximately 8 x 4 m were discovered in the south-western side of the excavation area (Aun 1995, fig. 1). No datable finds were found from the building. It has been associated with the kiln, located ten metres north-east, which by its very nature and the specificities of the region, is dated to the end of the 13th or to the 14th century (Heinloo 2006, 45). On the basis of the measurements of the building we cannot eliminate the possibility that it might even have been used as a residential house.

A massive, 1.2 m thick layer (Fig. 5: c) containing bricks and their fragments, covering an area of 80 sq m was discovered at the plot of 6a Ülikooli St. Some of the bricks, measuring 9 × 14.5 × 32 to 10 × 15 × 22 cm were heavily burnt, while others were obviously less severely burnt. On one side, the bricks had longitudinal parallel grooves, evidently made by hand. The earliest presumable date for the layer of waste-bricks and brick manufacturing refuse would be the turn of the 13th and the 14th centuries (Vissak 2000, 116). Also in the northern part of the plot on 1 Kitsas St. (Fig. 5: d), a layer of brick fragments was found. In this excavation the cultural layer was up to 80 cm thick (Vissak 2000, 118). In addition, at the 7 Vanemuise St. plot, north-east from the alleged brick kiln, a 0.3 to 0.9 m thick cultural layer (Fig. 5: e) which consisted of bricks and clay was found immediately on top of the prehistoric strata (Aun 1995, 92).

The pits formed as a result of clay mining were concentrated on the south-west side of Ülikooli Street (Fig. 5: f) on the north-west–south-east directional section and to a lesser extent, immediately north and north-east of the intersection of Ülikooli and Vanemuise streets (Heinloo 2006, 34 and the excavations referred to therein; Fig. 5: g). The clay mining pits are steep-walled digs, reaching into the natural blue-and red clay layers. The depths of the pits range from 35 to 120 cm. At the plot of 6a Ülikooli St. the pits were clearly distinguishable from each other due to a narrow clay partition. Based on the stratigraphic position and comparing the dates of other parts of the brick-making complex (clay conservation pits, brick kilns, heaps of waste-bricks), the date of the clay mining pits is placed from the end of 13th to the beginning of 14th century (Heinloo 2006, 34 f.).

At 2 Vallikraavi St. a natural basin was used for depositing pure red clay. Prior to the placement of the clay layer, this clay-conservation pit was artificially deepened in the south-eastern part (Heinloo 2006, 35; see also Fig. 5: h). Remarkably in the western part of the excavations at 2 Vallikraavi St., a clear red clay layer, up to 90 cm thick, covering an area of 45 sq m was found (Vissak 2000, 115). Fragments of round pot, or '*kugeltopf*' type of ceramic vessel, were found which were dated to the turn of the 13th and 14th centuries in this context by Rünno Vissak (Heinloo 2006; see also Vissak 2000, 116).

The rescue excavations at Küüni Street revealed a dark thick cultural layer, which consisted of fragments of bricks and was deposited on top of a natural layer of lime. The fragments of local-type ceramic vessels found from this layer were dated from the end of the 13th century to the 14th century. This date is also supported by the wooden drainage systems found in the same trench, which based on the finds, are dated to the end of the 13th century to the 14th century (Heinloo 2012, 13 f.).

Traces of brick-making have been found in Viljandi as well. In the course of the excavations in 21 Lossi St., two trenches were found in the immediate vicinity of the medieval town wall. These trenches were filled with mortar crumble, fragments and residue of bricks, roof tiles and their pieces. This fill, consisting of construction residue, was efficient in canalizing the groundwater. It is remarkable that there were no traces of mortar on the bricks and tiles that filled the trenches and some of these had been distorted to the point of being unusable or re-burnt. The production waste of bricks and roof tiles points to the existence of a medieval brick-firing place in the neighbourhood (Tvauri 2010, 159). From the stratigraphy it can be concluded that the trenches were dug soon after the construction of the town wall (Tvauri 2009, 6). The beginning of the construction of the town wall of Viljandi is suggested to be dated to the 14th century (Bernotas 2013a, 18).

The output of bricks

Bricks in the Middle Ages were used in several different types of constructions, notably in town fortifications, ecclesiastical buildings, castles and private houses. In the construction of the town wall of Tartu, bricks were used

extensively (Bernotas 2011, 63 f.). This has found further confirmation in several excavations in the last years. The town wall in the Town Hall Square consisted of mostly 30–60 cm fieldstones, reddish mortar with white lime fragments and fragments of bricks between the stones as a filling. The eastern side of the wall consisted of 8–9 cm thick bricks (Bernotas & Roog 2012, 3). North-east from the crossroad of Küüni and Poe streets the town wall was 1.15 to 1.25 m wide. The wall was made of fieldstones stacked in layers, but for levelling the rows bricks were used (Heinloo 2012, 18 f.; Fig. 6).

South-west from the crossroad of Küüni and Poe streets, the width of the wall was 2 metres. A remarkable discovery was the edge made of bricks, perpendicular to the town wall, which may mark a passageway or aperture in the town wall. The dimensions of the bricks used in the masonry were 8 × 15 × 31 cm (Heinloo 2012, 19).

Fig. 6. Town wall on the north-east side of the crossroad of Küüni and Poe streets. View from south. Photo by Eero Heinloo.

At Küüni Street a part of medieval town wall's (semi-)circular tower was found. In the construction of its west side a regular fieldstone wall, bound with lime mortar was documented, bricks were also documented to a lesser extent (Heinloo & Vissak 2010, 8 f.).

One of the earliest and most spectacular specimens of Gothic brick architecture in the Baltic countries is the Dome Cathedral of Tartu, dedicated to Apostles Peter and Paul. It has been suggested, that the construction of the cathedral probably started in the second third of the 13th century (Valk 1995, 59; see also Alttoa 1992). The walls of St. John's Church in Tartu were laid of layers of fieldstone and brick bound with lime mortar alternated in the foundation laid upon fieldstones which were packed with sand (Alttoa 2011, 15 f.).

The foundation of the Dominican monastery was of fieldstones, the upper part of brick (Tamm 2002, 56). The alleged buttress of the same building, found in the excavations in 2005, was made of brick and granite stones (Tvauri & Bernotas 2006, 105). The alleged walls of St. Catherine's nunnery in Tartu were also made of brick (Tvauri & Bernotas 2007, 174).

The oldest examples of stone houses in Tartu are a one-room brick building in Kompanii Street from the 13th–14th century and house remains from Lossi

Street. There is no detailed information about the first building, but the walls of the last-mentioned brick house stood on top of the fieldstone foundation. This building has been dated to the 14th–16th century. Another brick building from the 14th–16th century has been found in the Tartu Botanical Gardens at Lai Street (Bernotas 2012, 160, and references therein).

Several buildings where brick has been applied in construction have been found in the vicinity of Tartu. It's been noted, that brick was a common building material in the castles of southern Estonia (Andres Tvauri, pers. comm.). For example, in the course of the excavations it became evident that the castle of Varbek had been erected in at least two stages. At first, a building with the shape of an irregular rectangle was erected, using granite stones and bricks (dimensions 30–31 × 15–15.5 × 10 cm) (Tvauri 2002, 154). The walls of the medieval bishop's castle of Varbek near Tartu were laid of bricks with dimensions of 30 × 14 × 9 cm and quarry stones, and was remarkably thick – the westward wall was 3 m and the southward wall 2.5 m thick (Tvauri 2005, 127 f.). At Laiuse Castle, the excavations of the inside of the eastern wall of the building revealed two window recesses, widened on the inside and lined with bricks. The brick walls were rather heavily demolished (Vissak 2003, 124). In the excavations at the Kärkna Monastery, a brick floor was found which had a brick lining laid to the inner side of the castellum wall (Tvauri 2000, 59).

As areas adjacent to Tallinn have abundant supplies of limestone, this was the main building material in masonry and there have been no traces found of medieval brick buildings in Tallinn. Therefore it might be suggested that the main focus of the brickyard was to produce roof tiles and building details for a number of different buildings. For example, the roof of the chapel of St. Anthony in Niguliste Church in Tallinn was always covered with stone roof tiles. This roof made of monk-nun type tiles was repaired in 1672 and 1679, and in the 1680s even the roof tiles burnt and replacements were purchased in Lübeck for repairs (Lumiste & Kangropool 1990, 50). The fragment of roof tile made in the Lübeck St. Petri brickworks found at Haapsalu (Russow & Pärn 2008, 131, 138) also indicates that the material was brought from elsewhere. St. Petri brickyard exported roof tiles to many countries around the Baltic Sea (Kristensen 2007, 231).

Discussion

So far it is evident that the traces of medieval brick-making found from Estonia date to the 14th century. Thus it can be stated that the beginning of brick-making clearly correlates with the beginning of the construction boom in the Estonian area in the 14th century, during the course of which the town areas were re-planned, and the construction of town fortifications, stone churches and stone houses began. From the discussed material, it might be concluded that the brick-making complex from the southern suburban area of Tartu derives from the turn of the 13th and 14th centuries at the earliest. Since there were bricks used for

the levelling of stone layers in the town wall of Tartu, it might be suggested that the beginning of the construction of the town wall cannot be dated earlier, and therefore a suitable date would be the first half of the 14th century. This hypothesis is supported by the fact that as the suburban areas of Tartu have been extensively covered by archaeological fieldwork and no other traces of brick-making have been found elsewhere besides the material examined in the current research (Andres Tvauri, pers. comm.). It has been noted that also in Europe, most towns throughout medieval and early modern period strove to keep brick-making outside the towns, not just because of the fire risk but also because of the unpleasant fumes given off during firing. On the other hand, possessing widespread raw material for making bricks made it possible to manufacture them close to where they were to be used. This had a great economical advantage (Smith 2004, 258).

Brick-making might be considered essential in medieval urban design as due to the timber structures, the danger of fire was constant. For example, the town council of Tallinn fought constantly against wooden buildings by prohibiting their construction, requiring the demolition of the existing ones and their rebuilding into stone houses, and covering the roofs with roof tiles. The town council of Tallinn tried to create order in construction, and even made the new owners to rebuild the wooden houses in stone in a period of around 3–4 years; threatening that otherwise the house would fall to the ownership of the city (Kivi 1966, 21 f.). Despite the orders, the number of wooden buildings decreased very slowly and the constant danger of conflagration remained (Kivi 1966, 24).

In my previous publications, I have suggested that in the present-day Estonian area the development from the first traces of an urban settlement to a walled medieval town took approximately 50–100 years (Bernotas 2013a). What was the comparable situation in some of the better known towns around the Baltic? For example, there is still no written reference to the true medieval city of Rostock at the end of the 12th century. However, historians accept that the first German settlers and merchants arrived there between 1108 and 1190. At present we know as little about the exact time of the founding as we do of the appearance of the first urban settlement (Muslow 2001, 290). The building of the brick and field-stone wall with guard towers in the second half of the 13th century then marked the final medieval city borders (Baier 1976, 106; see also Muslow 2001, 291). This date gives an impression that the time from the rudimentary urban settlement to the walled medieval town in some German areas around the Baltic might even in bigger cities have taken around century, similarly to the Estonian area (Bernotas 2013a).

In some areas around the Baltic, brick-making was a forced choice. For example, on the lowland of Great Poland throughout the 13th century, the basic building material was wood. Timber was used in military and even ducal architecture. The situation changed when the Dominican and Franciscan monks, two urban orders, came to Poland. The first was the establishment of the Franciscan order in 1239. They brought the art of brick architecture and brick production to the towns of Great Poland and Kujawy. A stronger and more resistant building material was

needed, and brick was the answer. Moreover, it was a very convenient material, as clay was easily available in this region. There were also rich deposits of limestone, used for making mortar (Poklewski-Koziełł 2001, 146 and references therein). It has been assumed that King Casimir the Great (1333–1370) made use of the building workshops developing in towns from the middle of the 13th century onwards (Poklewski-Koziełł 2001, 147). During his reign in the Duchy of Mazovia, the important town of Warsaw was surrounded by a defensive wall and had a brick castle erected by the duke. From there the Vistula River ran towards the royal town of Plock, where the King built a brick castle and surrounded the town with a brick defensive wall (Poklewski-Koziełł 2004, 150). Prior to 1250, the regularly planned area of the city of Wroclaw was encircled with a system of brick ramparts, complete with towers and a moat. Around the middle of the fourteenth century, districts added to the city on its south and west side were fortified in a similar manner (Piekalski 2011, 378).

According to the traditional view, brick was an expensive and rare medieval building material in some parts of Europe, as for example in Finland (Ratilainen 2012a, 17 and references therein; see also Ratilainen 2012b, 198). Similarly in western Europe, in the Netherlands, in the town of s'Hertogenbosch, as a rule the use of stone and bricks during this early period was limited only to public, ecclesiastical and military buildings, such as the early 13th century town wall with its gate houses (Janssen 2002, 142). In Alkmaar, Netherlands, the use of quite expensive brick was also meant to impress the town's visitors (Bitter 2010, 152). In Sweden, stone as a building material was mainly used in buildings which symbolized both divine and secular power: churches and castles. Dwelling houses of stone and brick were reserved for the nobility, the clergy, and the rich burghers (Sundnér 1997, 79). Brick remained expensive throughout the medieval period. The burghers of Antwerp, following the attack on their city in 1542, spent over 10 000 000 guilders on updating the defences with stone-faced and bastioned walls in the Italian style. Even with brick substituted for stone, Italianate defences were expensive and were thus largely concentrated in the main zones of conflict (Courtney 2006, 168). In England, brick had a theoretically huge potential market, but in practice it was in competition with stone in most districts and its cost of production was too great even though the clay itself was cheap. Wage costs were high, both for skilled moulders and layers, for large numbers of unskilled labourers, and additionally the kilns voraciously consumed fuel. Coal had to be transported and so was not cheap, probably even if carried as ballast in boats that had taken grain to the north-east. In the same way, bricks were too heavy for easy transport and with a lot of expenses production at a single centre for distribution over a wide area was not sensible, which is the typically restrictive pattern of a medieval bulk industry (Hinton 1990, 168).

It might be assumed that direct contact between Estonian area and England was rather unlikely and there was instead probably a mediator. The English influence has, after all, been the subject of a strong influence on the Hanseatic towns of

the 14th century – for example Torún's Church or Jacob's Church in Rostock (Alttoa 2011, 50). Comparing the brick-making data from England, it appears that a municipal brickyard in Hull was recorded as early as in 1303 and continued in production until the middle of the 15th century. Brick had made occasional appearances before in England, but Hull marks its first significant bulk use; Hull's town walls were built of brick. Some other east coast towns made similar use of it (Hinton 1990, 168). Large sections of the town wall of London were rebuilt in brick in the second half of the 15th century. The parapet was built in brick and brick arches were built behind the wall in at least three sections, perhaps as a defence against cannons. This is probably the earliest large-scale use of brick in London and might be seen as the beginning of the rise in the fashion of brick buildings, which were to predominate in the 16th century and later (Thomas 2002, 127; about brick usage in London Wall in Saint Alphage Garden see also Smith 2004).

Considering the workforce, not a lot of information has survived. From the available material it appears that the master of the Livonian Order asked in 1436 to deploy the German-originated brickmaster to Narva, with a purpose of choosing a place for the brickworks and to search for suitable clay for firing bricks. The master of the order announced that he gave an order to the Commander of Tallinn to give horses and a man who would transport the brickmaster to Narva and back (Kivi 1966, 144). The limestone products and the stone-carvers of Tallinn were widely known in the Middle Ages and later. These masters often worked outside their home town and country boundaries, and their products were exported overseas (Kivi 1966, 152). They[3] were highly skilled and were often asked to go to supervise construction works in other cities and abroad (Kivi 1966, 165). For example, it has been suggested that stonemasons in Sweden generally belonged to the mason's lodges attached to major construction projects and therefore moved from one project to another (Sundnér 1997, 88 and the references therein). It has been noted that the masons who built the city wall of Visby, Gotland, ended the construction works at the end of the 13th century and moved to new jobs in Tallinn, Kalmar, Turku and Åland (Kivi 1966, 154). Therefore it seems probable that the brickmasters working in Estonia were often itinerant, similarly to stonemasons. For example, in England the archaeological evidence has also been used to suggest itinerancy amongst tilers (Stopford 1993, 96).

Conclusions

Based on the research in the current article, it might be suggested that the beginning of brick-making clearly correlates with the beginning of the construction boom in Estonia in the 14th century. In the course of the latter, the town areas

[3] Most of the workers' ethnicity was Estonian, however among the masters there were few Estonians. Most of the foreign workers and masters descended mainly from the Rhineland, Westphalia and Gotland (Kivi 1966, 154).

were re-planned, the construction of the town fortifications, stone churches and stone houses had started. The presented dates support the hypothesis that the construction of the town wall of Tartu began in the first half of the 14th century. Brick-making was essential for the development of the medieval urban townscape, as the old-fashioned wooden buildings presented a constant danger of fire. The previous research shows that the development from the first traces of an urban settlement to a complete medieval walled town in the present-day Estonian area took approximately 50–100 years. According to the discussed information, it might be suggested that it was the same in some of the German areas around the Baltic. The art of brick architecture and brick-making spread from German areas to the towns of Great Poland and Kujawy through the Dominican and Franciscan orders. There have been found only a limited number of archaeological evidence of medieval brick making from Estonian towns besides Tartu. It might be suggested that brick was a rather expensive building material in Estonia, limited only to castles and buildings in the townscape such as fortifications, ecclesiastical buildings and private houses. Even though there is little information preserved about brick-making workers, it seems probable that similarly to stone-carvers of Tallinn the brick-masters were often foreigners who worked outside their hometown and country boundaries.

Acknowledgements

I am grateful to my colleagues Tanja Ratilainen, Jussi-Pekka Taavitsainen and Andres Tvauri for valuable comments in the course of composing this article. In addition I would like to thank Rünno Vissak and Eero Heinloo for allowing me to use the material from the excavations in Tartu. I am also thankful to Jean Price for language corrections. This publication has been completed thanks to funding from the Turku University Foundation.

References

Alttoa, K. 1992. Eesti tellisgootika uurimisseisust. – Eesti Teadusliku Seltsi Rootsis aastaraamat, XI, 1988–1990. Stockholm, 9–26.

Alttoa, K. 2011. Tartu Jaani kirik. (Eesti kirikud, III.) Muinsuskaitseamet, Tallinn.

Aun, M. 1995. Tartu keskaegse eeslinna kultuurkihist Küüni tänava arheoloogilise materjali põhjal. – Tartu arheoloogiast ja vanemast ehitusloost. Ed. H. Valk. (Tartu Ülikooli Arheoloogia Kabineti toimetised, 8.) Tartu, 91–97.

Baier, G. 1976. Das Stadtbild als Spiegel der Geschichte. Die großen Küstenstädte und ihre Baudenkmale. – Denkmale in Mecklenburg. Ihre Erhaltung und Pflege in den Bezirken Rostock, Schwerin und Neubrandenburg. Weimar, 53–136.

Bernotas, R. 2011. Medieval town wall of Tartu in the light of recent research. – EJA, 15: 1, 56–72.

Bernotas, R. 2012. New insights on the changes of townscape in 14th-century Tartu. – EJA, 16: 2, 153–168.

Bernotas, R. 2013a. Estonian small towns in Middle Ages – archaeology and history of urban defense. – Estonian Historical Journal. In print.

Bernotas, R. 2013b. Medieval fortifications of Pärnu. An archaeological approach. – Zeitschrift für Archäologie des Mittelalters. In print.
Bernotas, R. & Roog, R. 2012. Aruanne arheoloogilisest järelvalvest Tartus, Magistri tänaval ja Raekoja platsil toimunud elektrikaablitrassi rajamisel 2012. aasta augustis. Manuscript in the National Heritage Board.
Biermann, F. 2012. Brick technology and use in Medieval Pomerania – the monastic example. – 18th Annual Meeting of European Association of Archaeologists. 29. August – 1. September 2012, Helsinki, Finland. Abstracts. Ed. E.-M. Viitanen. Helsinki, 266.
Binding, G. 2004. Medieval Building Techniques. Tempus, Stroud.
Bitter, P. 2010. 'In de vesten, tot Alcmair' – inside the moats, at Alkmaar. – Lübecker Kolloquium zur Stadtarchäologie im Hanseraum, VII: Die Befestigungen. Verlag Schmidt Römhold, Lübeck, 147–162.
Courtney, P. 2006. Armies, militias and urban landscapes: England, France and the Low Countries 1500–1900. – Cities in the World, 1500–2000. Papers Given at the Conference of the Society for Post-Medieval Archaeology, April 2002. Eds A. Green & R. Leech. Maney Publishing, London, 167–193.
Drake, K. 2007. Gotische Backsteinbaukunst in Finnland. – Backstein Baukunst. Zur Denkmalkultur des Ostseeraums. Dokumentation der Tagung zum 75. Geburtstag von Gottfried Kiesow in der Wismarer St. Georgen-Kirche, 31.8.–1.9.2006. Deutsche Stiftung Denkmalschutz, Bonn.
Hansson, M. 2006. Aristocratic landscape. The spatial ideology of the medieval aristocracy. (Lund Studies of Historical Archaeology, 2.) Almqvist & Wiksell International.
Harjula, J. & Immonen, V. 2012. Reviving old archaeological material. A project analysing finds from the early medieval fortified site of Koroinen in Turku. – Castella Maris Baltici, X. Eds K. Uotila, T. Mikkola & A.-M. Vilkuna. Society for Medieval Archaeology in Finland, Saarijärvi, 183–190.
Heinloo, E. 2006. Tartu lõunapoolne eeslinn kesk- ja varauusajal arheoloogia andmetel. Peaseminaritöö. Tartu. Manuscript in the Institute of History and Archaeology of the University of Tartu.
Heinloo, E. 2012. Küüni tänava rekonstrueerimise II etapi käigus teostatud arheoloogilised uuringud 2010. aastal. Manuscript in the Town Museum of Tartu.
Heinloo, E. & Vissak, R. 2010. Küüni tänava rekonstrueerimise käigus toimunud arheoloogiline järelvalve 2009. aastal. Manuscript in the Town Museum of Tartu.
Herrmann, C. 2007. Mittelalterliche Architektur im Preussenland. Michael Imhof Verlag, Petersberg.
Herrmann, C. 2012. Monastic orders as pioneers of brick architecture in medieval Poland, Pomerania and Prussia. – 18th Annual Meeting of European Association of Archaeologists. 29. August – 1. September 2012, Helsinki, Finland. Abstracts. Ed. E.-M. Viitanen. Helsinki, 266.
Hinton, D. A. 1990. Archaeology, Economy and Society: England from the Fifth to the Fifteenth Century. Seaby, London.
Janssen, H. L. 2002. Patrician and aristocratic town residences in s'Hertogenbosch c. 1250–c. 1550 – the archaeological evidence. – Medieval Europe Basel 2002: Centre, Region, Periphery. Vol. 2: sections 4 and 5. Eds G. Helmig, B. Scholkmann & M. Untermann. Folio Verlag Dr. G. Wesselkamp, Hertingen, Basel, 140–148.
Kivi, A. 1966. Tallinna manufaktuuride ja tööstuste ajaloost. – Tallinn. Linna asustus- ja ehitusajaloolisi materjale seitsmes köites. Eds E. Alamaa & A. Kivi. Eesti NSV Riiklik Ehituskomitee, Tallinn, 120–329.
Kristensen, H. K. 2007. The production and use of bricks. – The Archaeology of Medieval Europe. Vol. 1. Eds J. Graham-Campbell & M. Valor. Aarhus University Press, 230–232.
Lumiste, M. & Kangropool, R. 1990. Niguliste kirik. Kirjastus Kunst, Tallinn.
Muslow, R. 2001. Rostock – Medieval Archaeology: An Encyclopedia. Garland Publishing, New York, London, 289–292.
Peres, T. M. & Connaster, J. B. 2008. Brick making as a local industry in Antebellum Kentucky and Tennessee. – Tennessee Archaeology, Vol. 3, issue 2. Eds M. C. Moore & K. E. Smith. Tennessee Council for Professional Archaeology, 105–122.

Piekalski, J. 2011. Wrocława in the twelfth–sixteenth century. – The Archaeology of Medieval Europe. Vol. 2: Twelfth to Sixteenth Centuries. Eds M. Carver & J. Klápště. Aarhus University Press, 376–378.
Poklewski-Koziełł, T. 2001. The castle in the defensive system of royal towns in Great Poland in the 14th century. – Castella Maris Baltici, 3–4. Eds K. Alttoa, K. Drake, K. Pospieszny & K. Uotila. Society for Medieval Archaeology in Finland, Turku, Tartu, Malbork, 145–149.
Poklewski-Koziełł, T. 2004. The royal castles and defensive towns on trading routes through Poland to the Baltic Sea in the 14th–15th century. A contribution to the history of country defence system planning. – Castella Maris Baltici, 6. Ed. A. Kuncevičius. Savastis, Vilnius, 147–152.
Ratilainen, T. 2012a. Tiiliä tulkitsemassa. Hattulan Pyhän Ristin kirkon muuraaminen keskiajalla. Licenciate thesis. Turun yliopisto. Historian, kulttuurin ja taiteiden tutkimuksen laitos. Turku.
Ratilainen, T. 2012b. To study medieval brick building technique by applying digital surveying methods cases: Holy Cross Church of Hattula and Häme Castle. – Castella Maris Baltici, X. Eds K. Uotila, T. Mikkola & A.-M. Vilkuna. Society for Medieval Archaeology in Finland, Saarijärvi, 197–208.
Russow, E. & Pärn, A. 2008. Archäologische Untersuchungen in Haapsalu: Bischofsburg, Marktplatz und Vorstadt. – AVE, 2007, 127–138.
Smith, T. P. 1985. The Medieval Brickmaking Industry in England 1400–1450. (British Archaeological Reports. British Series, 138.) B.A.R., Oxford.
Smith, T. P. 2004. The late medieval bricks and brickwork of London Wall in Saint Alphage Garden, EC2. (London Archaeologist, 10, Autumn 2004.) London Archaeologist Association, 255–263.
Stopford, J. 1993. Modes of production among medieval tilers. – Medieval Archaeology, 37, 93–108.
Sundnér, B. 1997. Building stone as archaeological source material. – Visions of the Past. Trends and Traditions in Swedish Medieval Archaeology. Eds H. Andersson, P. Carelli & L. Ersgård. (Lund Studies in Medieval Archaeology, 19.) Central Board of National Antiquities, Institute of Archaeology, Lund University, 73–90.
Tamm, J. 2002. Eesti keskaegsed kloostrid. Eesti Entsüklopeediakirjastus, Tallinn.
Thomas, C. 2002. The Archaeology of Medieval London. Sutton Publishing, Stroud Gloucestershire.
Torbus, T. 1998. Die Konventsburgen im Deutschordensland Preussen. R. Oldenbourg Verlag, München.
Tvauri, A. 2000. The archaeological investigations in Viljandi, Tartu and Kärkna. – AVE, 1999, 54–62.
Tvauri, A. 2002. Archaeological investigations at the Bishop's Castle of Varbek (Kastre). – AVE, 2001, 152–159.
Tvauri, A. 2005. Archaeological investigations at the medieval bishops's castle of Varbek (Uue-Kastre) in 2002–2004. – AVE, 2004, 127–132.
Tvauri, A. 2009. Aruanne arheoloogilistest kaevamistest Viljandis Lossi 21 hoone (endine kino "Rubiin") idaküljel 2009. aastal. Manuscript in the National Heritage Board.
Tvauri, A. 2010. Archaeological excavations at Lossi 21, Viljandi. – AVE, 2009, 157–163.
Tvauri, A. & Bernotas, R. 2006. Archaeological investigations carried out by the University of Tartu in 2005. – AVE, 2005, 101–110.
Tvauri, A. & Bernotas, R. 2007. Archaeological investigations in Tartu and Vorbuse settlementsite. – AVE, 2006, 167–181.
Valk, H. 1995. Tartu Toomkiriku kalmistust ja ümbruskonna varasemast asustusest. – Tartu arheoloogiast ja vanemast ehitusloost. Ed. H. Valk. (Tartu Ülikooli Arheoloogia Kabineti toimetised, 8.) Tartu, 1995, 59–80.
Vissak, R. 2000. Results of the archaeological investigations at the SE foot of Toomemägi, Tartu. – AVE, 1999, 113–120.
Vissak, R. 2003. Archaeological investigations of the Laiuse castle. – AVE, 2002, 118–126.

Rivo Bernotas

TELLISETOOTMINE KESKAEGSEL LIIVIMAAL – EESTI NÄITEL

Resümee

Tänapäeva Eesti alal on keskaegseid tellishooneid leitud mitmest linnast. Telliseid on kasutatud nii linnakindlustuste, vaimulike kui ka ilmalike hoonete ehitusel. Sellest hoolimata pole keskaegset tellisevalmistamist siiani veel eraldi uuritud. Kui tellisetootmine kui uurimisvaldkond tervikuna on unarusse jäänud, siis isegi vähem on tähelepanu pööratud selle erinevatele aspektidele, mis annavad tunnistust telliste valmistamisest, näiteks praaktellistele. Käesolevas artiklis vaatlen keskaegsele tellisetootmisele viitavat arheoloogilist materjali Eesti alalt ja analüüsin ajaloolis-võrdlevale meetodile ning Euroopa materjali dateeringutele tuginedes, kas ja kuidas teadaolevad andmed tellisevalmistamisest Eesti alal seonduvad nn ehitusbuumiga siinses piirkonnas. Esimene kirjalik teade Tallinna linna telliselöövi kohta pärineb ühest linnamüntla kohta käivast märkusest 1365. aastast. Selles on märgitud, et müntlahärra (raeliige, kellele allus müntla majandamine) Peeter Stockelstorpi ajal olla müntla nelja aasta jooksul andnud tulu 885 Riia marka, millest 75 kulutatud telliselöövi tarbeks. Tähendatud telliselööv asus Telliskopli poolsaarel, praeguse Tallinna Keraamikatehase kohal Kopli ja Maleva tänava nurgal. Millal see telliselööv asutati, ei ole teada, kuid linnarae vanimad arveraamatud annavad selle rajamisviisi kohta mõningaid andmeid. Tähendatud telliselööv rajati Tallinna linna ja kolme linnarae liikme kulul ühisettevõttena. Linnaraad lunastas osanike osaõigused linnale järk-järgult, tasudes neile igal aastal linnalaekast teatud summa kuni osamaksu kustutamiseni. Näib, et telliselöövi osaõigused lunastati linnale juba 1370. aastal. Telliselöövis põletati telliseid ja katusekive, mille valmistamise protsessi jälgis tellisemeister. Keskaegse Tartu lõunapoolse eeslinna alalt avastatud telliste valmistamise kompleks, mille hulka kuulusid nii tellisepõletusahjud, praaktellisekuhjatised, savikaevanduslohud kui ka savisäilituslohud, on dateeritud 13. sajandi lõpu kuni 14. sajandi algusega. Mainitud piirkonna lähedusest leitud loodusliku pinnase peal paiknenud tellisetükke sisaldanud kultuurkiht on dateeritud sama perioodiga. Jälgi tellisetootmisest on avastatud ka Viljandist, kus linnamüüri läheduses toimunud päästekaevamiste käigus paljandusid kaks kraavi, mis olid täidetud praaktelliste ja -katusekivide ning nende katketega. Avastatud tootmisjäägid viitavad keskaegse tellisepõletusahju lähedusele. Kultuurkihi stratigraafiast tulenevalt võib järeldada, et mainitud kraavid rajati vahetult peale linnamüüri ehitust. Viljandi linnamüüri rajamise olen oma varasemas publikatsioonis dateerinud 14. sajandiga. Käesolevas artiklis esitatud uurimistulemustele tuginedes võib öelda, et tellisetootmise algus korreleerub 14. sajandil Eesti alal aset leidnud aktiivse ehitustegevusega, mille käigus toimusid muudatused linnaplaneeringutes ja alustati linnakindlustuste, kivikirikute ning kivimajade ehitust. Tartu materjali vaadeldes võib öelda, et esitatud dateeringud

toetavad hüpoteesi, mille kohaselt algas Tartu linnamüüri ehitus 14. sajandi esimesel poolel. Tellisetootmine oli keskaegse linnamaastiku arengus olulisel kohal, kuna vanamoodsad puitehitised olid tuleohtlikud. Keskajal levis tellisevalmistamine Saksa aladelt ida suunas eelkõige dominiiklaste ja frantsisklaste mungaordude tegevuse tulemusel. Peale Tartu on Eesti linnadest keskaegsest tellisetootmisest napilt jälgi leitud. Võib oletada, et analoogselt mõningate piirkondadega Euroopas oli ka siinsetel aladel tellis pigem kallis ehitusmaterjal, mida kasutati vaid linnustes ja erinevates ehitistes linnades (kindlustused, vaimulikud ning ilmalikud hooned). Kuigi tellisetootmisega tegelnud töölistest on vähe teada, tuleb tõenäoliseks pidada, et analoogselt Tallinnast teadaolevatele kiviraiduritele olid ka tellisemeistrid tihti välismaalased, kes töötasid väljaspool oma kodulinna ja riigi piire.