Estonian Journal of Archaeology, 2020, **24**, 1, 70–85
https://doi.org/10.3176/arch.2020.1.03

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BRICKS FOR THE COUNTRY OF WOOD: BRICKMAKING PRACTICES IN MEDIAEVAL NOVGOROD (11TH–13TH CENTURIES)

In the wooden mediaeval cities of the Kievan Rus', from the late 10th to mid-13th century, brick construction was an exclusive and expensive activity which limited the number of edifices to ca 200 in all. Nevertheless, those created a demand for continuous brick production from the mid-11th century. For archaeologists and architectural historians, the clear chronology of the churches provided by the chronicle record gives a superb chance to trace the development of the brick (thin tile *plinthoi*, adopted from Byzantium) industry in fine detail. The research aimed to investigate the development of brick production in various Early Russian cities, its continuity and discontinuity, basing on the first-hand analysis of the technological features of bricks, and to trace the movements of the brickmakers groups between the centres of construction activity in Kievan Rus'. It is claimed that in the early 12th century, Kiev, Chernigov, Pereyaslavl', Polotsk, Smolensk and Novgorod each had their own brickmaking workshops, whose production differs in the types of frame (fixed and separable, with and without bottom) used for hand-moulding, smoothing the surfaces, post-moulding treatment (cutting off the leakages), and the marking of the batches for firing in kilns. The case of Novgorod was chosen as the illustrative example for this paper. As has been reconstructed from the features of the bricks, 12th century Novgorodian brickmaking technology originated in Kiev, where it was established earlier. In Novgorod, it quickly began to develop independently, reflecting the existence of a separate brickmaking workshop. However, Novgorodian bricks followed the tendency to diminish in size that was characteristic for most cities of Kievan Rus' throughout the 12th century, which is shown in the table of the brick sizes of the selected monuments. The same features of bricks from several 12th century churches in Pskov and Ladoga witness for the spreading of Novgorodian technology there along with the complete consequent transfer of the building crew. Of the particular shapes of bricks, narrow five-cornered bricks for the eave cornices were usual, moulded in the special frames. The cases of a variety of special moulded brick shapes being produced for two 13th-century churches with elaborate articulation of the façades of Smolensk style, stand out as particularly noteworthy, testifying to interaction between the local brickmakers and master builders from elsewhere responsible for the unusual architectural decoration.

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Introduction

Monumental masonry construction first appeared in the lands populated by the Eastern Slavs in the late 10th century AD, at the same time as the completion of the formation of the 'state' of the Rus' – a conglomerate of principalities, more or less independent of each other, frequently hostile and uniting in short-lived alliances – that in historiography is termed Early Rus' or Kievan Rus'. At that key moment, under the influence of Byzantium, Rus' adopted Orthodox Christianity, receiving together with it, notably, the 'cultural package' of Eastern Christian art and monumental architecture. Initially, in the 11th century, the construction of masonry buildings was an exclusive event. As it developed on the local soil, masonry architecture acquired a certain distinctive character, due, among other things, to the formation of local workshops (Mango 1976, 324 ff.; Ousterhout 2019, 540 ff.). This period in the Early Russian state was brought to an end in the mid-13th century by the devastating Mongol invasion, which halted the construction activity for half a century. From the whole period, since the late 10th till the mid-13th century, ca 40 stone and brick masonry buildings are standing today, of which no one preserved intact (Faensen & Ivanov 1975, 329–359). Ca 200 sites of ruined buildings dated to the same period were archaeologically detected in dozens of Early Russian towns and cities (Rappoport 1982). This number complies with the chronicles' evidence on masonry construction events, most often distinguished from wooden construction by special wording. Contemporary wooden structures, common for both vernacular and ecclesiastical local architecture, amounted to thousands of buildings.

The Early Russian brick of Byzantine type – a thin rectangle with similar length and width, but rarely completely square (the Greek term *plinthoi* is generally used for the bricks of this period) – was, from the late 10th century, the main building material, often along with rubble stone, for more than 200 of the monumental architectural structures, mainly Orthodox churches in the population centres of Kievan Rus': Kiev, Chernigov, Pereyaslavl' Yuzhny, Polotsk, Smolensk, Grodno, Novgorod and others. *Plinthoi* were used no more after the Mongol invasion. The West European bar brick type was introduced to Kiev from Poland in the 13th century only a decade before invasion, and to Novgorod from Livonian Order in the last decade of the century (Rappoport 1995, 46; Antipov & Gervais 2015).

The large number of brick buildings and ruins from the premongol period can be confidently associated with buildings mentioned in the chronicles that often give exact dates for the construction and consecration of churches. It is important too that, in contrast to the territory of the former Roman Empire, in Kievan Rus' there were no sources of spolia – ruins of structures from the preceding era of Antiquity or the early Middle Ages that people readily re-used as raw materials in the erection of new buildings in High Mediaeval Europe. Since building materials were almost always made afresh for each new building, they can, more often than not, be confidently dated on the basis of the chronicle date for the construction, which has opened up great prospects for the study of the distinctive characteristics of Early Russian bricks, their local differences and changes over time.

Our research aims to investigate the development of brick production in various Early Russian cities, its continuity and discontinuity, basing on the first-hand analysis of the technological features of bricks, and to trace the movements of the brickmaker groups between the centres of construction activity in Kievan Rus'. The case of Novgorod was chosen as the illustrative example for this paper.

Studies of the characteristics of bricks

In Middle Ages the production of brick was manual. The main stages in the manufacture of a brick were the extraction and preparation of raw material, moulding, drying and firing. At the raw material stage, the most important thing was picking the right deposits, with lean clay being most suitable for brickmaking. The extracted clay was specially processed – frozen, pounded to reduce the size of the particles and sifted. It was then mixed with sand in particular proportions, and sometimes also with other leaning agents – granulated limestone, ground ceramics (chamotte), grus (crushed stone). The character of the clay and the leaning agents in the brick paste determines its degree of plasticity and liability to deformation, the rate of drying, the evenness of firing and, consequently, substantially affected the final appearance of the brick (Sanotskij 1904; Arkin 1946). Each brick was moulded manually in a separate frame. In Russia, manual production survived up to the early 20th century, and numerous instructions for the 'cottage industry' of that period describe the moulding technology in detail. No brick frames from the pre-Mongol period survive, though the recent find of the 14th century bar brick wooden frame in Novgorod seems to be a carbon copy of the early 20th century frames (Fig. 1) (Pokrovskaya & Singh 2020). The process of hand-moulding a brick consisted of packing an amorphous mass of ceramic paste into a frame. Then the excess was removed from the open side and that surface levelled off, after which the raw brick was extracted from the mould, dried out and fired (Belavenets 1905).

Already in the early 19th century, the diversity of bricks from Kievan Rus' was noted during the first studies of pre-Mongol architectural monuments. By the late 1800s, it had become customary to mention the dimensions and certain other conspicuous characteristics of the brick in the publication of restoration and archaeological reports. Studies in the first half of the 20th century produced a considerable body of data, facilitating the first attempts to form an outline picture of the evolution of the technology in separate building centres in Kievan Rus' (Karger 1958, 456). In the second half of the 20th century, greater attention was paid to the study of the format of the brick, i.e. its dimensional properties and the way they changed over time, from building to building (Voronin & Rappoport 1979, 375 ff.). This work identified a general tendency for bricks to gradually reduce in length and width over the course of the 11th–13th centuries accompanied by an increase in thickness. The assortment of bricks (the set of figured shapes typical for one or a group of structures) was particularly noted during restoration studies.

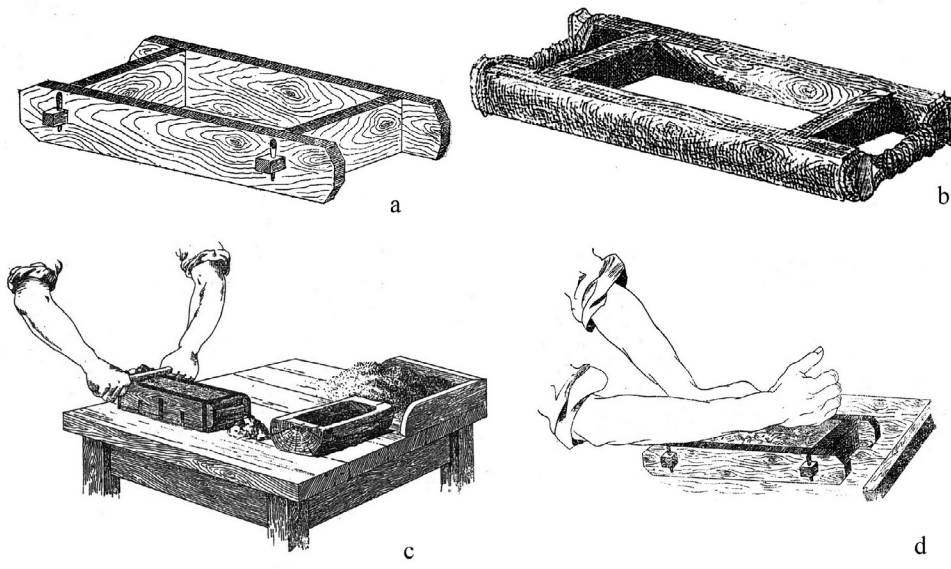

Fig. 1. Illustrations from the early 20th century Russian handbook for 'cottage' brick production. a–b – variants of the 'open frame' brick mould, c – lengthwise sweep with a tool, d – irregular sweep by hand (Belavenets 1905).

Publications covered in the greatest detail instances of the marking of bricks in the form of stamps, relief symbols and labels that obviously reflect the system by which the production of bricks was organized and perhaps also the link between builders and clients. The study of Early Russian bricks was summed up in the works of Pavel Rappoport. Based on the marking of bricks he came to the conclusion that the bricks in different cities were produced by different groups of brickmakers following their own accustomed techniques. Although there are no mention of the builders teams of Early Rus' in the written sources, Rappoport considered certain sets of similarities in architectural features and building techniques to be the evidence on activity of building teams as long-term and stable unions of craftsmen (Rappoport 1995, 31 ff., 193 ff.; see also Ousterhout 1999, 50 ff.).

Further studies of bricks from Kievan Rus' identified greater diversity in the methods of moulding bricks and their peculiarities, which were determined on the basis of a whole set of characteristic traces of smoothing and imprints on the surfaces of bricks, as well as treating of surfaces with combings, relief marks and signs. In the series of case studies, it emerged that the distinctive characteristics were systemic in nature: identical features were found in bricks from buildings belonging to one construction centre and close in date, and, conversely, in different cities or in the same city, but in different time periods, those characteristics differed considerable (Gordin & Ioannisyan 2003).

Recent research of the technological features of the Early Russian *plinthoi*, based on the long-term systematic analysis of both field mass finds (thousands of items)

and museum assemblages (hundreds of items), has led to the more detailed picture of this diversity (Jolshin 2014). The smoothing of the surface (which was at the top during the moulding process) was performed by one of the two main means: a single lengthwise sweep with a wooden board (Kievan bricks of the 11th and 12th centuries, Novgorodian, Polotsk, and Smolensk bricks of the 12th century) or by hand with an irregular (circular, zigzag or other) motion (Kievan bricks of the late 10th century, the 11th-century bricks of the Cathedral of St Sophia in Novgorod and almost all bricks made in Chernigov) (Fig. 2). The marks left on the opposite, lower, bed of the brick make it possible to determine whether the used frame had a bottom or not. A smooth, even surface of the lower bed, similar to that of the headers, is evidence of the use of

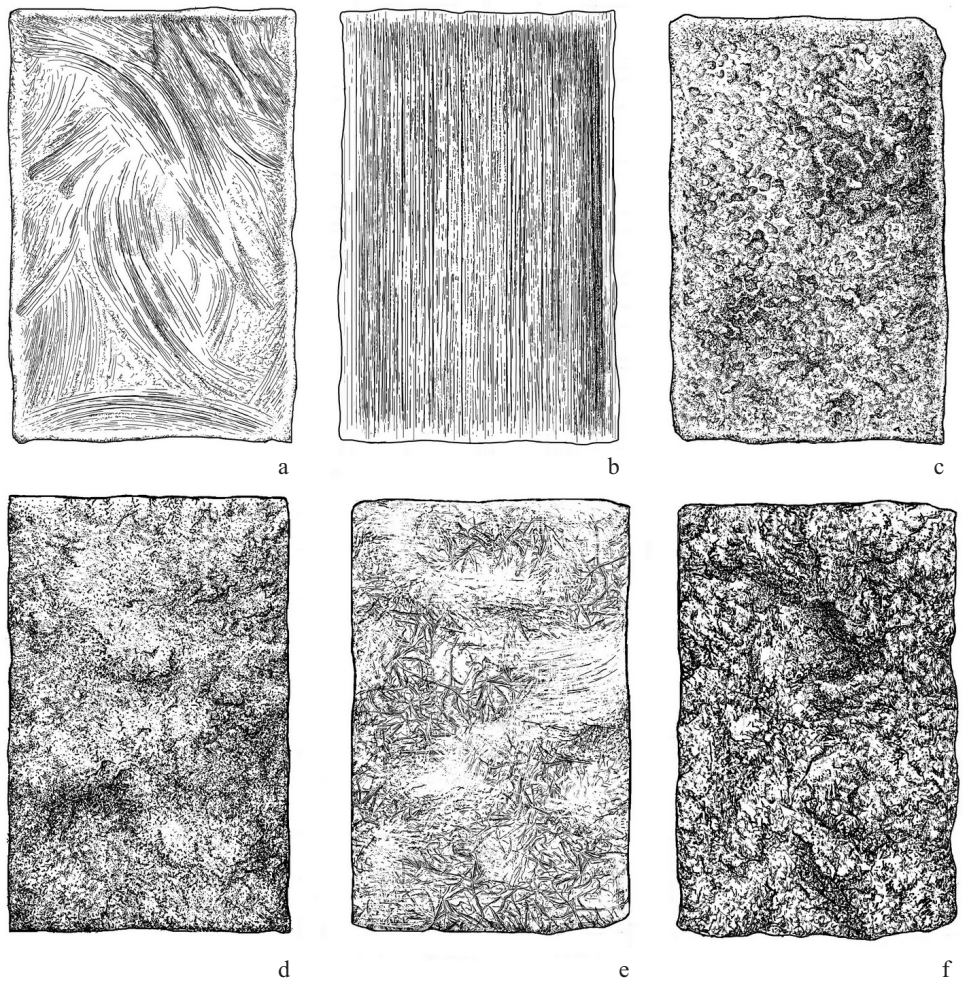

Fig. 2. Typical marks on the upper surface (a–c) and lower bed (d–f) of brick in Kievan Rus'. a – irregular sweep by hand, b – lengthwise sweep with a wooden board, c – rain marks, d – imprints of sand bed, e – imprints of grass, f – imprints of clay bed. Drawings by Kseniya Dubrovina.

a mould with a bottom or else a separate board placed underneath (the bricks of the Cathedral of St Sophia in Kiev from the 1030s). An even more reliable indicator of this is the imprint left by the grain on the lower bed and the marks of the joints between the boards when the bottom of the mould was made of several pieces of wood (Polotsk and Smolensk bricks of the 12th century). Conversely, a lower bed with an uneven surface and the imprint on it of a special sprinkling of something (sand, crushed brick or limestone, clay or hay) is indicative of the use of a frame without a bottom. In some centres, the process entailed smoothing off the bricks on both sides.

The most telling are the marks left by the wooden mould on the headers of the bricks. They are often slight and visible only under oblique lighting. The presence of marks running vertically across the headers is almost always evidence of the use of a fixed (non-separable) frame without bottom (Fig. 1) (the bricks of the Transfiguration Cathedral in Chernigov and the Cathedral of St Sophia in Novgorod, both built in the second quarter of the 11th century, and bricks from Kiev and Novgorod in the 12th–13th centuries). Bricks shaped in an open frame usually display considerable variation in thickness. On the lower edge of the headers there are often signs of large leaks of ceramic paste caused by an excessive amount being pressed into the frame. In many cases there are indications of this leakage being removed (cut off or smoothed) during the subsequent processing of the raw brick. The edges of the upper bed of the brick are usually slightly raised towards the headers due to the removal of the frame from the raw brick. Sometimes the makers sought to correct this deformation by using a board or the sides of the frame, the result of which was impressed skirts (particularly characteristic of Kievan bricks throughout the 12th century). Horizontal (crosswise) marks of wood grain on the headers are most often evidence of the use of a separable frame. (The horizontal marks from cutting rectangular bricks into a special figured shape have a different appearance.) A frame of this sort often left no marks at all and the headers appear smooth. In some instances, we find small neatly faceted flanges on one or two edges of the header – marks from the sides of the frame (bricks from Chernigov, Polotsk, Smolensk and Grodno in the 12th–13th centuries). Since the frame was carefully taken apart after the ceramic paste was packed into it and smoothed, bricks made in this way do not usually have any serious deformations or fluctuations in thickness. A special case is the making of bricks in a frame with skewed headers (used in the late 10th-century Church of the Tithe in Kiev and in Pereyaslavl' Yuzhny in the late 11th and early 12th centuries) (Schäfer 1974). The headers sometimes show horizontal traces of the frame. Such features point to the bricks being formed in a fixed frame with a bottom, from which the raw brick was extracted by turning it over. At the present time at least four most frequently used methods of shaping Early Russian bricks have been identified – no less than ten if we take nuances of the process into account (Fig. 3).

The deliberate marking of the bricks is directly connected with the method of moulding. The application of relief devices on the headers of bricks was possible only when using a separable frame. The distribution of such marking and the traces of that method of moulding coincide. Where a non-separable frame was

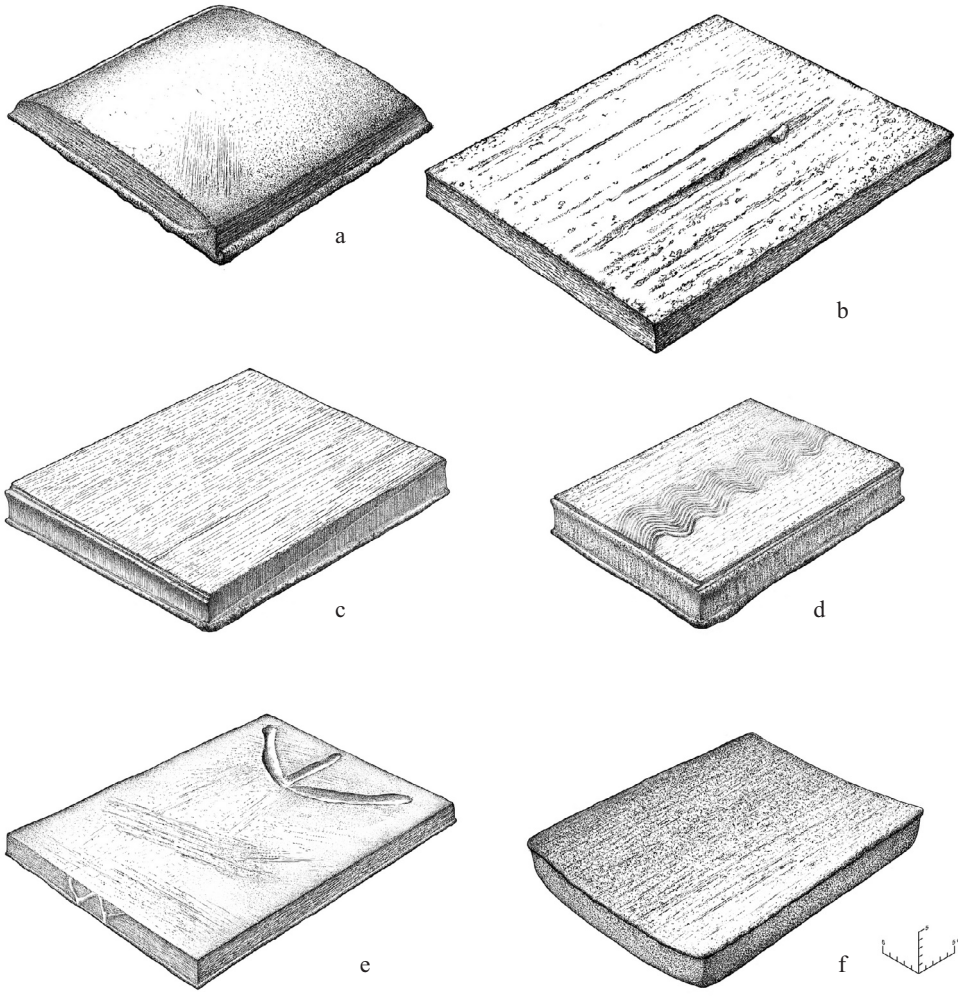

Fig. 3. Models of brick appearance. a – Kiev, late 10th century (the church of Tithe), b – Kiev, mid 11th century (the church of St Sophia and Golden Gate), c – Kiev, late 11th – early 12th century, d – Kiev, 2nd half of 12th century, e – Chernigov, late 11th century, f – Pereyaslavl' Yuzhny, early 12th century. Drawings by Kseniya Dubrovina.

used the headers remained without markings, while scratches were made with a comb on the surface of the beds (bricks made in Kiev, Pereyaslavl' and Vladimir-Volhynsky in the middle and second half of the 12th century). Marks made with

a finger are found in conjunction with various moulding methods (Kievan, Chernigovian and Novgorodian bricks of the first half of the 12th century), as are stamps impressed into the surfaces (the bricks of the Church of St Demetrius in Pskov and others; the bricks of some churches in Smolensk, Polotsk and Novgorod-Seversky).

The full set of characteristics of Early Russian bricks, including dimensions, markings, assortment and moulding method is today highly informative for typologization, narrow dating and attribution (Jolshin 2017).

The transfer and development of brickmaking tradition: the case of Novgorod

In the most northerly of the Early Russian principalities, the lands of Novgorod, the first masonry building appeared half a century after the first such construction in Kiev. It was the Cathedral of St Sophia (1045–1050), built not long after the edifice of the same name in Kiev (1030s) (Hamilton 1983, 39). However, the bricks used to build the Novgorodian cathedral are dissimilar to the Kievan ones. They show signs of having been made using a non-separable bottomless mould. A distinctive characteristic of a large number of bricks that reliably belong to the original masonry of the building is the specific treatment of the upper bed. More often than not, this is an even surface with slight traces of having been smoothed with the hand. The only analogy for these bricks with regard to both the method of moulding and the smoothing of the upper surface are traces found on the *plinthoi* of the Transfiguration Cathedral in Chernigov, which was constructed in the 1030s. This is probably evidence that brickmaking in Novgorod in the mid-11th century was carried out by a group of craftsmen who had previously worked in Chernigov, while the architects and masons came to Novgorod from Kiev. On the completion of the Cathedral of St Sophia, the building team left Novgorod, since no further masonry construction is known to have taken place in the city right up until the early 1100s.

After a long hiatus, monumental construction was resumed in Novgorod in the early 12th century. The first building, according to the chronicles, was the Church of the Annunciation in the residence of the Novgorodian prince at Gorodishche outside Novgorod, which was begun in 1103. Art historians confidently connect one more church in Novgorod itself and two main monastery churches in the environs of the city with a princely decree of the first quarter of the 12th century (Hamilton 1983, 43 f.; Shtender 2008, 567 ff.). The bricks in all those buildings do not differ in the method of moulding and their dimensions vary within the limits 31–38 × 20–23 × 4–5 cm. They display the signs indicated above for the use of a non-separable mould.

At the turn of the 12th century, several separate masonry construction organizations were already actively at work in Rus' – in Kiev, Pereyaslavl' and Chernigov. As has already been noted, the method of moulding bricks differed

considerably in each of the centres. The Novgorodian method is almost completely analogous to the brickmaking tradition in Kiev, where such technology was employed earlier, from the 1070s onwards. Close to the Church of the Annunciation, the only known brick kiln from the pre-Mongol period in the Novgorodian lands was found. It was rectangular in shape with a fire chamber divided into two parallel channels (Lipatov 2005) (Fig. 4). A kiln of the same design has also been found in Kiev. By contrast, the brick kilns excavated in Chernigov and Smolensk were round in plan. Thus, the characteristics of the production technology for Novgorodian bricks in the early 12th century indicates that it was specifically Kievan brickmakers who came to Novgorod.

Dozens of Novgorodian churches of the 12th century, well dated in chronicles and investigated with archaeological excavations both of standing buildings and ruins, allow us to speak of almost constant and uninterrupted masonry construction in Novgorod in that century (Shtender 2008). The gaps in the 1130s–1140s and 1150s–1160s are usually put down to the Novgorodian building team working in the neighbouring centres, Pskov and Ladoga respectively, where in those years several urban and monastery churches were constructed. While the design of those churches was a development of tendencies that can be observed in the Novgorodian architectural tradition of the earlier 12th century, the characteristics of the brickmaking process fully continued the late 11th-century 'Kievan' technology described above (Fig. 5). Nevertheless, certain changes can also be observed.

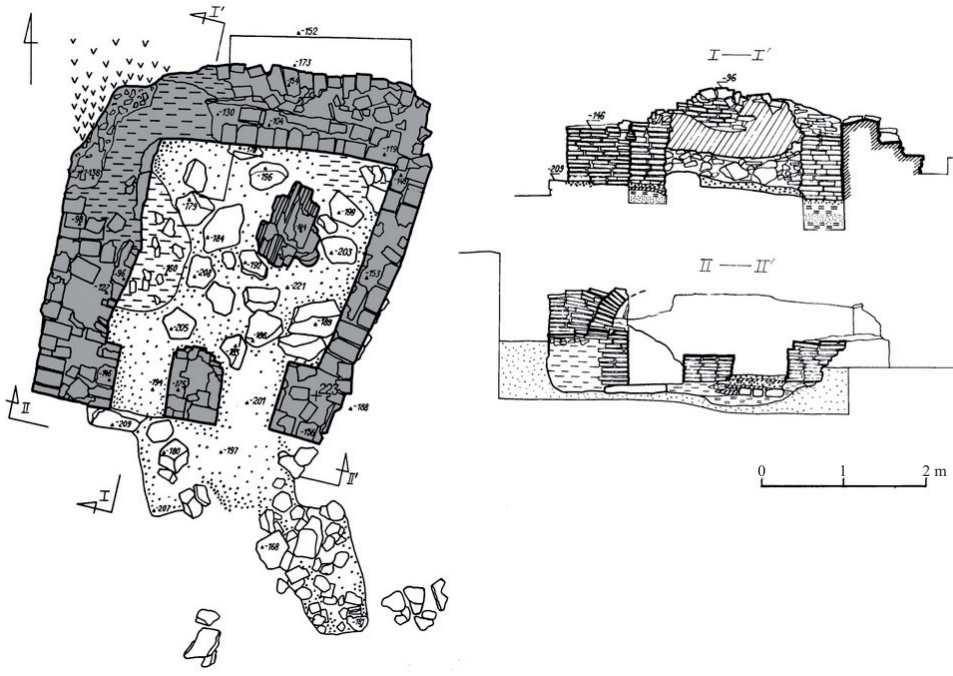

Fig. 4. Brick kiln of ca 1103 on the Gorodishche near Novgorod. Plan and section (Nosov et al. 2005).

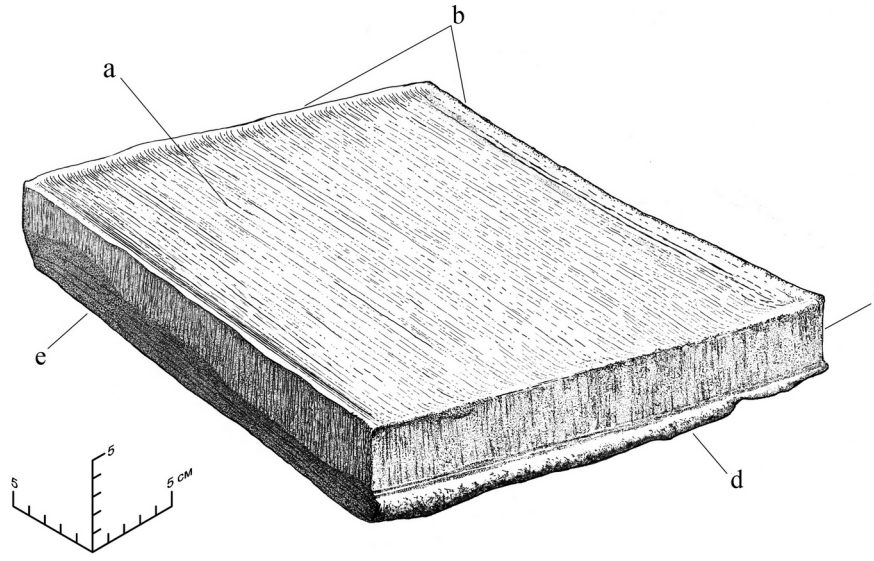

Fig. 5. Typical 12th century Novgorodian brick features. a – lengthwise sweep, b – raised edges, c – vertical marks on the headers, d – leak of ceramic paste at the bottom, e – cut of the leak of ceramic paste. Drawing by Kseniya Dubrovina.

Firstly, in the mid-12th century, the dimensions of the bricks were reduced to 27–30 × 17–20 × 4.5 cm. Secondly, the presence of deep imprints of grass on the lower bed became a characteristic feature of the bricks. The smaller format was in accordance with the general Early Russian tendency in brickmaking: such dimensions are more or less typical for all the centres of construction in the second half of the 12th century and early 13th (Table 1). This decrease coincided with a gradual reduction in the size of the central cross-domed core of churches in the 12th century. The imprints of grass, by contrast, are exclusively characteristic of Novgorodian bricks from the mid-1100s onwards.

The figured shapes of bricks in Novgorodian buildings are not especially diverse. There was constant use of five-cornered bricks to create the toothed friezes that were a characteristic feature of Byzantine churches. The width of this kind of brick decreased in accordance with the diminishing size of the structures (Fig. 6). In the 11th century five-cornered bricks were produced by cutting down ordinary bricks before firing (in the Cathedral of St Sophia), later by using special moulds. The use of shaped bricks in two 13th-century Novgorodian edifices (the Churches of St Paraskeva on the Marketplace and of the Archangel Michael on Prusskaya Street) is revealing. A large variety of shapes was required to produce elaborate architectural elements with a smooth-flowing profile characteristic of a style that spurned the laconic forms of the Novgorodian school and can be connected with the employment in Novgorod of builders from the region of

Table 1. Selected brick sizes[1]

Building	Date	Mould type	Brick size
Kiev, the church of Tithe	989–996	Fixed frame with a bottom	30 × 30 × 2.5
Kiev, the church of St Sophia	1030s	Separable frame	38 × 28 × 3.5
Chernigov, the church of Transfiguration	1030s	Fixed frame	36 × 28 × 3
Novgorod, the church of St Sophia	1045–1050	Fixed frame	40 × 26 × 4
Kiev, the church of Dormition of the Cave monastery	1073–1077	Fixed frame	35 × 28 × 4
Pereyaslavl' Yuzhny, the church of Archangel Michael	Ca 1089	Fixed frame with a bottom	35 × 26 × 4
Pereyaslavl', the church of Transfiguration	Early 12th century	Fixed frame with a bottom	30 × 22 × 4
Chernigov, the church of Dormition in Elets monastery	Early 12th century	Separable frame	36 × 28 × 3.5
Novgorod, the church of Annunciation on Gorodishche	1103	Fixed frame	32 × 22 × 5; 35 × 20 × 4
Pskov, the church of St Demetrius	1130s	Fixed frame	32 × 23 × 5
Kiev, the church of St Cyril	1140s	Fixed frame ('Kievan'); separable frame ('Chernigovian')	28 × 20 × 5
Smolensk, the church of SS Peter and Paul	Mid-12th century	Separable frame	31 × 21 × 4
Vladimir-Volhynsky, the church of Dormition	1156–1160	Fixed frame	32–35 × 22–23 × 4.5
Ladoga, the church of St George	1160s	Fixed frame	30 × 18 × 4.5
Novgorod, the church of SS Peter and Paul	1185–1192	Fixed frame	28 × 18 × 4.5
Novgorod, the church of Transfiguration in Nereditsa monastery	1198	Fixed frame	27 × 19 × 4.5
Novgorod, the church of St Paraskeva on the Marketplace	1207	Fixed frame	27 × 19 × 4.5
Rostov, the church of SS Boris and Gleb	1211–1214	Separable frame	26 × 16 × 4

[1] The sizes of the most significant and firmly dated edifices are included in the table. The average values of the most used brick size are collected from the publications and field reports and checked in museum assemblages in Kiev, Chernigov, Novgorod, and St Petersburg. For the dating of churches (see Rappoport 1982).

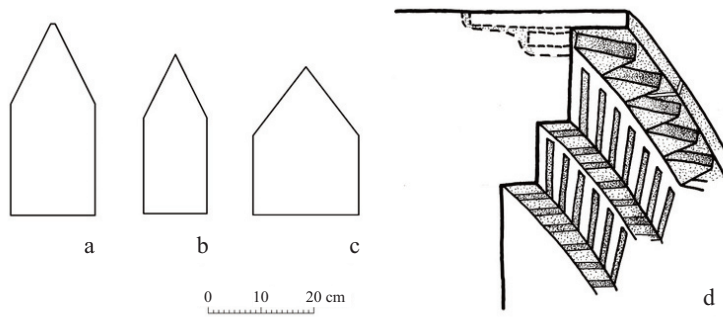

Fig. 6. Five-cornered bricks for the dog-teeth friezes in Novgorodian churches. a – the church of St Nicholas (1113), b – the church of St George in Ladoga (1160s), c–d – the church of Transfiguration in Nereditsa monastery near Novgorod (1198). a–c – by author, d – after Grigorij Shtender (Gladenko et al. 1964).

Polotsk and Smolensk (Gladenko et al. 1964, 201 ff.). All these figured bricks were not cut out using a template, but rather made in special moulds, while all the characteristics of the moulding process followed Novgorodian tradition (Fig. 7).

The marking of bricks has been recorded only in very insignificant quantity, in the form of sporadic signs made with a finger or a sharp object on the upper surface of the bricks, and that chiefly in the first half of the 12th century. There is no system recognized in these signs, likewise in late 11th century Kiev, and completely different to Chernigov, Polotsk, and Smolensk. The sole exception is the bricks of the Church of St Demetrius of Thessaloniki in Pskov, whose

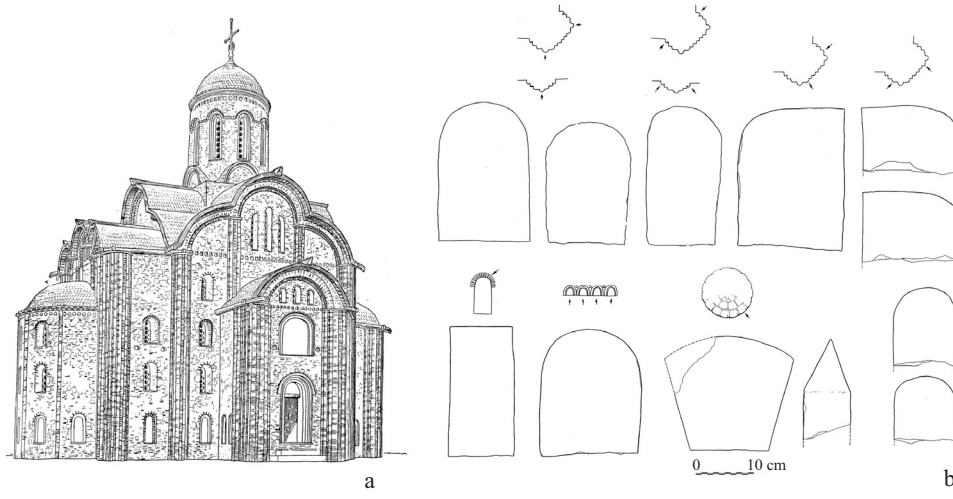

Fig. 7. The church of Paraskeva on the Marketplace in Novgorod (1207). Remodelling (a) and mould bricks (b). After Grigorij Shtender (Gladenko et al. 1964).

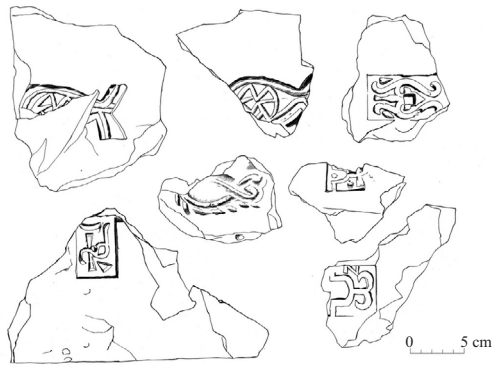

Fig. 8. Stamps on the upper surface of bricks in the church of St Demetrius in Pskov (1130s) (Beletskij 1971).

upper surfaces were marked with elaborate symbols using special, most probably metal, stamps (Beletskij 1971) (Fig. 8). The significance of both the Novgorodian marks and the Pskovian devices remains a mystery, while some of them were interpreted as the princely property signs ('Rurikid signs') (Mikheev 2017, 29).

Conclusions

The distinctive features of brickmaking technology in Kievan Rus' in the 10th–13th centuries studied on the basis of traces left on the bricks make it possible to reconstruct the activities of individual groups of master builders responsible for masonry construction in different principalities, to determine their place of origin and movements (Fig. 9). Builders, together with brickmakers, came to Novgorod from the southern principalities twice: in the mid-11th century from Kiev and Chernigov; in the early 1100s again from Kiev. On the second occasion, brickmaking turned into a local tradition that began to develop independently of the metropolis. Bricks of Pskov and Ladoga witness the participation, or even transfer of Novgorodian brickmakers to these cities for periods of the building activity in the 1130s–1140s and 1150s–1160s accordingly. In Novgorodian buildings of the late 1100s and early 1200s, architectural features point to the involvement of architects and masons who had gained experience in Polotsk and Smolensk, while the bricks in the terms of moulding technology were made following established local practices. This was perfectly combined with the production of bricks with shapes previously unknown in Novgorodian architecture.

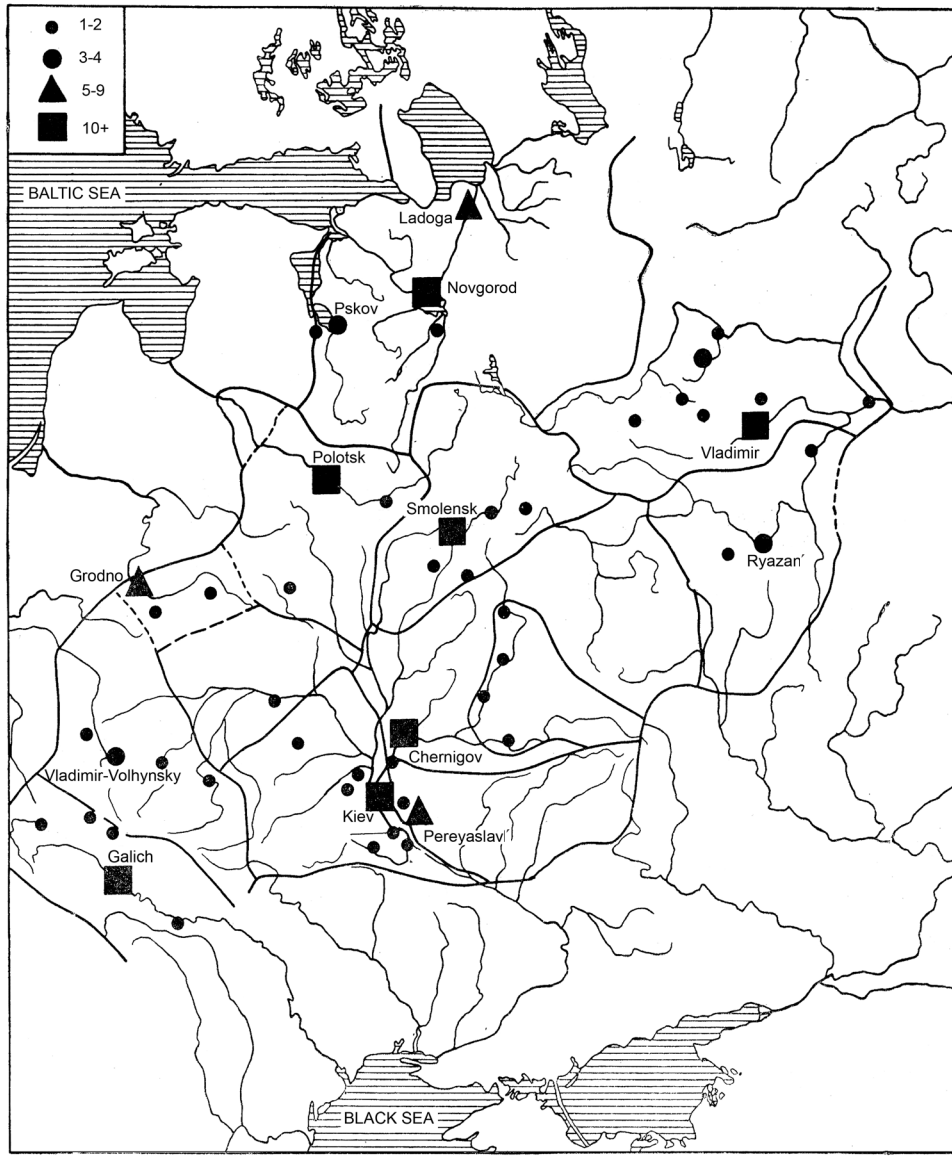

Fig. 9. Map of the building centres of the Early Russian architecture (signs for amount of buildings) (Rappoport 1982).

Acknowledgements

This publication has been completed thanks to funding from the Russian Science Foundation (RSF), project No. 18-18-00045 "Civil stone architecture of Novgorod (14th–15th centuries): a complex study". The publication costs of this article were partially covered by the Estonian Academy of Sciences.

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TELLISKIVID PUIDUMAALE: TELLISKIVITOOTMINE KESKAEGSES NOVGORODIS (11.–13. SAJANDIL)

Resümee

Kiievi-Vene keskaegsetes puumajadega linnades oli telliskivitootmine 10. sajandi lõpust kuni 13. sajandi keskpaigani eksklusiivne ja kallis ettevõtmine, seepärast oli tollal kivimaju vaid 200 ringis. 11. sajandi keskpaigast alates kasvas nõudmine pideva tellisetootmise järele. Arheoloogidele ja arhitektuuriajaloolastele pakuvad kroonikates selgelt kirja pandud andmed kirikute kronoloogiast suurepärase võimaluse üksikasjalikult jälgida telliste (Bütsantsist ülevõetud õhuke kivi või plaat *plinthoi*) tootmise arengut. Käesolevas uurimuses on käsitletud tellisetootmist mitmetes Vene linnades, selle järjepidevust ja katkemist. On toetutud telliste tehnoloogiliste omaduste analüüsile ja vaadeldud ka tellisemeistrite gruppide liikumist Kiievi-Vene ehituskeskuste vahel. Väidetavalt olid 12. sajandi algupoolel tellisetöökojad nii Kiievis, Tšernigivis, Perejaslavlis, Polatskis, Smolenskis kui ka Novgorodis. Nende toodang erines raami tüübilt (fikseeritud ja eraldatav, põhjaga või ilma põhjata), raame kasutati käsitsi vormimiseks, pindade tasandamiseks ja vormimisjärgseks töötluseks. Enne põletusahju panemist tehti tellisepartiile vastav märge. Meie uuringu otstarvet silmas pidades valiti sobivaks näiteks Novgorod. Telliste omaduste lähemal uurimisel selgus, et 12. sajandi Novgorodi tellisetootmise tehnoloogia võeti üle Kiievist, kus töökojad olid juba varem sisse seatud. Novgorodis hakkas tootmine kiiresti iseseisvalt arenema, tekkisid eraldi tellisetöökojad. Sellegipoolest kippusid Novgorodi tellised järgima tendentsi väiksemamõõduliste telliste poole, mis oli tüüpiline enamikule Kiievi-Vene linnadele 12. sajandil. Seda näitab telliste suuruse kohta käiv tabel. Mitme 12. sajandi Pihkva ja Laadoga kiriku ehitusel kasutatud telliste omadused annavad tunnistust Novgorodi tehnoloogia levikust koos ehitajatega. Mis puutub tellise kujusse, siis olid tavalised vastavates raamides vormitud kitsad, viisnurksed kivid räästakarniiside jaoks. Kahele 13. sajandi kirikule Smolenski stiilis keeruka liigendusega toodetud erilise kujuga tellised on väärt esiletõstmist. Need annavad tunnistust koostööst kohalike tellisetootjate ja mujalt tulnud ehitusmeistrite vahel, mille tulemusena valmisid sellised ebatavalised arhitektuurilised kaunistused.