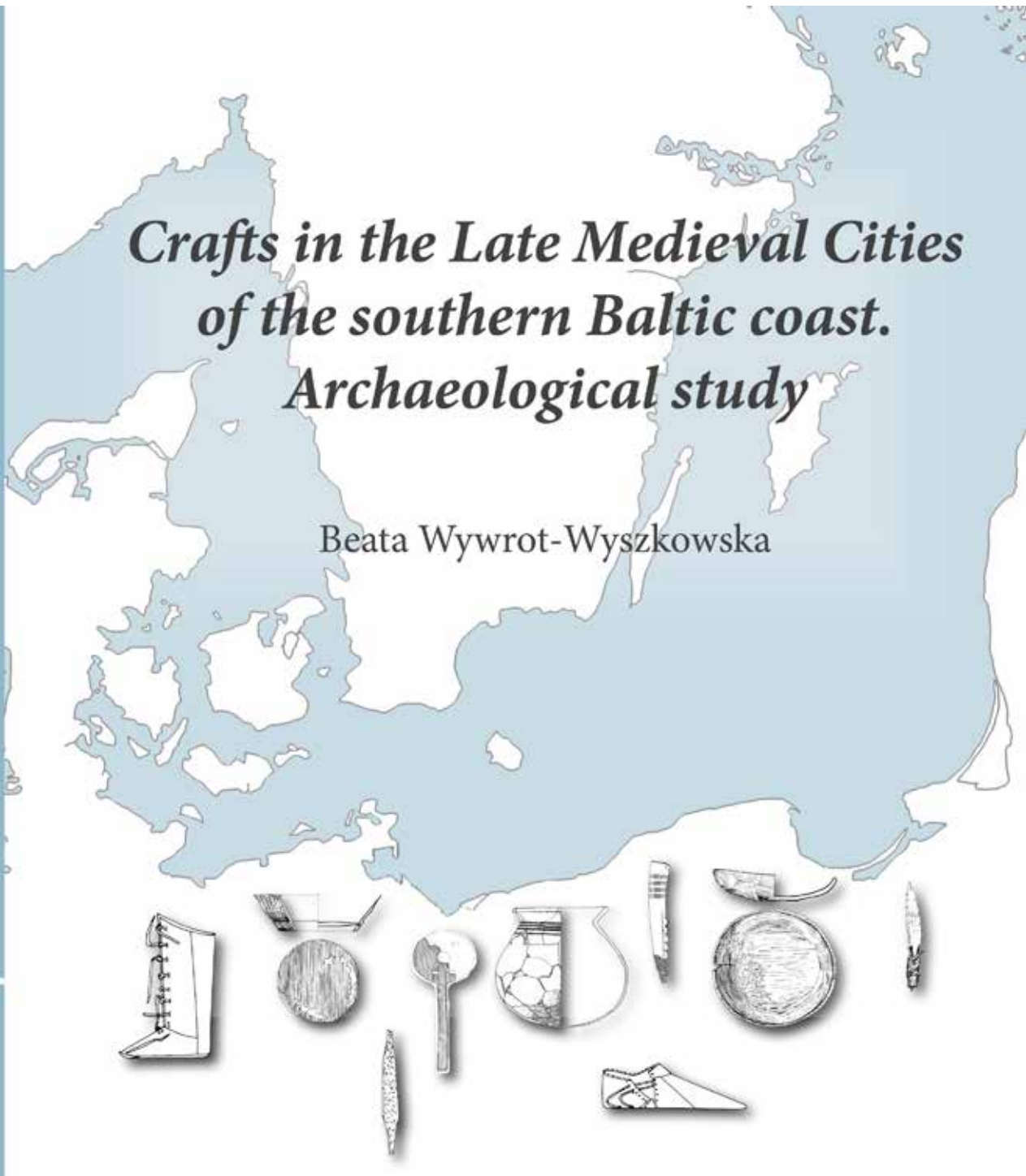
Crafts in the Late Medieval Cities of the southern Baltic coast. Archaeological study

Beata Wywrot-Wyszkowska



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On the cover: greyware ceramics from Stragard, wooden dishes, leather footwear, knife sheath, iron knives and tool for twisting ropes from Kołobrzeg

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Contents

1. Introductory issues

In the 12th and 13th centuries, in the Baltic coastal region of Central Europe, significant transformations took place in the life of local communities related to the organization of cities under German law and the influx of people from northern and central Germany (see, for example, Johansen, von zur Mühlen 1973; Piskorski 1987; 2000; Rębkowski 2001; Militzer 2012). The main purpose of this urban transformation was to foster economic revival, and its basic element was the reorganization of old centres or the construction of new cities. Along with the colonization campaign, transformations took place in various spheres of urban life. These changes related to the legal basis, spatial structure, and ethnic composition of the inhabitants. The urbanization process also resulted in changes in the economic basis for the functioning of cities, primarily in the organization of crafts and the production techniques used (Rębkowski 2007a, 99).

The changes that began in the 12th and 13th centuries resulted in intensive economic development of the Baltic cities and this has generally been related to trade conducted within the Hanseatic League (see, for example, Schildhauer 1995; Gläser 2000). Increasingly frequently, however, one can come across opinions that one of the most important factors determining the economic development of urban centres was craft production. Through the demand for various raw materials, this created the basis for trade and contributed to its activation (see, e.g., Mührenberg 2002a, 83; Müller 2005a, 83; Bulach 2013, 12). Crafts in the Baltic cities were characterized

by a high degree of specialisation, which is reflected in a very large professional diversity. Mass-produced products were the subject of local and regional exchange and sometimes export. On the other hand, craftsmen constituted a significant group of buyers not only of raw materials, but also of many other imported goods.

1.1. The State of research

Issues related to crafts in late medieval cities on the southern Baltic coast have long been of interest to historians. Among the literature on this subject, already in the mid-19th century, a monumental work on the history of trade and crafts in Gdańsk had been published (Hirsch 1858). Later, many other works were published in which guild documents were edited and published, or in which professional organizations, social and economic relations, and the spatial organization of craft production were discussed.[1] Issues related to crafts and their importance in the socio-economic life of cities were also presented in works presenting various aspects of their history. Here we can cite the examples of texts devoted to the history of Elbląg (Gierszewski, Groth 1993), Kołobrzeg (Riemann 1924), Stargard (Teske 1843; Boehmer 1903), Szczecin (Labuda 1983) and Greifswald (Kattinger 2000b). Other important items referring to this field of research are also publications relating to the medieval names of streets, which very often derived from the specialization of the craftsmen living there. Such studies have been undertaken, for example, for Kołobrzeg (Kübler 1918), Szczecin (Lemcke 1881), Greifswald (Biederstedt 1982) and Rostock (Koppmann 1902; Münch, Mulsow 2010). Works on the sociotopography of urban centres also occupy an important place in craft studies. Publications on such topics have been published for Lübeck (Hammel 1987), Greifswald (Igel 2010) and Elbląg (Czaja 1992a).

A new stage in research on late medieval cities has been opened by excavations, and especially the intensive development of urban archaeology (Rębkowski 2001, 8). Archaeological research conducted on a large scale in the historical cores of many Central European centres, including those in the coastal region of the Baltic Sea, much of it conducted as salvage operations related to various types of construction investments during urban redevelopment or renewal, has contributed to the

1 See, for example, selected studies for Tallinn (Johansen, von zur Mühlen 1973; Kaplinski 1980), Riga (Stieda, Mettig 1896), Elbląg (Matz 1920; Wanta 1995; Tandecki 1997), Gdańsk (Bogucka 1962), Szczecin (Blümcke 1881), Greifswald (Krause, Kunze 1900; 1901; Biederstadt 1983; Kattinger 2000a), Rostock (Stieda 1892; Dragendorff 1896; 1899) and Lübeck (Wehrmann 1872; Stieda 1887; Warnecke 1937).

discovery of extremely numerous and diversified archaeological sources that constitute an excellent basis for undertaking various studies on many manifestations of life in the city. They are not only a valuable supplement to written records, but also create wide opportunities to learn about many phenomena that are not always accessible through these types of historical sources.

Archaeological research produces numerous finds of structures and objects related to craft activities, as well as remains of the products themselves. This state of affairs means that the archaeologists who use materials from excavations in their studies are becoming more and more accustomed to research on crafts. This trend in research on the cities of the High and Late Middle Ages largely emerged in the last decades of the 20th century. Initially, the subject of crafts was taken up by German archaeologists and referred mainly to cities located in central and upper Germany and Switzerland. In my opinion, the work of W. Janssen (1986) can be considered groundbreaking in this research. It was he who in a more systematic way identified and defined various categories of finds confirming craft activity and presented the cognitive possibilities of the archaeological sources in this field of study. Janssen also devoted a lot of space to theoretical and methodological considerations, supported by a number of examples of finds relating to the definition of crafts and research issues. His work demonstrated the directions of craft studies that could be carried out on the basis of the archaeological evidence. Also in the context of later discoveries, the methodological assumptions and research issues presented by W. Janssen remained valid, and similar fields of study on late medieval crafts have been developed by subsequent researchers (see, e.g., Verhaeghe 1995; Müller 2000).

Since the end of the 1990s, there has been a clear intensification of research on crafts based on the archaeological evidence. These studies resulted in numerous publications presenting mainly post-conference materials (e.g., Von Schmieden 1999; Handwerk 2000; Mittelalterliche Öfen 2002; Schmiedehandwerk 2004; Lübecker Kolloquium 2006; Archäologie und Handwerk 2008; Wytwórczość 2009). At the same time as the appearance of these publications sharing the results of archaeological research on artefacts, the scientific literature began to consider the evidence from craft quarters of cities (Enzenberger 2007) and discuss, selected branches of production (Wywrot-Wyszkowska 2008; Kowalska 2013; Starski 2016). It is also worth mentioning a series of texts devoted to crafts in cities located in today's Mecklenburg-Vorpommern (Archäologie unter dem Straßenpflaster 2005).

The state of knowledge is advanced for some categories of sources, such as pottery, iron products, leather artefacts, wooden products and finds related to metal casting. This state of development also made it possible to undertake more detailed research on the changes in production techniques and the range of production

taking place in the 12th–13th centuries (see for example, Müller 2005a; 2006a; Rębkowski 2006a; 2007a; Röber 2006; 2008). A special place here is occupied by interdisciplinary studies carried out by German archaeologists, historians and linguists on the development of crafts in the period from the turn of the 10th and 11th centuries to the turn of the 15th and 16th centuries (Lübke, Müller 2006). The subject of this research has included issues in the crafts of cities on the southern coast of the Baltic Sea, such as those related to traditionalism, professionalism, innovation and technology transfer (see Becker et al. 2004, Müller 2005a; 2005b; 2006b).

There have been similar attempts to undertake interdisciplinary research in relation to other fields of craft production. As an example may be cited a project on medieval leather production that took place in Poland (*In gremio – in praxi* 2009). In this latter case, however, it should be emphasized that these activities were limited to archaeologists, historians, art historians, archaeozoologists and conservators each presenting the cognitive possibilities and research issues specific to each discipline in the study of medieval leatherwork. We can only hope that this kind of cooperation will be activated in the future and that it may result in a more complete understanding of the processes related to the creation and development of leather crafts.

1.2. Purpose and scope of work

The subject of this work is the study of craft production in urban centres located on the southern coast of the Baltic Sea. Taking into account the level of advancement of excavations and the type and quality of evidence discovered, research on crafts can be carried out for over twenty urban centres: Tallinn, Tartu, Riga, Elbląg, Gdańsk, Puck, Stargard, Pyrzyce, Szczecin, Kołobrzeg, Pasewalk, Neubrandenburg, Strasburg, Anklam, Greifswald, Stralsund, Ribnitz, Rostock, Güstrow, Wismar, Lübeck and Schleswig (Fig. 1). This list contains both large cities, which were centres of the long-distance Hanseatic trade, as well as small towns that functioned only as centres of local trade and local craft production. The varied socio-economic importance of individual towns certainly determined the number of crafts operating in them and the nature of the production taking place in them.

The rich and diversified sources obtained by investigations so far constitute a good basis for attempting a synthetic approach to crafts in the municipal towns on the Baltic Sea.[2] The main goal of this project is to characterize craft production.

2 In central European historiography, the terminologies of urbanization differ from those generally current in the Anglophone world. In the period discussed in this work, the process was underway of replacing the various earlier forms of urban centres organized under so-called du-

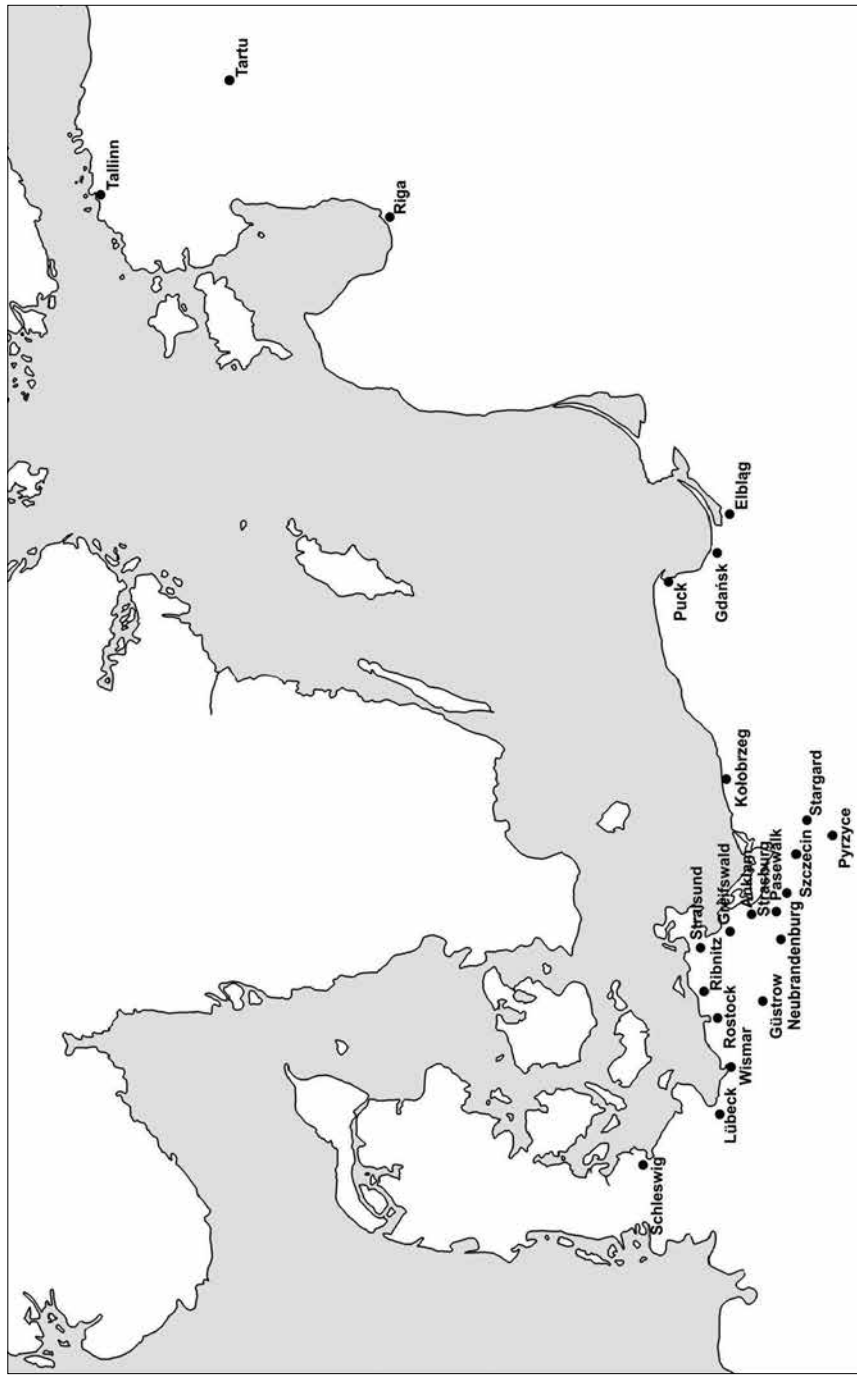

Fig. 1. The southern coast of the Baltic Sea showing sites discussed in the present work

What I have in mind here is first and foremost identification of particular types of craft activity, definition of the range of products manufactured, the tools used, as well as the raw materials and technological processes. Thanks to discoveries of the remains of production sites in some towns (including Lübeck, Rostock, Stralsund, Greifswald, Neubrandenburg, Pasewalk, Kołobrzeg, Stargard, Puck, Gdańsk, Elbląg, Riga, Tallinn and Tartu), it is also possible to consider issues related to workshop equipment and the organization of crafts in the urban space.

Another issue is an attempt to outline the nature and pace of changes taking place in the techniques and range of craft production in these urban centres. Along with the colonization campaign, settlers arrived in the towns founded east of the Elbe. They originally came from diverse regions, including Lower Saxony, Rhineland, Westphalia and Thuringia, and with them came new production technologies and the transfer of a new set of products to these areas. It seems important to try to answer the question of how quickly the new manufacturing techniques spread in individual towns. It should be remembered that some of the municipal centres in question were founded in older polycentric places, early urban centres or only a short distance from them (Rębkowski 2001, 53 ff.). The participation of the native population also played a role in the creation and development of municipal centres, most notably in Livonian and Estonian cities, where a significant part of the inhabitants were of local origin.[3] Only in the largest centres, such as Riga, did more than half the population originate from German areas; in others the percentage was much smaller (Czaja 2002, 71). Therefore, it is extremely important for these considerations to identify local production traditions and determine their importance in craft production (see also Müller 2006a, 18-21).

The intention of the present work is also to attempt to discuss the unification of craft production in the Baltic towns, the development of which becomes more visible over time. Another important issue seems to be specifying the local differences

cal law, often associated with a stronghold, and the emporia/*Seehandelsplätze*. These were being superseded by centres called here 'miasta komunalne' (communal towns/municipal towns – in other words, those run by a town council) that tended to be located on a virgin site and organized on the basis of legal regulations modelled on the pattern of those of German towns. The term is more or less the equivalent of the German term *Rechtsstadt*, in other literature simply referred to as a chartered town (translator's footnote).

3 Livonian and Estonian cities were characterized by the great ethnic diversity of their inhabitants, including Germans, Swedes, Latvians, Livs, Estians and Ruthenians. Individual ethnic groups differed significantly in terms of wealth. The wealthiest was the German population, mainly engaged in trade and crafts. The poorer groups included residents of local origin, who most often made their living from hired work, and to a lesser extent from crafts (Czaja 2002, 71–72).

within the region. These may relate primarily to the type and intensity of craft activity, in the sense that it may be specific only to certain cities located in a particular area or functioning only within certain political structures.

Chronologically, the present work covers the High and Late Middle Ages. The lower caesura for these considerations is therefore in the twelfth and thirteenth centuries, the age that saw the beginning of the process of establishment of municipal cities under German law in the southern coastal area of the Baltic Sea. The first centre to receive such city rights was Lübeck, which received its location privilege as early as 1143. Most of the urban centres included in this work were founded in the 13th century. Only Puck was founded in the mid-14th century. The turn of the 15th and 16th centuries is taken as the upper caesura for the consideration of the material in this book. This period saw significant changes occurring in urban crafts, in terms of the raw materials used, technologies and the assortment of manufactured products (see for example, Zwischen Tradition und Wandel 2009). These changes mark the next stage of the development of craft production, associated with the modern period.

* * *

This work was created thanks to the kindness of many people and institutions. In collecting the research material, I had the help of a number of people: Dr Erki Russow and Ülle Tamla from the Institute of History at the University of Tallinn; Krista Sarv from the Estonian Historical Museum in Tallinn; Arvi Haak from the Tartu City Museum; Dr Ieva Ose and Dr Viktorija Bebere from the Institute of History of the University of Latvia in Riga; Dr Grażyna Nawrolska and Dr Mirosław Marcinkowski from the Archaeological and Historical Museum in Elbląg; Ewa Trawicka, Beata Ceynowa and Bogdan Kościński from the Archaeological Museum in Gdańsk; Prof. Dr hab. Marian Rębkowski, Dr hab. Prof. IAE PAN Andrzej Janowski, Dr Paulina Romanowicz and Marek Dworaczyk from the Centre for the Archaeology of the Middle Ages of the Baltic Countries in Szczecin Polish Academy of Sciences, Institute of Archaeology and Ethnology; Dr hab. Marcin Majewski, Karolina Stań and Karol Kwiatkowski from the Archaeological and Historical Museum in Stargard; Sławomir Słowiński from the National Museum in Szczecin; Dr Detlef Jantzen, Dr Heiko Schäfer, Dr Jörg Ansorge, Renate Samariter, Ralf Mulsow and Peter Teichert-Köster from the Mecklenburg-Vorpomeranian Conservation Office in Schwerin. I would like to thank all these people for their kindness and time devoted to me.

The search for materials in Tallinn, Tartu, Rostock and in the Archives in Lübstorf were made possible thanks to a scholarship awarded by the Foundation for Polish Science, as part of the KWERENDA program – edition 2011.[4]

4 The scholarship was awarded on the basis of resolution No. 146/2011.

2. Characteristicts of the Evidence

The basic issue in research on craft production is the representativeness of the archaeological sources and the potential possibilities of their use as determinants of individual crafts (Janssen 1986, 310 ff.; Müller 2000, 21 ff.; Rębkowski 2007a, 103). It should be remembered that in general, no traces have been preserved in the excavation material from the activities of many craftsmen, for example: barbers, soapmakers, porters, parchment makers (see Janssen 1986, 311 ff.). These limitations result primarily from the nature of the sources themselves and the fact that archaeological sites do not reflect all traces of human activity (Rębkowski 2007b, 24). It should also be added that the excavations in all the urban centres that we are interested in most often have taken place in the form of rescue excavations, as a result of which the location and area of archaeological excavations are subordinated to the requirements of construction investments, rather than research needs.[1]

1 Kołobrzeg may serve as an example here, where archaeological excavations were carried out most often in the front parts of plots, at the expense of their rear parts. Moreover, from the 14th century onwards, brick tenement houses, which may later have been rebuilt many times, were built on the street frontages of many of the plots of land sometimes resulting in the destruction of any cultural layers remaining there (cf. Rębkowski 1989, 464; 1995, 11). This is definitely a state of affairs that has had an impact on the type of evidence discovered, and its state of preservation, abundance, etc.

Another factor that is not without influence on the cognitive value of a significant part of the archaeological evidence recovered in such work is the fact that in many cases the material has not always been recovered by controlled archaeological excavations, but has been obtained during the so-called 'watching briefs' carried out during various development projects. Large areas of some towns have been 'investigated' merely in this way.[2] In the worst case scenarios, the material that is obtained as a result of such operations – most often deprived of context – has little cognitive value for studies on the issues we are interested in.

Another issue is the specificity of the study of archaeological material, which is not only extremely time-consuming, but also expensive, especially since in most of the analysed urban centres we are dealing with wide-area excavations, which have resulted in obtaining huge amounts of various finds. Therefore, in publications making research results available, most often only selected groups of material sources and related issues are discussed in some form of interim or thematic reports, while the remaining material is treated very summarily, if at all. The full study of archaeological sources should of course involve the performance of many specialist analyses (for example archaeozoological, dendrological, paleobotanical, numismatic, petrographic, physicochemical) of the material from excavated assemblages (cf. Janssen 1986; Müller 2000). But for various reasons, primarily financial, it is not always possible to achieve this aim. The most cognitively valuable sources that can be widely used in various studies are created only when all categories of finds obtained during excavations have undergone comprehensive and interdisciplinary analyses, the results of which are then published. Among the towns surveyed, only in the case of Kołobrzeg (Archeologia Kołobrzegu 1996–1999; 2010; 2016), Stargard (Archeologia Stargardu 2012; 2016; 2017) and Puck (Puck 2017) can it be said that we are dealing with such publications.

In the course of archaeological research, various types of evidence are obtained that allow us to learn about crafts. According to the division proposed by W. Janssen (1986) and F. Verhaege (1995), they are represented by:

2 This is especially visible in relation to smaller urban centres, including Pyrzyce (cf. Cnotliwy, Nawrolski 1996) or Neubrandenburg (cf. e.g. Schmidt 1990; 2001). Also in Stargard, for a very long time, the research activities of archaeologists in the area of the chartered town were limited to the observation of construction excavations (see e.g., Rogosz 1980). Only over the last decade has systematic rescue research been taking place from the beginning. Sometimes this also applies to larger centres. For example, in Gdańsk, out of 227 archaeological interventions conducted in 1988–2005, as many as 83 were the so-called watching briefs (Paner 2006a, 48–60). On the other hand, in Lübeck and Stralsund, systematic archaeological research was often limited to the digging of several small trial trenches or the so-called control profiles (see e.g., Meyer 1980; Falk 1987; Gläser 1989a; 1989b; Kaute, Schäfer 2000).

1. Production sites or production devices discovered in situ (for example, buildings, furnaces, pits, structures for special purposes (tannery tanks, gutters);
2. Movable production residues (for example, accumulated raw materials, semi-finished products, production waste, scrap products, etc.);
3. Tools (for example, knives, planes, drills, shoe lasts, awls, casting moulds, crucibles, etc.);
4. Finished products.

All these categories of finds have been recorded during excavations carried out in the areas of the urban centres discussed here. The vast majority of the sources used in this work are already published materials. They have been supplemented with finds that the author became familiar with during research in a series of museums and offices of conservation services. In addition, I took into account unpublished research reports and inventory lists of archaeological material located in the archives of these institutions.

Due to the current preliminary state of the post-excavation analysis of the material sources obtained in Tallinn, research on them has so far been possible only to a very limited extent, and only in the case of certain areas of crafts: stonemasonry, wooden vessel production, non-ferrous metal casting (Vissak 2006), shoemaking (Sarv 2000; 2006), bone, horn and antler working (Luik, Maldre 2003) and glassmaking.[3]

During excavations in Tartu, remains of devices and production waste related to blacksmithing (Metsallik 1995; see also Peets 2003), bronze-foundry[4] (Trummal 1992) and brick production (Vissak 2000; Mäesalu 2006) were discovered. The archaeological material also demonstrates the processing of non-ferrous metals (Vissak 1994; Vissak, Heinloo 2003), leather (Mäesalu 2006),[5] antler and

3 I became acquainted with selected groups of finds related to non-ferrous metal casting and glass production during research conducted in the collections of the Institute of History of Tallinn University. These are finds obtained during excavations at the site on Vene Street, no. 9 (Al. 6713), Sulevimägi 4–6 (Al. 6648), Sauna 10 (Al. 6332), Roosikrantsi 9, 11 (Al. 6109) and in the market square (Al. 4061).

4 Throughout this book, the Polish text the term '*ludwisarz, ludwisarstwo*' is used for a particular branch of craft equivalent to the German *Rotgießer*. In both cases, the term refers to heavy metal casters producing a wide variety of cast works such as bells, statues, candlesticks and other things from an alloy of copper and tin (bronze). The term commonly translates as bell-founder, but another branch of the industry was as a *Grapengießer* – the producer of cast bronze cauldrons with tripod feet – discussed further below. The Polish term is translated here as 'bronze-founder' (translator's footnote).

5 Some of the materials related to shoemaking production are known to me from personal examination. These are primarily fragments of footwear discovered in the market square, which are currently in the collections of the Tartu Linnamuuseum (Tartu City Museum).

horn-working (Vissak et al. 2015), cooperage (Vissak 2002) and textile production (Rammo 2009). A serious difficulty in the study of crafts in Tartu is the lack of analytical studies of not only the equipment and production remains, but also the finished products. Only certain categories of such material have been the subject of such analyses, such as cooperage (see Vissak 2002).

Despite many years of archaeological work, the available materials for the study of crafts in medieval Riga are quite modest. The reasons for this should be seen in the low level of development of the analysis of individual categories of finds to date, as well as in the fact that some of the materials are dispersed, primarily from excavations conducted by institutions outside Riga.[6]

During the course of research in Riga, finds were identified confirming glassmaking (Caune 2003; 2004), leather-working and shoemaking (Bebre 1983; 1987; 1998; 2005; 2009), blacksmithing (Caune, Ose 2006), weaving (Zariņa 2001; Caune, Ose 2006), non-ferrous metal casting (Svrāne 1994; 2002), goldsmithing (Svrāne 2000; 2002), bone and antler working (Tilko 2000; 2003; 2005; Strēle, Tilko 2001) and amber working (Strēle 2005). The excavated material also includes artefacts attesting to fishing (Caune, Ose 2006). We have very limited data regarding cooperage and turnery. Although the products of these crafts (barrels, and other stave-built containers as well as turned vessels) are common finds,[7] they have not yet been the subject of analysis. So far, only a large number of small wooden products, such as spoons, scoops, etc., have been published (Bebre 2000; 2003). The vast majority of the excavated material dates back to the 13th–14th centuries (Caune, Ose 2006, 459). For the later period, only few remains of goldsmithing (Svārne 2000) and leatherworking (Bebre 1998; 2005) have been recorded.

In the case of Elbląg, the best known evidence for crafts relates to pottery (Marcinkowski 2003a; 2006a) and broadcloth production (Maik 1997a). The archaeological material obtained in the Old Town contains products, much less often tools and production waste, which indicate working of antler and horn (Marcinkowski 2003b; 2004a; 2004b), lathe-turning, cooperage, leatherwork, blacksmithing (Nawrolscy 1989; Nawrolska 2006; 2009; Marcinkowski 2009; 2014) and shoemaking (Nawrolscy 1989; Domagalska 2007; Marcinkowski 2009; 2014). During the excavations, finds related to fishing (Marcinkowski 2006b; 2006c) and shipbuilding (Litwin 2004) were also recorded. Interesting data were obtained for research on the production of ceramic architectural details (Kutzner 1997). The majority of these materials date back to the initial period (13th–14th centuries) of the

6 Information from Dr I. Ose of the Institute of History of the University of Latvia.

7 These artefacts are known to me from personal examination. They are housed in the collections of the Rīgas vēstures un kuģniecībasmuzejs (Rīga City History and Navigation Museum).

city's development, which is the result of the significant destruction of later layers. It is also worth recalling that in the immediate vicinity of the Old Town, the Teutonic Order founded the New Town, which received a location charter in 1347 (Czaja, Nawrolski 1993, 62). The New Town was inhabited mainly by craftsmen, including brewers, as well as people engaged in animal breeding (Czaja, Nawrolski 1993, 112). Production activities were probably concentrated there in the 14th and 15th centuries. Unfortunately, no archaeological research has yet been carried out in the New Town, thanks to which it would be possible to obtain further material for studies on Elbląg crafts.

Large-scale excavations in Gdańsk have provided a huge amount of evidence for learning about the crafts which took place in this city. Unfortunately, due to their quantity, most of them have not yet been fully analysed. Therefore, despite the wealth of finds, we currently have relatively limited data to use in this study. Most publications providing the results of excavations are generally preliminary reports, and in them the individual authors have focused on discussing only a selection of the material remains within a broad chronological framework, usually covering the Middle Ages (14th–15th centuries) and the modern period (16th–18th or 16th–19th centuries). We encounter a similar situation in the case of publications presenting the results of analyses of artefacts.

On the basis of available publications, supplemented with material obtained as a result of a search of as-yet unpublished material in archaeological stores,[8] we have good information on the production of pottery (Kościński 1998a; 1998b; 2003; Trzeciecka, Trzeciecki 2002; Starski 2022a; 2022b), turnery and cooperage (Barnycz-Gupieniec 1961; Kasprzak 2007a; 2010a; 2010b), blacksmithing (Trawicka 2003; 2007; 2010), weaving (Jabłońska 2009a; 2009b; Grupa 2012), antler and horn working Hilczerówna 1961; Paner 2006b; Kasprzak 2007b; 2010a; 2010b; Jaskólski 2008) and shoemaking (Wiklak 1967; Ceynowa 2003; 2005b; 2020a; Wywrot-Wyszkowska 2010; Jędrzejczak-Szkutnik, Rembisz-Lubijewska 2018; Blusiewicz 2022a). The archaeological material also includes finds related to shipbuilding (Ossowski, Kościński 2003; Kocińska 2004a; 2004b; Trawicka 2004; Litwin 2004; Kościński 2020), fishing (Kasprzak 2010a; 2010b), rope-making (Kasprzak 2003a, 2010a; Grupa 2012; Krzywdziński 2013), brewing (Polak 2007; 2022; Kuczma,

8 Material was sought in the archives of the Archaeological Museum in Gdańsk, where I read unpublished reports on excavations and preliminary analyses of selected assemblages of artefacts, as well as became acquainted with the inventories of finds. During this work, I collected materials for research on pottery (the 'Monopol' site – SAZ 255/98/01), cooperage and turnery (the site at Łagiewniki/Rybaki Górne Streets – SAZ 255/39/07) and shipbuilding (the Lastadia site – SAZ 255/133/02; 255/133/03; 255/133/04).

Dyrda 2009) and amber working (Wapińska 1967; 1993; Paner 2006b; Ruta 2020; Blusiewicz 2022b).

Puck can be considered one of the best-studied small towns in the area studied here. Excavation work carried out in various parts of the urban complex have produced various types of material – such as the relics of production equipment, production waste and finished products – which allows us to learn about the crafts practiced there. These finds, dating back to the second half of the 14th and 15th centuries, have already been extensively researched, which significantly increases their cognitive value. These include finds confirming pottery production (Starski 2016), shoemaking (Blusiewicz 2013; 2017a), cooperage, turnery (Starski 2017a), carpentry (Blusiewicz 2017b), blacksmithing (Miścicki 2017a) as well as baking (Starski 2017b) and brewing (Starski 2014).

Archaeological research carried out in Kołobrzeg over several decades has resulted in the discovery of extremely numerous and diverse sources, and some of them have already been fully published (see Archeologia Kołobrzegu 1996–1999; 2010; 2016). The available material and, above all, the advanced state of its analysis make it possible to study the production of pottery (Rębkowski 1995; 1999a; Dworaczyk 2016a), blacksmithing (Polak 1996a; 1997a; 1998a; 1999a; Janowski 2016a), cooperage and turnery (Polak 1996b; 1997b; 1998b ; 1999b; Bobik 2016), tanning, shoemaking, leatherworking (Wywrot-Wyszkowska 2008; 2009a; 2016a), bone, antler and horn working (Rębkowski 1996a; 1997; 1999b; Wywrot-Wyszkowska 2016b), broadcloth production (Maik 1996; 1999; 2000a; 2016) and baking (Wywrot-Wyszkowska 2017). In the archaeological material are also finds that indicate a number of other activities, such as fishing (Polak 1996a; 1998a; 1998b; 1999b; Bobik 2016; Janowski 2016a), amber-working (Rębkowski 2000; 2006b; Wywrot-Wyszkowska 2016b), ropemaking (Maik 1996; 1997b; 1998; 1999; 2016; Polak 1997b), shipbuilding (Polak 1996a; 1996b; 1998a; 1998c) and wheelwrighting (Polak 1996b; Bobik 2016). A certain difficulty in research on Kołobrzeg's crafts is the limited number of finds dating to the 15th century, which is mainly due to the poor preservation of the layers accumulated during this period (see Rębkowski 1995, 11; Wywrot-Wyszkowska 2008, 13).

Relatively few sources for research on crafts have been obtained in Stargard. This is mainly due to the small scope of systematic excavations, which have taken place only in the last dozen or so years (see Archeologia Stargardu 2012; 2016; 2017). The discoveries made in this town provide material for research on bronze-foundry (Majewski 2013; Majewski, Ogiewa-Sejnota 2017), pottery manufacturing (Zyśko 2011; 2013; 2017; Romanowicz, Zyśko 2012; Dworaczyk 2016b), leather working (Wywrot-Wyszkowska 2009b; Stań 2011; 2012; 2013; 2017), blacksmithing (Rogosz 1980; Janowski 2012; 2017a), bone, antler and horn working (Janowski 2016c; 2017b)

and the manufacture of vessels and other objects from wood (Bobik 2012; Bucka 2017). All finds related to crafts come from the initial period of development of the chartered city – as in the case of some other towns, the lack of later material is the result of insufficient preservation of the later layers. In the excavations conducted so far, only rather thin medieval deposits were recorded, with the oldest ones, created in the 13th and the first half of the 14th centuries, being the best preserved.

We have a very modest group of sources in the case of Pyrzyce, where archaeological work has been limited to archaeological watching briefs of various construction activities (see, for example, Cnotliwy, Nawrolski 1996; Porzeziński 2010). These circumstances make the study of crafts in this town extremely difficult. So far, only a few publications have been published presenting finds of pottery (Dworaczyk 1998; Porzeziński 2010) and leather goods (Kowalska 1996).

Despite several decades of archaeological research in Szczecin, we only have fragmentary data for studies on crafts (see Cnotliwy 2002). The source publications to date refer mainly to the pre-location period (Cnotliwy et al. 1983; Dworaczyk et al. 2003; Kowalska, Dworaczyk 2011). However, the late medieval materials await full study, of which only finds related to the production of wooden (Baran 2003) and leather objects (Kowalska 1999; 2009; 2013) have so far been subject to detailed analyses.

There are very limited sources for learning about crafts in the case of Neubrandenburg, where systematic rescue excavations have taken place only since the 1990s (see Schmidt 2001). It is only in the case of pottery production that we have much information (Schmidt 1989; 1990; 1997; 1998; Jantzen 1997). In addition, the finds from the town include those related to bronze-foundry (Kaute 2006), other non-ferrous metal casting (Schmidt 2000) and the production of bone objects (Schmidt 1999; Lehmkuhl 2005).

In Greifswald, as a result of intensive excavations conducted since the 1990s, extremely rich and diverse materials dating back to the 13th–15th centuries were obtained. Noteworthy are the discoveries of evidence of bronze-foundries (Schäfer H. 1995; 1996; Ansorge, Rütz 1999; Rütz 2002), pottery workshops (Brandt 2000; Schäfer H. 2006), blacksmithing (Schäfer C. 1997a; Schäfer H. 1997a; 2006), tanneries (Schäfer C. 1997b; Enzenberger 2000; 2007) and bakeries (Schindler, Kaute 2009). In the town and in its immediate vicinity, remains of production equipment related to the activities of construction crafts were recorded (Ansorge 2000; Brandt, Lutze 2000). The archaeological material also includes numerous finds (finished products, production waste, tools) confirming the activity of such specialists as coopers (Schäfer, Schäfer 1998; Robben 2006; 2009),wood-turners (Ansorge et al. 2003), wheelwrights (Ansorge 2005b), comb makers (Ansorge, Rütz 1999;

Samariter 2004), goldsmiths (Schäfer, Ansorge 1995), fishermen (Enzenberger 2007; Schäfer C. 2016), as well as craftsmen engaged in casting of non-ferrous metals and the production of bone objects (Schäfer C. 2005). Discoveries related to the functioning of public bathhouses in this town are unique in the entire region (Enzenberger 1997; 2007).

Unfortunately, we do not have more detailed source studies enabling research on other areas of craft activity in Greifswald. The above remark applies primarily to leather production. Despite a significant number of finds of various products, mainly footwear, and waste generated during shoe production (Schäfer C. 1997a; Schäfer H. 2006; Enzenberger 2007), there are no studies on larger series of such artefacts. So far, only selected assemblages of leather goods have been published (Schäfer C. and H. 1997; 1998) and a few utensils and tools (see Kaute 1998; Ansorge 2003; 2005b; Enzenberger 2007).

Also in Stralsund, very numerous assemblages of finds related to craft activity were recovered from deposits of the 13th to 15th centuries, although the varied state of their analysis allows research only in some of its fields, such as blacksmithing (Kulessa 2000; 2003; 2004), bronze-foundry (Kaute, Schäfer 2000; Samariter 2000; Fries, Wiethold 2003; Ansorge 2005a), tanning (Kaute, Schäfer 2000; Ansorge et al. 2003), pottery manufacture (Schäfer H. 2004a; Hoffmann, Schäfer 2005), brewing (Ansorge, Wiethold 2002; Fries 2003), baking (Brüggemann 2015) and shipbuilding (Kulessa 2000; 2003). In the area of Stralsund, finds indicating the casting of non-ferrous metals and the production of bone and amber objects were also identified (Samariter 2007; 2010), as well as those related to goldsmithing (Ernst 1999; Möller 2006).

Although there are numerous groups of excavated finds indicating intensive leather working, so far several publications have appeared presenting only a few products (see e.g., Fries 2002; Möller 2004; Brüggemann 2008) or the tools used for their production (Möller 2006). Similar comments also apply to other categories of artefacts, primarily pottery, blacksmithing, cooperage and lathe-turned products.

In Rostock, archaeologically, the best-recognized crafts are those dealing with metal processing. During the excavations, remains were discovered of blacksmithing (Mulsow 2000a; 2008), bronze-foundry (Schäfer C. and H. 1994; Mulsow 2000a; 2000b; 2006) and goldsmithing workshops (Kaute, Schäfer 2003). Interesting data were also obtained for the study of tanning (Mulsow 2000a; 2006; Schäfer H. 2000a), shoemaking (Mulsow 2000a; 2006),[9] shipbuilding (Mulsow 2006), and

9 Some of the finds related to shoemaking workshops are known to me from personal examination. These concern material obtained from Grubenstraße (HRO 411), currently kept in storerooms in Lübstorf.

bone, antler and horn working (Lehmkuhl 1993; Mulsow 2000b; 2006; Schindler 2007), pottery (Burrows, Gaimster 2000), bakery (Konze 2005; Mulsow 2006), cooperage (Mulsow 2000a; 2005a) and clothmaking (Schäfer C. and H. 1996). As in the case of Stralsund, also for Rostock there are no studies or publications of finds specifically addressed to the issue of confirming the activities in the town of craftsmen. This applies to the evidence of both finished products (including ceramic vessels, wooden vessels, leather and metal products) and production waste.

The available archaeological sources from Wismar allow the study of only a few areas of craft activity, i.e., bronze-foundry (Grabowski 2002a), cooperage, turnery (Buchholz 1994), carpentry (Mulsow 2005a), baking (Grabowski 1996) and bone and horn working (Ottenbreit 1994; Lehmkuhl 2005). We also have only limited materials regarding smaller towns located in today's Mecklenburg-Vorpommern. In Güstrow, finds related to pottery manufacture (Schäfer H. 2004b), bronze-foundry (Fries 2014) and tanning (Wietrzichowski 1997; Demuth 2010) were obtained. Sources confirming pottery manufacture (Schäfer H. 1999a), bronze-foundry (Hoffmann V. 2006) and tanning (Hoffmann V. 2000) were discovered in Pasewalk. In turn, traces of bronze-foundry were recorded in Ribnitz (Konze, Rütz 2008) and Anklam (Hoche, Fries 2004). Remains related to bone and horn working were also found in the latter town (Lehmkuhl 1993; 2005).

In Lübeck, thanks to the discovery of many production sites along with relics of technical equipment, the activities of bakers (see e.g., Gläser 1989a; Müller Uwe 1992a; Mührenberg 2002a; Grabowski 2007), bronze-founders (Gläser 1989b; Gläser, Mührenberg 1998; Drescher 2017) and potters (Meyer 1980; 1993; Buchin, Erdmann 1986; Braun 2002) have been recorded. The archaeological material also includes finds (production waste and semi-finished products, finished products and tools) testifying to the production of artefacts of antler and horns (Stephan 1978; Falk 1983; Falk, Gläser 1988; Gläser 1989c; Müller Uwe 1992b; Mührenberg 1999; 2006), amber working (Müller Uwe 1992b; Mührenberg 2000), shoemaking (Groenman-Van Waateringe, Guiran 1978; Vons-Comis 1982; Groenman-Van Waateringe, Krauwer 1987; van den Berg, Groenman-Van Waateringe 1992; Volken 2002) and weaving (Tidow 1978; 1980a; 1980b; 1984; 1986; 1992; 2006). In addition, there have been recorded artefacts that can be identified with shipbuilding (Ellmers 1985; 1992) and ropemaking (Tidow 1978; 1984; 1992).

In the case of Lübeck, of the three categories of archaeological sources certifying craft production mentioned above, only the production equipment has been fully analysed. There is still a lack of detailed analyses of the remaining groups of finds. This mainly concerns waste groups associated with certain pottery, antler and horn working and amber production sites. Similar comments can also be made in

relation to finished products. Although significant collections of turned and stave-built vessels, as well as barrels and other wooden objects have been recovered during excavations (Gläser 2000, 135), we currently have only a few publications of larger series of such finds (Neugebauer 1954; Hahn 1978; Falk 1987; Gläser 1989c). There is a similar situation in the case of metal objects. Among the products of local crafts, or the ceramic vessels have been the most fully published (Drenkhahn 2015; 2917a; 2017b, there also older literature).

In Schleswig, numerous assemblages of products, production waste and raw materials have been discovered, which have enabled research into local pottery manufacture (Lüdtke 1985), leather production (Schnack 1992; 1998; Van de Wall-van der Woude, Groenman-van Waateringe 2001), turnery (Ulbricht 2006a), cooperage (Ulbricht 2006b), carpentry, production of small wooden objects (Saggau 2006), blacksmithing (Saggau 2000), ropemaking (Körber-Grohne 1989) and bone, antler and horn processing (Ulbricht 1984). It is worth emphasizing that almost all these finds, especially items made of organic materials, have been subject to specialist expert analyses.

The excavated material from Schleswig comes mainly from deposits accumulated in the 11th–14th centuries. However, later material is very scarce. Nevertheless, such a chronology of assemblages of finds related to craft production, primarily pottery, shoemaking, antler and horn working, cooperage and turnery, made it possible to observe the changes taking place in the coastal towns of the Baltic region at the turn of the 12th and 13th centuries in the techniques and range of manufactured products and the raw materials used, which significantly influenced the development of crafts in these centres.

As the above presentation shows, over twenty types of craft activity have been identified archaeologically in the towns of the coastal region in the southern part of the Baltic Sea. These include: pottery manufacture; bronze-foundry; blacksmithing; cooperage; wood-turning; carpentry; wheelwrighting; weaving (including production of woollen broadcloth); tanning (including red-leather and white-leather tanning); leather-working; shoemaking; patten-making; patching (reuse of recycled leather scraps); horn-working; non-ferrous metal working; goldsmithing; amber-working; rope-making; boatbuilding; masonry; fishing; baking; brewing; bathhouse management and glass working. This list contains a much smaller number of crafts than lists prepared on the basis of analyses of the written records, usually covering several dozen and sometimes over a hundred professional

specializations.[10] This disproportion is related to the previously mentioned problem of the representativeness of the survival of archaeological sources (see Janssen 1986; Rębkowski 2007a, 103).

The state of knowledge of the above-mentioned crafts in individual urban centres is very uneven. This is the result not only of the varied spatial scope and nature of archaeological research, but above all of the varied degree of the post-excavation processing and reporting of material from excavations. This results in a situation that in many towns (including Stralsund, Greifswald, Rostock, Neubrandenburg and Wismar), despite significant quantities of sources, only finds related to selected fields of crafts, for example bronze-foundry, blacksmithing, pottery manufacture, cooperage, turnery and horn-working, have been published. There are no studies of larger collections of evidence confirming the existence of other crafts (such as shoemaking, broadcloth-making or rope-making).

Considered on the scale of the entire region, however, the available archaeological sources enable studies on all areas of crafts included in the above list, in the period from the end of the 12th century to the turn of the 15th and 16th centuries. It should be noted, however, that most of the finds related to various types of craft activity date back to the initial period of development of the municipal towns in the coastal regions of the Baltic Sea, mainly to the 13th and 14th centuries. We have later materials only from a few centres, including Stralsund, Greifswald, Güstrow, Anklam, Pasewalk, Puck and, with some reservations, Gdańsk.

10 See data relating to, for example, Riga, Tallinn, Lübeck (Stieda, Mettig 1896, 43 ff., 65, 77), Elbląg (Tandecki 1993, 172; 1997), Gdańsk (Hirsch 1858, 298 ff., see also Steida, Mettig 1892, 77) , Kołobrzeg (Tepp 1980, 50 ff.), Greifswald (Kattinger 2000a, 81 ff., there further literature), Stralsund (Möller 2006, 242, there further literature) and Rostock (Mulsow 2000a, Fig.1, there further literature).

3. Crafts attested in archaeological sources

3. 1. Pottery Manufacture

Pottery is one of the most numerous categories of finds obtained during excavations in all the Baltic coastal towns discussed here. This is due to the fact that – unlike objects made of, for example, organic raw materials – ceramic products remain in good condition, regardless of the environment in which they lay after being deposited. In addition, ceramic vessels, widely used in all groups of medieval society, were quickly damaged, which resulted in a high demand for such products and the constant renewal of supplies from the producer to the consumer (Rębkowski 2001, 159). This is reflected in the large number of discovered assemblages of fragments of ceramic vessels, and is also evidence of the mass scale of their production. In addition to vessels for household use, medieval potters also produced stove tiles, lamps, net weights, spindle whorls and other ceramic items. The archaeological evidence for pottery production obtained during excavations consist primarily of fragments of the finished products.[1] Remains of kilns and accompanying

1 See, for example, the published results of analyses of such finds from Schleswig (Lüdtke 1985), Lübeck (Drenkhahn 2015; 2017a; 2017b), Rostock (Schäfer H. 2005a), Greifswald (Brandt 2000; Scharmach, Schäfer 2000; Ansorge et al. 2003; Samariter et al. 2003), Güstrow (Schäfer H. 2004b), Neubrandenburg (Schmidt 1989; 1990), Pasewalk (Schäfer H. 1999), Kołobrzeg (Rębkowski 1995; 1999a; Dworaczyk 2016a), Pyrzyce (Dworaczyk 1998; Porzeziński 2010), Star-

production waste that can be identified with pottery workshops have – so far – been discovered only in a few towns.

The remains of a pottery workshop from the first quarter of the 13th century were discovered in Lübeck, in the yard of a corner plot at Koberg 15–16 (Meyer 1980; Buchin, Erdmann 1986). It was equipped with a pear-shaped domed kiln (Meyer 1980, 64 ff., Fig. 26; Buchin, Erdmann 1986, Fig. 1). This device had two chambers located one above the other. They were divided by a grate, which rested on an oval plinth erected in the middle of the lower chamber. Vessels to be fired were placed in the upper chamber. On the western side of the kiln, near the lower chamber, there was a fire pit connected to it. On the opposite side, at the level of the firing chamber, there was a ventilation hole, which was also a hatch to the kiln. Below this opening there was a kiln pit (Fig. 2). After it had gone out of use, the kiln was partially dismantled and covered with a levelling layer, the contents of which included fragments of defectively fired vessels, mainly pots with convex bottoms (Meyer 1980, 69, Fig. 27). According to the estimates of K. Buchin and W. Erdmann (1986, 57 ff.), a maximum of approximately 6,000 vessels could be fired annually in this device. Unfortunately, archaeological research in the plot in question was limited to carrying out only a few small trial excavations (see Meyer 1980, 83, Fig. 25). Their limited scope made it impossible to precisely identify the manner of development and development of the yard where the workshop was located.

In the same quarter, in its north-west part, another place related to pottery production was discovered. In a small trial pit, set out in the back of the property at Kleine Burgstraße 11, layers of clay with traces of burning were recorded, containing numerous pieces of charcoal in their upper part, which could have been formed during the use of a kiln. During the research, no obvious remains of such a structure were found, but its existence would probably be evidenced by the burnt and crushed pieces of clay and fragments of ceramic tiles that were the debris of the destruction of its walls. About 600 fragments of pottery, both grey and glazed redware, were recovered from the studied area, including many fragments from defectively fired vessels. The greyware products included pots with convex bottoms and pots with three legs (so-called pipkins), as well as jugs and bowls, while jugs were also identified in the assemblage of glazed redware. This workshop clearly was involved in the manufacture of both greyware and glazed redware vessels, and

gard (Zyśko 2011; 2013; 2017; Romanowicz, Zyśko 2012; 2016; Dworaczyk 2016b), Puck (Starski 2016), Gdańsk (Trzeciecka, Trzeciecki 2002; Kościński 2003; Starski 2022a) and Elbląg (Marcinkowski 2003a; 2006a).

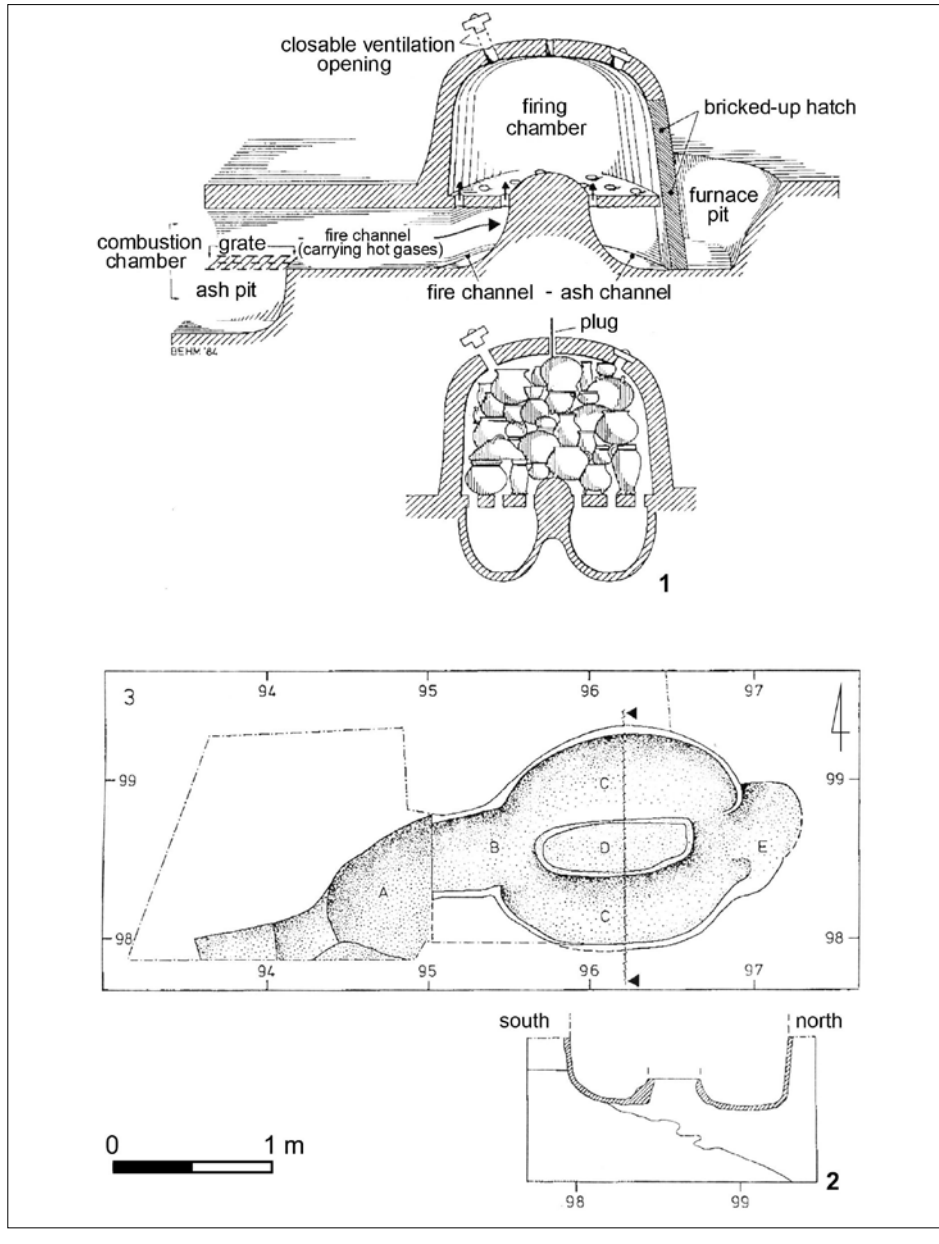

Fig. 2. Lübeck, Koberg 15–16. 1 – reconstruction of pottery kiln, 2 – plan and cross-section of the kiln (after Buchin, Erdmann 1986, Fig. 1)

its activity dates to the first half of the 13th century and it seems to be slightly later than the workshop at Koberg 15–16 (Meyer 1993, 277–279).

This pottery workshop should also be associated with the finds of ceramic waste generated during the production of glazed redware ceramics, recorded on the plot of Große Altefähre 1, located in the neighbouring building block opposite the property of Kleine Burgstraße 11 (Braun 2002, 165, 170 f., Fig. 6). These fragments were buried in layers of earth and rubble brought to the plot to raise the ground and provide a surface. Among this ceramic material, among other things, were 20 fragments of defectively fired vessels decorated with anthropomorphic ornaments (Braun 2002, 165–168, Figs. 2–5).[2] Among them was a group consisting of 12 fragments of jugs with representations of female figures. These artefacts indicate that glazed jugs decorated with the so-called 'dancing girls' motifs were manufactured in Lübeck as early as the first half of the 13th century (Drenkhahn 2015, 138).

In Greifswald, on the property at Lange Straße 3 located in the southwestern part of the city, a pit was discovered containing nearly 4,200 fragments of ceramic vessels dating to the second half of the 13th century (Brandt 2000, 118). The majority of the assemblage consisted of fragments of grey ceramics, including many specimens deformed as a result of overheating and high temperatures (Fig. 3). No kiln was discovered in the course of the excavations, but its former presence nearby seems to be supported by the discovery of numerous pieces of burnt clay on which the burnt-out impressions of grass admixture were visible, as well as regularly spaced, elongated and slightly rounded impressions, most likely made of wooden rods. They may be the remains of a kiln dome made of an appropriately woven wooden framework covered with clay (Brandt 2000, 121). In addition, two elongated pits sunk into the natural sandy substrate were discovered. There were thin (c. 2–4 cm thick) layers of clay on their walls and bottoms. It is possible that they were used for the soaking of previously cleaned clay (Brandt 2000, 117). It can therefore be assumed with a high degree of probability that on the property in question there was a workshop where pots of various sizes with convex bottoms were produced, and to a lesser extent, jugs in the second half of the 13th century (Brandt 2000, 118, Figs. 3–6).[3] On a neighbouring property (Lange Straße 1),

2 From the assemblage of waste obtained here, only fragments of pottery with anthropomorphic decorations have been published. It is not known whether this waste dump had contained fragments of vessels decorated with other motifs. The quantity of this waste is also unknown (see Braun 2002, 165).

3 In the excavated ceramic material, the presence of fragments of vessels, mainly jugs, fired red, was also recorded. Remains of white slip were visible on some of them. On others, remnants of yellow and orange-brown glaze were found irregularly covering the walls of the ves-

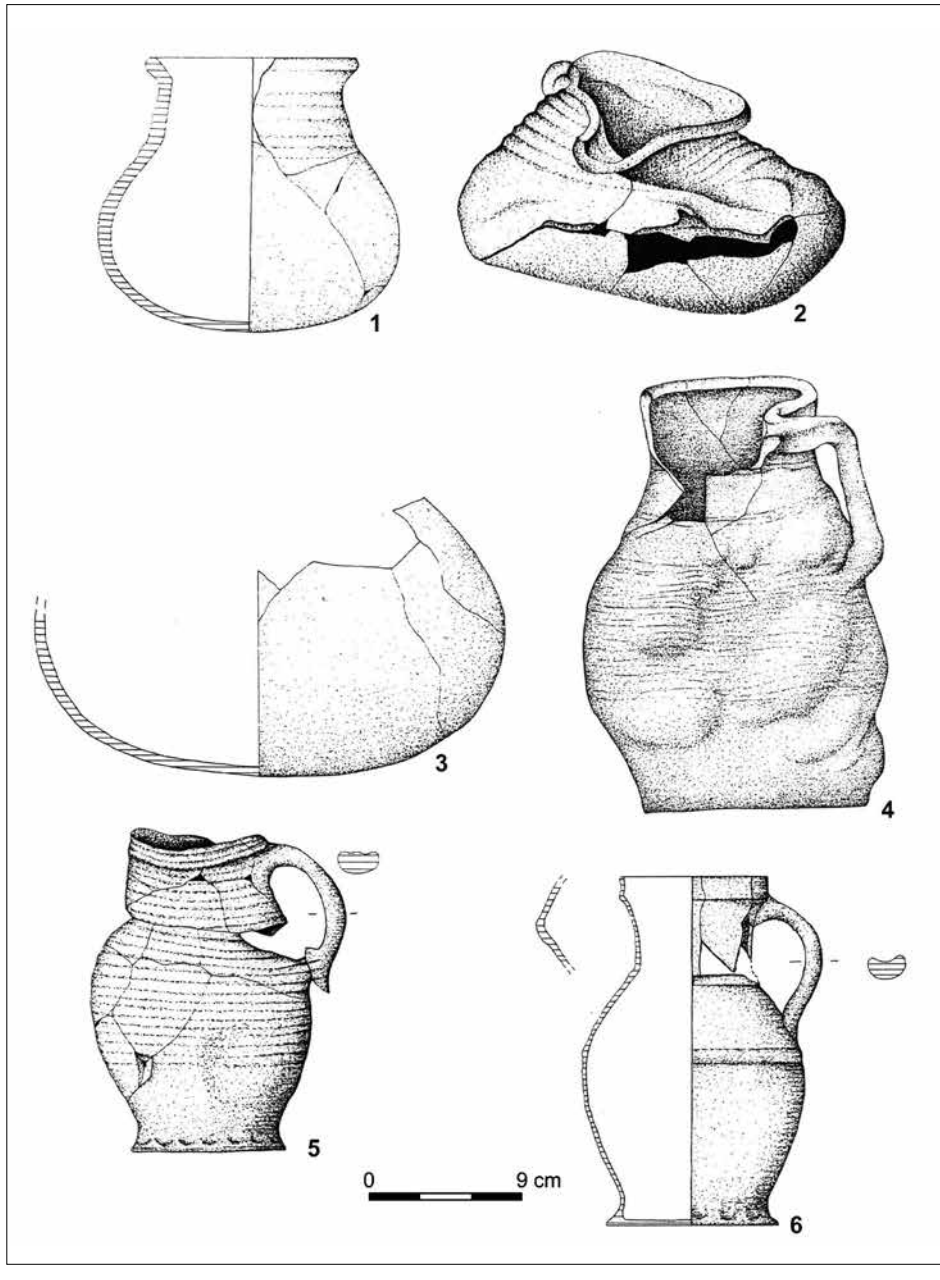

Fig. 3. Greifswald, Lange Straße 3. Selection of vessels discovered in a pit filled with waste from pottery production (after Brandt 2000, Figs. 3; 6)

a large collection of vessel fragments was discovered, including damaged and incorrectly fired items.[4] The finds from both plots are most likely related to the same workshop. This is supported by the fact that on the plan of Greifswald dating to 1707, at Lange Straße in the place of the current properties 1 and 3, one wide corner plot was marked (Schäfer H. 2000a, 57, Fig. 8, there further literature).

In the southern part of Greifswald, further pits filled with waste from pottery production were recorded. They were located on plots located near the walls at Rubenowstraße 3 and Rakower Straße 1 and they had been deposited in the third quarter of the 13th century. These assemblages were dominated by fragments of greyware vessels, and only sporadically were there fragments of traditional products (Schäfer H. 2006, 356). The grey vessels discovered on the property of Rakower Straße 1 deserve special attention. They are characterized by a relatively low hardness of the body, which may indicate that they were fired in an uncontrolled atmosphere, in a simple single-chamber kiln, although their shapes do not differ from other grey wares used at that time (see Schäfer H. 2000a, 57).

The remains of a thirteenth-century pottery workshop were discovered in Elbląg at Sukiennicza Street. This workshop was located on a corner plot, located right next to the town's defences (Marcinkowski 2003a, 205 ff., Figs. 6–7). In its front part there was a wooden frame-built structure with a small annexe added to its eastern wall, interpreted as the potter's house and workshop. In the rear part of the yard there was a kiln built of clay, on an oval plan (3.40 × 2.60 m) oriented on the north-south axis (Fig. 4). Although no obvious traces of a partition were recorded in the kiln, it can be assumed that the fireplace part must have been separated from the part intended for firing. Perhaps each time, a makeshift partition was made using misfired vessels to ensure the proper course of the firing process. There was a kiln pit near each of the shorter walls of the structure (Marcinkowski 2003a, 194–196, 212 ff., Figs. 2, 4–5). It is estimated that the temperature in this kiln would have reached a maximum of 900°C (Marcinkowski 2003a, 215). The workshop also included devices used for processing clay, sunk into the ground, of which two pits have been preserved, located in the western part of the yard. An exceptionally large collection (82,451 fragments) of sherds of grey ceramics was recovered from the

sels, which may suggest that they are defective products. Based on these observations, D. Brandt (2000, 120) assumed that glazed vessels were produced in Greifswald. However, as the author of the study himself noted, the above fragmens were characterized by varying degrees of firing (Brand 2000, 118, especially fn 11). Therefore, it seems that these are defective greyware products, and the presence of enamel spots on the walls may be accidental (see also Rębkowski 2001, 188).

4 This discovery was made at the end of the nineteenth century (Brandt 2000, 115, there further literature).

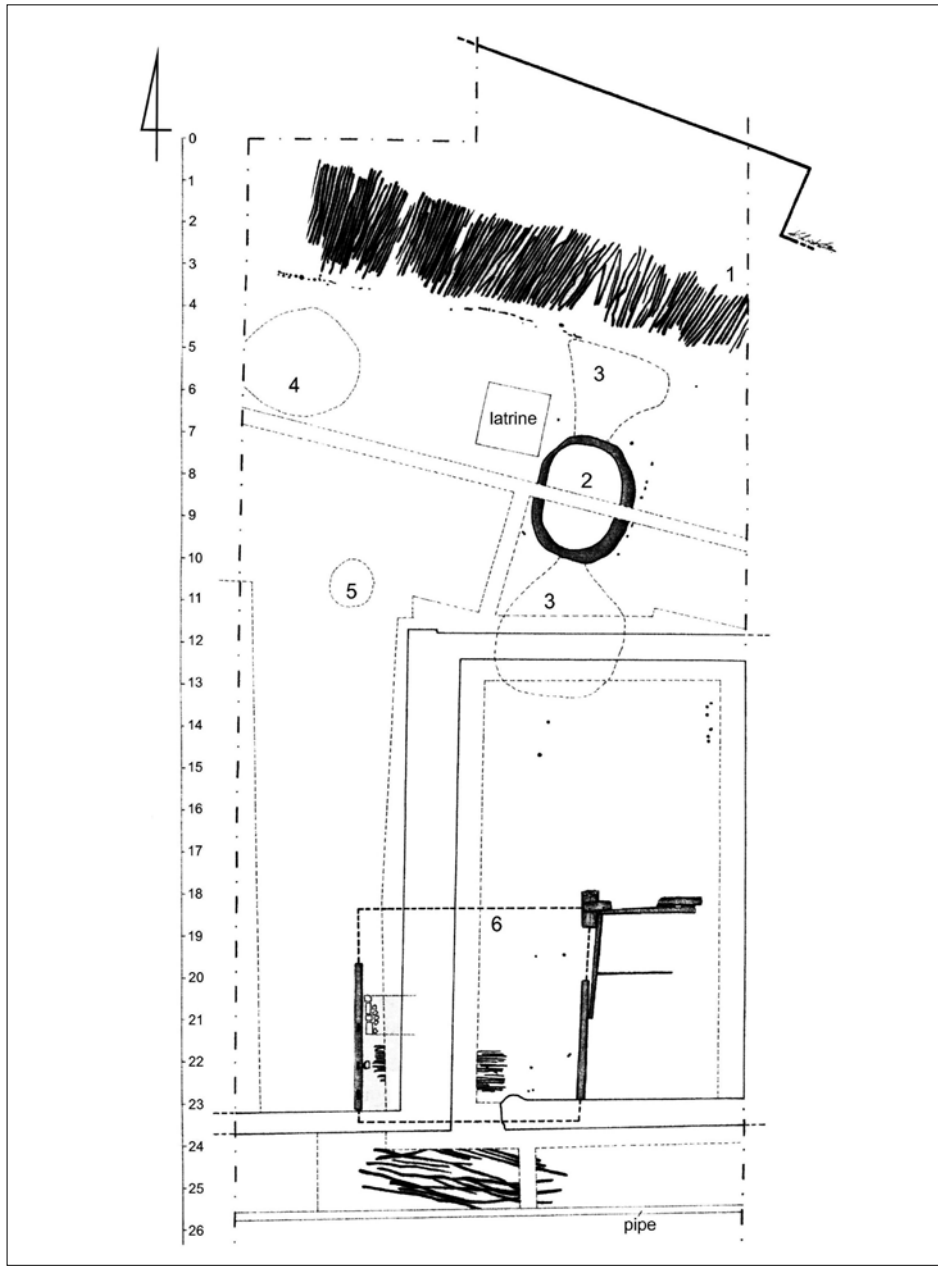

Fig. 4. Elbląg, ul. Sukiennicza. Plan of facilities related to the pottery workshop. 1 – wooden street, 2 – pottery kiln, 3 – kiln pits, 4 – Feature 13, 5 – Feature 10, 6 – House 10 (potter's house) (after Marcinkowski 2003a, Fig. 6)

interior of the kiln, the kiln pits and from the layers surrounding them. The craftsman working here produced vessels – pots and jugs with flat bottoms, bowls, cups and lids, as well as spindle whorls and net weights (Marcinkowski 2003a, 206–212).

This workshop was established at the turn of the 1270s and 1280s and operated for about 10 years, i.e. until 1288, when a huge fire largely destroyed the buildings of Elbląg (Marcinkowski 2003a, 201 f). The sudden interruption of its activity was indicated by the presence of the last load of vessels inside the furnace. According to estimates made by M. Marcinkowski (2014, 173), during the ten-year period of use of this device, approximately 41,500 vessels could have been fired in it, of which 37,300 were usable products. Approximately 130–150 tons of clay were used to produce them, and 621–1035 m^3 of wood were used to burn them.

Traces of local pottery production have also been identified in smaller, inland municipal centres, an example of which is Strasburg. Although no workshops themselves have been discovered in the city, their existence is evidenced by the dumps of production waste discovered in the eastern part of the city (Schäfer H. 1997c). Near the city wall, on the property at Mauerstraße 11–12, a pit was discovered from which nearly 10,000 fragments of vessels were recovered, including faulty ones. This assemblage is dominated by pots with convex bottoms, with a few pipkins and cups (Schäfer H. 1997c, 174–175, Fig. 2:a–e). A similar assortment of products was made in the workshop from which came the waste deposited just behind the town defences, near Jüteritzer Tor (Schäfer H. 1997c, 177). Both assemblages date to the second half of the 13th century. Their chronology indicates that in Strasburg, which was founded in the mid-13th century, vessels fired in a reducing atmosphere were produced already in the initial period of its development (Schäfer H. 2000a, 58).

Pottery production is very well documented in the excavations from Neubrandenburg (Schmidt 1989; 1990; 1997; 1998). Several workshops operating in the period from the second half of the 13th century to the end of the 15th century have been identified in the medieval city (Fig. 5). One of them was discovered in the south-eastern part of the city, at Pfaffenstraße. Within it, a pottery kiln and several pits where waste products were dumped were recorded (Schmidt 1990, 11 ff.). The good state of preservation of the remains of the kiln made it possible to reconstruct it. It was a two-chamber device, oriented on the east-west axis, and sunk into the ground. The walls of the furnace were made of clay, and the inside was additionally lined with pieces of vessels (Schmidt 1990, 13, Fig. 5). The length of the furnace was 1.96 m, the width was 1.30 m, and the original height was estimated at approximately 1 m. The combustion chamber had dimensions of 1.02 × 0.92 m and the firing chamber measured 1.08 × 1.04 m. They were divided by columns made of broken vessels. The kiln could have fired about 60 vessels at a time (Schmidt

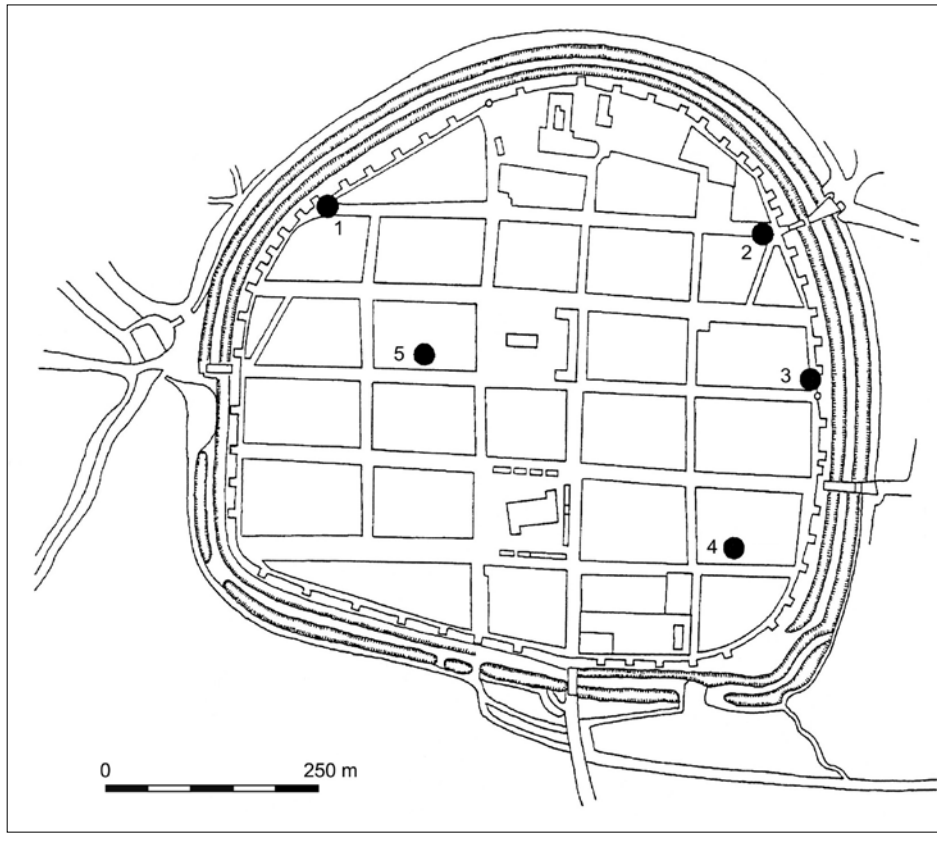

Fig. 5. Neubrandenburg. Location of pottery workshops of the 13th–15th centuries. 1 – Nr 2 Ringstraße, 2 – Friedländer Tor, 3 – Nr 5 Ringstraße, 4 – Pfaffenstraße, 5 – Treptowerstraße (after Schmidt 1998, Fig. 1)

1990, 38). The assemblage of ceramic retrieved during the excavation (a total of 3,695 fragments) was dominated by fragments of greyware, and only sporadically there were fragments of glazed redware vessels and net weights (Schmidt 1990, 11–13, 27, tab. 5–7). This workshop operated from the second half of the 13th century to the end of the 1320s (Schmidt 1990, 13).

A little further to the north, during earth-moving related to the construction of a pipeline running through the plot at 5. Ringstraße, a pit was found filled with fragments of broken vessels, including misfired ones. Due to the limited scope of research, this feature has been only partially explored (Jantzen 1997, 183). Over 5,000 fragments of pottery, mainly grey wares, were collected from the excavated

part of the pit. A small percentage (5%) of the finds were glazed redware (Jantzen 1997, 183 ff., Fig. 2). This assemblage dates back to the late 13th or early 14th century. Another place where pottery waste was deposited was recorded in the north-eastern part of the city, near Friedländer Tor. A dozen or so metres from this gate, a pit was discovered filled with fragments of vessels, including deformed and misfired ones. This collection (consisting of approximately 3,000 fragments) included mainly grey wares accompanied by a few fragments of glazed redware (Schmidt 1990, 7, tab. 1). This waste had most likely been removed from a workshop located on the extreme edge of the town, right next to the urban defences (Schmidt 1998).

In turn, in a block of buildings located on the western side of the market square, remains of a fourteenth-century pottery were discovered. It was located on a plot of land facing Treptower Straße, running from the southwest corner of the market square towards the walls. The investigation covered a significant part of the plot, which allowed for the identification of its layout and development (Fig. 6). The workshop was located in the yard of the property, where two kilns with oval outlines and of similar dimensions were discovered, placed one on top of the other. The later kiln had been almost completely destroyed by subsequent activity. The older one had two chambers separated by two columns placed near the walls. Its length was approximately 2.40 m and its width was 1.20 m. Further back in the yard there was a well and next to it a pit (dimensions 3.36 × 2.15 m) filled with homogeneous, light grey clay. This feature could have been used to soften the raw material. The workshop was probably connected with a small, sunken building erected at the eastern border of the plot (Schmidt 1998, 189 ff., Figs. 2–4). What is surprising is the fact that no production waste was recorded in the studied area. According to V. Schmidt (1998, 191), this material could have been deliberately removed from the plot during the course of the operation of the workshop. Alternatively, and more likely, layers containing such material were removed during levelling the land, as evidenced by the serious damage that had been caused to layers and features on the site resulting from subsequent construction work.

In the north-western part of the city, on a plot at the current Nr 2 Ringstraße, there was a workshop whose activity dates back to the period between the second half of the 14th century and the end of the 15th century. Within it, the relics of two kilns placed next to each other and two pits filled with production waste were discovered (Schmidt 1990, 7–11, Fig. 3).[5] An extremely large amount of ceramic material

5 This workshop was discovered accidentally during earthmoving, which also largely destroyed the remains of any workshop equipment and waste dumps located here. Suffice to mention that two heaps of waste lying near the kilns were removed before the arrival of archaeol-

(41,800 fragments), dominated by fragments of vessels, was collected from the workshop area; a small percentage (about 10%) of these sherds were redware vessels glazed on the inside (Schmidt 1990, 7–10, 38, tabs 2–4). Additionally, fragments of pot tiles for domestic heating stoves fired in reducing and oxidizing atmospheres as well as net weights were recorded (Schmidt 1990, 25, 27). Both kilns had oval plans and were oriented NE–SW. One of them had survived in a condition that allows its reconstruction. It was a two-chamber kiln about 2.90 m long and up to 2.60 m wide (Schmidt 1990, 11, 33, Fig. 4). It is estimated that about 120 vessels could have been placed in this kiln at one time. However, their annual production probably ranged from 2,700 to 2,850 pieces (Schmidt 1990, 38).

Local potters were mainly engaged in the production of grey vessels, including pots with convex bottoms, pipkins, pots with flat bottoms, jugs, bowls, cups and pans. In the light of the finds obtained from the workshops located in front of Friedländer Tor on Pfaffenstraße, and the contents of a waste pit found on the street running along the city

ogists. Also, the extensive damage to the kilns makes it impossible to decide whether they were built at the same time or whether they were used one after the other (for more on the circumstances of the discovery, see Schmidt 1990, 7 ff.).

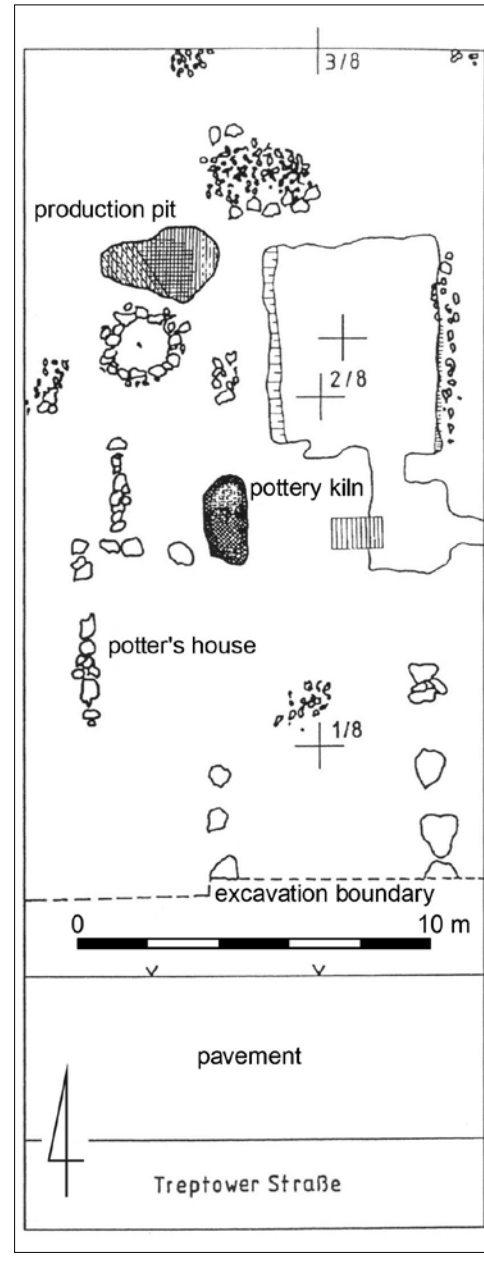

Fig. 6. Neubrandenburg, Treptowerstraße. Pottery workshop of the 14th century (after Schmidt 1998, Fig.2)

wall at Nr 5 Ringstraße, redware vessels glazed on the outside were also produced in Neubrandenburg from the turn of the 13th and 14th centuries, although on a small scale (Schmidt 1989, 22–23, 27, 39; 1990, 37–38; 1997, 189; Jantzen 1997, 183). Probably in the second half of the 15th century, in the workshop at 2. Ringstraße, there was production, although very limited, of redware ceramics glazed on the inside (Schmidt 1990, 38). Local craftsmen also produced tiles, spindle whorls, net weights and lamps (see Schmidt 1989, 13–52; 1990, 16–27). In the initial period of the development of the chartered town, pottery workshops were located on its eastern outskirts. Later, they were located in the western part of the town (see Fig. 5, see also Schmidt 1997, 189). The kilns discovered in older workshops were much smaller than those used in later workshops. It is estimated that later devices could hold twice as many vessels (Schmidt 1990, 38). According to very general calculations, it is estimated that around 350,000 vessels could have been produced in the workshops at Pfaffenstraße, Friedländer Tor and Nr 2 Ringstraße in the period from the mid-13th century to around 1500 (Schmidt 1998, 188).

In Güstrow, on a peripherally located plot at Grüne Winkel 17, several pits containing production waste with a total weight of approximately 1 ton were discovered (Schäfer H. 2004b). The vast majority of them are fragments of grey wares, although a small percentage of red pottery was also recorded. Both of these groups are dominated by pitchers. Some of them have a form similar to Siegburg stoneware jugs (Schäfer H. 2004b, 110, Fig. 2). Cups are also a significant component of the collection of greyware products. Much smaller numbers of fragments had come from bowls burnished on the inside and single-handled pots with flat bottoms, whose form refers to modern urinals made of pewter or clay. A characteristic feature of the assemblage is the lack of kitchen utensils, for example pipkins or pots with convex bottoms. Moreover, almost all products are decorated with burnished, circular stripes placed in their upper parts, sometimes on their bellies. This suggests that these vessels were the product of a workshop (or workshops) specializing in the production of tableware – mugs, jugs and goblets. As a sideline to the main activity, tiles were also made there, as evidenced by the fragments of such products among the waste (Schäfer H. 2004b, 115, 117, Figs. 9.c–d; 10). The group of finds in question is dated to the first third of the 15th century (Schäfer H. 2004b, 120).

In a plot of land located near Jagower Tor in Pasewalk, on the corner of Marktstraße and Ringstraße, a dump of waste from a local pottery workshop (over 8,000 items) was discovered (Schäfer H. 1999a, 7 ff.). This assemblage was dominated by fragments of greyware vessels (approx. 60%) – pots with convex and flat bottoms, three-legged pipkins, bowls, jugs, and cups (Schäfer H. 1999a, Figs. 2–4;

5.a–d; 6.a–c; 9–12; 14–17).[6] The second largest group (less than 25%) was composed of sherds of redware, although in the case of this category of finds there are doubts whether they are fragments of unfinished products that had not been fired again after applying the glaze, or whether the production of unglazed vessels was intentional (Schäfer H. 1999, 10). They are represented almost exclusively by pipkins (Schäfer H. 1999a, Fig. 18.a–g). It is worth emphasizing that among the finds discussed there was a small percentage (about 5%) of fragments of brick-red vessels glazed on the inside, mainly pipkins (Schäfer H. 1999a, Figs. 25.a–c). These finds were accompanied by fragments of pot-form stove tiles fired in oxidizing and reducing atmospheres, as well as net weights (Schäfer H. 1999, Fig. 5.e–f; 6.d–e; 7.d–e; 20–22). This waste was deposited in the second third of the 15th century, probably shortly before the beginning of mass production in the western zone of the southern Baltic Sea of vessels fired in an oxidizing atmosphere and glazed on the inside (Schäfer H. 1999a, 10 ff.).

In Greifswald, the production of such products is confirmed already in the second half of the 15th century. At the northern end of Brüggstraße, a waste pit was discovered in which over 1,100 pieces of vessels were found (Scharmach, Schäfer 2000, 176 ff., tab 1). This assemblage was dominated by fragments (445 items) of grey wares, although the high frequency (402 items) of fragments of brick-red glazed vessels is striking, including specimens deformed by faulty firing (Scharmach, Schäfer 2000, 176, Fig. 7:c). A significant proportion of the assemblage were fragments of ceramics fired in an oxidizing atmosphere (243 items). It is not known, however, whether these are fragments of unglazed brick-red products intentionally-produced, or whether they were defective glazed items or greyware vessels (Scharmach, Schäfer 2000, 176). Among the finds discussed, a fragment of a matrix for making stove tiles was also identified. Its presence suggests that such items were also made in the workshop from which the waste came (Schäfer H. 2006, 356).

Brick-red glazed vessels were also made in late medieval Gdańsk. At Podwale Grodzkie Street, clusters of production waste and the probable remains of kilns were uncovered, proving the existence of craft workshops in this part of the city (Kasprzak 2003b, 93, Fig. 2). The evidence shows that this pottery production was carried out in the 15th century (Kościński 1998a; 1998b). However, the ceramic material (almost 6,400 vessel fragments) dating to the second half of that century is of particular importance for these considerations. The assemblage was still dominated

6 It should be added here that the grey vessels also included burnished products: jugs, cups and bowls. The outer surfaces of the jugs and cups were burnished, while in the case of the bowls, this applied only to the inner surfaces (Schäfer H. 1999a, 9).

by greyware vessels (slightly over 60%), although it is distinguished by a relatively large share of brick-red glazed wares (nearly 30%) and unglazed wares (about 10%) (Kościński 1998a, 27). Among the grey vessels, almost exclusively flat-bottomed pots and large bowls were recorded. The glazed brick-red products were represented only by fragments of jars with flat bottoms and tripod-legged pipkins, while the unglazed brick-red products were represented by flat-bottomed jars, lids and, slightly less often, pipkins (Kościński 1998a, 28).

Extremely interesting discoveries related to pottery manufacture were made in Stralsund. On the plot at Marienstraße 22, located in the south-eastern part of the city, a brick-built kiln was discovered. Inside it and in its immediate vicinity there were numerous fragments of ceramics, including defective items.[7] As the preliminary analysis of the excavated material has shown, the craftsmen working here produced products representing various technological groups. These were redware, brown-grey and white ceramics (Schäfer 2004a, 615; Hoffmann, Schäfer 2005, 266). The assemblage of ceramic finds collected in the investigations is dominated by tableware; small tiles and stove tiles covered with green glaze were much less common. Some of the vessels, mainly jugs and small cups covered with green glaze on both sides, are imitations of Siegburg stoneware (Fig. 7:3–4). Some jars have inscriptions carved in Gothic letters on their walls (Fig. 7:5), while others have applications with figural and architectural representations. One of them is decorated with a tracery motif, the same as that found on the fragment of a matrix identified among the presented finds (Fig. 7:1). The next two matrices show standing and sitting female figures (Fig. 7:6–7), and the third one shows the image of a city surrounded by a wall (Fig. 7:2). These moulds could have been used to decorate both vessels and tiles. This workshop operated in the mid-15th century (see Hoffmann, Schäfer 2005, 265). The finds indicate that the workshop at Marienstraße 22 probably specialized in the manufacture of richly decorated luxury products. The nature of its production clearly distinguishes it from other potteries in the region (Schäfer H. 2004a, 615).

Apart from those discussed above, no other pottery workshops or dumps of production waste have as yet been discovered in other towns on the southern Baltic coast. Nevertheless, due to the widespread use and relatively short durability of ceramic

7 The results of the research at this site have not been fully analysed; there have only been short notices published that briefly discussed only the finds. It is also not known what the structure of the kiln was, it was only noted that it was built of bricks (Schäfer H. 2004a). Later publications relating to this workshop merely duplicate the information contained in the above-mentioned communication (see Hoffmann, Schäfer 2005; Möller 2006).

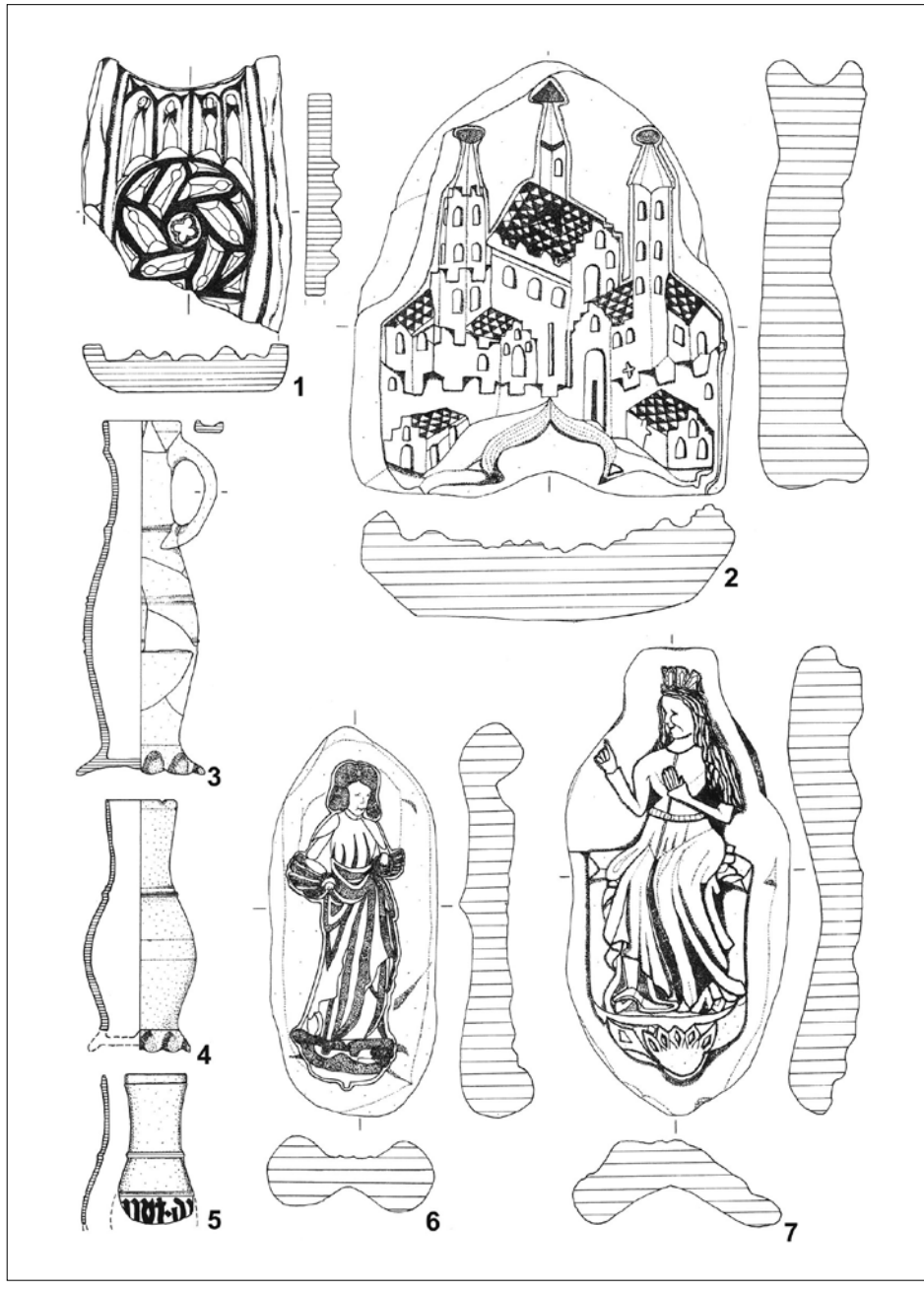

Fig. 7. Stralsund, Marienstraße 22. A selection of finds discovered in the pottery workshop (after Schäfer H. 2004a, Fig. 97)

vessels, pottery workshops must have existed in every city. In the 13th and 15th centuries, the basic type of vessels produced were still products fired in a reducing atmosphere. At some sites there were also significant proportions in the ceramic assemblages of the so-called traditional pottery, made using a technique typical of pottery in the later phases of the early Middle Ages (see Rębkowski 1995, 21). Such products have been found in some of the Pomeranian towns, such as Kołobrzeg (Rębkowski 1995, 21 ff., 1999a, 208 ff.), Szczecin (Rębkowski 2001, 174 ff.), Stargard (Romanowicz, Zyśko 2012, 89-90; Dworaczyk 2016b), Gdańsk and Puck (Starski 2016, 198 ff., tab. 18, fn. 378), but also in Elbląg, located in Prussia (Marcinkowski 2006a, 273–275; 2013, 239). These products were found primarily in layers created in the initial period of the development of these centres. They constituted a high percentage, sometimes reaching several dozen percent, of the vessels used at that time. The mass occurrence of traditional ceramics is evidence of its local production, which continued for some time after the chartering of the town, until such material fell into disuse (see Rębkowski 1995, 75–76; Romanowicz, Zyśko 2012, 96; Starski 2016, 198, 223). In some towns, such as Kołobrzeg and Szczecin, the production of such vessels could have continued for several dozen years after the chartering (Rębkowski 2001, 175 ff.).

In the 13th century, glazed redwares were produced in Lübeck (Meyer 1993, 278; Braun 2002), and from the turn of the 13th and 14th centuries in Neubrandenburg (Schmidt 1990, 37–38; 1997, 189). Their production was rather limited and gradually disappeared during the 14th century. This was probably related to the increasing inflow to the Baltic towns of stoneware vessels (mainly from the Siegburg workshops) [8] that were competitive in terms of quality and aesthetic value and effectively displaced other tablewares from the market, especially in port cities (see Rębkowski 2001, 179).

By the first third of the 15th century, clear symptoms of the gradual marginalization of the production of grey ceramics appeared, and in the second half of the century, the production of unglazed and glazed brick-red vessels becames more important (see Schäfer H. 1997b, 326 ff.; 1999 10 ff.; Kulessa 2003, 178, tabs 5–6; Drenkhahn 2015, 130, 226; Starski 2016, 187). This process probably took place at a different pace and intensity in individual centres. Suffice to mention that in Elbląg the beginnings of the production of glazed brick-red vessels date to the end of the 15th century (Marcinkowski 2006a, 293 f.; 2013, 245 f.).

8 See finds of such vessels from the towns of Mecklenburg (see Schäfer H. 1997b, Ansorge et al. 2003), Pomerania (Rębkowski 1995; Dworaczyk 2016a; Trzeciecka, Trzeciecki 2002; Kościński 2003) and Estonia (Russow 2006), among other places.

An important element of the potters' activity was the production of tiles. These craftsmen also built domestic heating stoves and similar devices (see Bogucka 1962, 157; Majewski 2015, 63).[9] In the light of the oldest finds of stove tiles, the first such heating devices could have appeared in Lübeck as early as the end of the 12th century (Drenkhahn 2017a, 249 ff.), and in Rostock in the first half of the 13th century (Ruchhöft 2003, 167 ff.). Tiled stoves were still not used very often in the Baltic towns in the 14th century; they became popular only in the 15th century (Schäfer H. 1997b, 329; 2004c, 97 ff.; Majewski 2015, 57 ff.). This phenomenon is reflected not only in numerous collections of tiles obtained during excavations (see, for example Schäfer H. 1997b; 2004c; 2012; Kowalska M. 2003; Kaute et al. 2006; Starski 2016; 2022b), but also in traces of their increased production recorded in groups of finds identified as the remains of fifteenth-century workshops (see, for example discoveries in Stralsund, Greifswald, Güstrow, Neubrandenburg and Pasewalk).

Late medieval potters produced pot-shaped and bowl-form stove tiles formed on a wheel, as well as slab and niche stove tiles made using special moulds (Majewski 2015, 79 ff., 104 ff.). Matrices for making tiles were identified in the Strasund workshop at Marienstraße 22 and also among the production waste discovered at Brüggstraße in Greifswald. In Stralsund, on the plot at Langestraße 17, where there was a 17th-century pottery, fragments of clay moulds were discovered embedded in the basement wall of the front building. They included a fifteenth-century matrix with a depiction of the Crucifixion scene, used for making niche tiles (Ansorge 2007, 209, Figs. 8–10; Schäfer 2009, 309, Fig. 12.1). In Rostock, on the property at Pläterstraße 14, fragments of 38 moulds were obtained (Burrows, Gaimster 2000, 281; see also Mulsow 2000a, 201–202, 212). They were used to produce tiles with depictions of the Blessed Virgin Mary and saints, including St Martin of Tours, St Dorota, and the Archangel Michael. Several dies were used to make small tiles decorated with plant motifs (see Burrows, Gaimster 2000, 281–292, Figs. 9–15). Based on stylistic premises, this complex can be dated to the last third of the 15th to the beginning of the 16th century (Burrows, Gaimster 2000, 281). The vast majority of these mould fragments were found in the fill of a sunken barrel that drained the cellar of the tenement house, and some of them were reused in laying its floor. No other indications of the existence of a pottery workshop was recorded on this plot, such as remains of a kiln or production waste. The location of the workshop where

9 In the late medieval Baltic towns there was no division into potters and stove makers (Bogucka 1962, 157, further literature there). Also in the early modern period, the production of tiles and the construction of stoves were still the responsibility of potters (Majewski 2015, 63 ff., further literature there).

these items had been used is therefore unknown. Nevertheless, they confirm the production of richly decorated plate tiles in fifteenth-century Rostock.

Without a doubt, pottery was an important branch of crafts in the towns of the southern Baltic coast, meeting the basic needs related to the everyday equipment of households, as well as producing ceramic items used in other areas of professional activity, including for fishing and textile production. As indicated by the discoveries in Elbląg at Sukiennicza Street (see Fig. 4) and Neubrandenburg at Treptower Straße (see Fig. 6), pottery workshops were characterized by a large area enabling the installation of the necessary production equipment – kilns, pits for processing clay, as well as fuel stores located in the yards. An integral part of these premises were buildings in which pottery was probably made and storage rooms were located. In a thirteenth-century workshop in Elbląg, such a building was erected in the front part of the plot, right next to the residential house. In turn, in the fourteenth-century workshop from Neubrandenburg, it was located in the yard. This varied location could be the result not only of individual needs, but also of changes taking place over time in the patterns of usage of town plots, related to the development of the front part of the lots, on which later buildings were usually erected covering the entire width of the property.

The pottery kilns discovered in the towns discussed here are two-chamber devices in which a controlled process of firing vessels could be carried out at temperatures up to 900°C (see Buchin, Erdmann 1986, 60; Marcinkowski 2003a, 215). Most of them were built of clay. The exception is the mid-fifteenth-century Stralsund kiln built of bricks – the difference in the building material used probably results from its later chronology (Hoffmann, Schäfer 2005, 263). Individual kilns had different capacities, which determined the number of pots fired at one time, which, to some extent, is a measure of the production volume. Unfortunately, the small amount of such data prevents a broader analysis of this issue. It can only be said that in late medieval Baltic urban centres, pottery workshops had diverse production capabilities. They were probably dependent on the economic situation of their owners, the nature of their business and the ability to sell goods.

3. 2. Blacksmithing

Medieval written sources differentiate the craftsmen involved in making various items from iron. They write of a category of blacksmiths being engaged in heavy work, producing 'large' iron equipment and another of small blacksmiths producing 'small' metal products. Then there were more specialised craftsmen: locksmiths,

knife makers, sword makers, needle-makers, nail-makers, shoesmiths, armourers, as well as the producers of anchors (see, for example, Hirsch 1858, 324; Stieda, Mettig 1896, 35, 40; Bogucka 1962, 107; Kattinger 2000a, 88). Not all of the above-mentioned craftsmen worked at the same time in every centre. The number of specializations depended on the size of each town (Mulsow 2005b, 301). In the excavated material from investigations in these centres, the blacksmith's work is very well evidenced by assemblages of iron products, rich in number and range, including many items used in almost all areas of everyday life.[10] Apart from the finds of finished products, archaeological research has also resulted in recovery of other material that is evidence of blacksmithing, which include primarily production waste as well as relics of devices and equipment used in the forge.

Extremely interesting data on the blacksmith's craft were obtained during excavations in the Port Suburb (Hafenvorstadt) in Stralsund (Kulessa 2000; 2003; 2004). This region was already inhabited in the 13th century by blacksmiths, including anchor producers, who are mentioned in written records (Kulessa 2003, 30 ff., further literature there). During excavations on the properties on Wasserstraße, remains of several workshops were identified. One of them was located in a wooden building occupying the front part of the plot at Wasserstraße 52–53 that had been erected in the 13th century. In its eastern part, divided by several wooden walls, five hearths made of flat bricks were recorded, and in the western part there are remains of a massive and high brick-built hearth with a quadrilateral plan (3.20 × 3.60 m). Two posts were incorporated into the face of the wall on the south, and these had probably supported the bellows. On the northern side of the hearth there was a massive log dug into the ground, interpreted as the base of an anvil (Kulessa 2004, 131, Figs. 3, 4). Located on the street side, the western room was separated from the wooden part of the building by a brick wall. It could have taken the form of a roofed hall open on one side (Kulessa 2004, 131 ff.).

In the second half of the 14th century, in place of the wooden building, a brick tenement house was built, 16.5 m long and approx. 10 m wide. Its ground floor was divided into two parts by a wooden wall. A little later, another partition wall, this time a transverse one, was built. As a result of these divisions, four rooms were created, each of which had a separate entrance, located on the gable sides (Fig. 8). One of the rooms (south-eastern) on the side of the yard had a partial brick floor,

10 See studies of iron products from Schleswig (Saggau 2000), Lübeck (Gläser 1989c; Müller Uwe 1996), Rostock (Ansorge 2012), Greifswald (Schäfer, Brandt 1996; Schäfer C. 1997a; Schäfer H. 1997d), Kołobrzeg (Polak 1996a; 1997a; 1998a, 1999a; Polak et al. 2010; Janowski 2016a), Stargard (Janowski 2012; 2017a), Puck (Miścicki 2017a) and Gdańsk (Trawicka 2003; 2004; 2007; 2010; 2020; Miścicki 2022a).

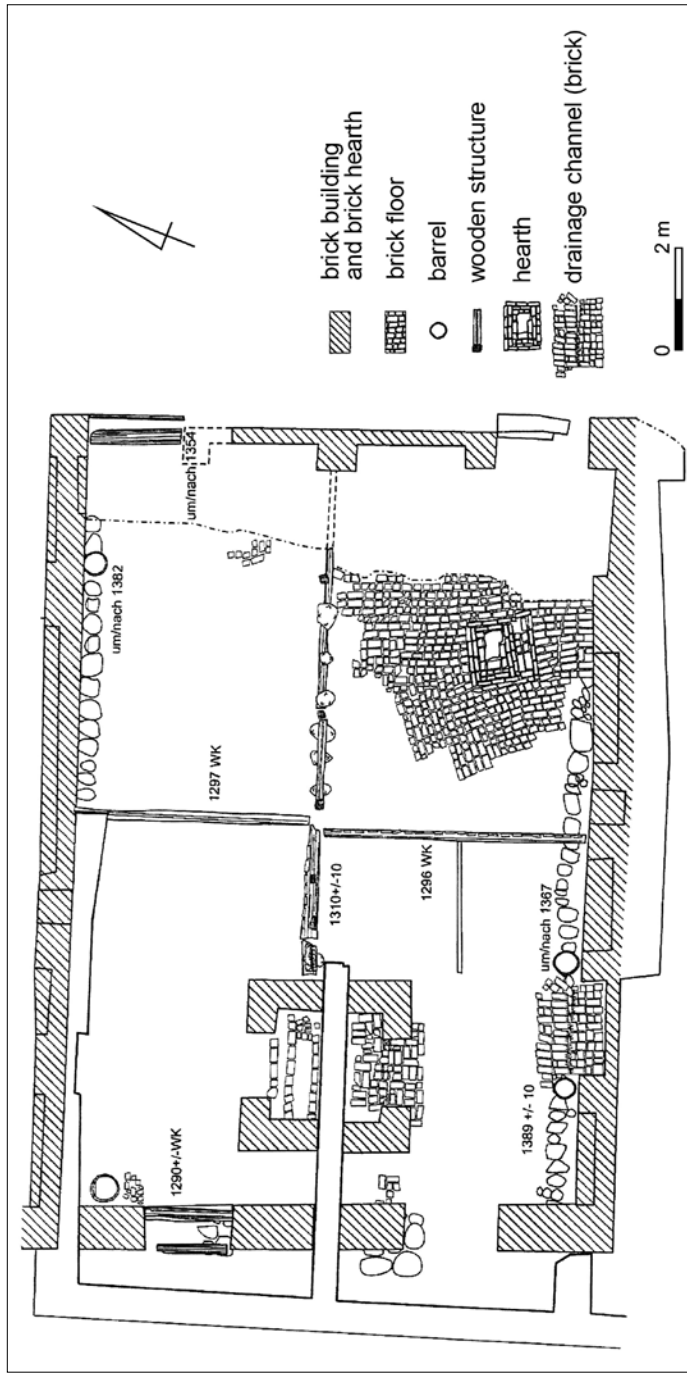

Fig. 8. Stralsund, Wasserstraße 52/53. Remains of a forge from the 14th century (after Kulessa 2004, Fig. 7)

on which a flat, four-sided hearth made of the same material was installed. In the front part of the tenement house, directly connected to the street, there was a division wall splitting this portion into two separate rooms. There was a high smithy hearth made of bricks straddling this wall, allowing it to be used simultaneously in both rooms. This hearth had two wide holes placed in opposite walls (northern and southern). On both sides of the hearth foundation there were recesses which, when discovered, were filled with slag (Kulessa 2004, 135). The layout of the ground floor of the front part of the tenement house indicates that there were two separate workshops here. In one of them (southern), opposite the hearth, right next to the wall of the building, two barrels were installed and between them a wide gutter made of bricks laid flat. A gutter sloped down on both sides towards the barrels. Relatively large pieces of iron could be placed in it to cool after thermal treatment, then poured with water that flowed into the barrels (Kulessa 2004, 135). On the premises of both forges, huge amounts of slag and coal were recorded, as well as many iron objects – nails, rivets and boat clasps. Some of the rivets and clasps did not show any traces of use (Kulessa 2000, Figs. 2.4–5; 2004, 132). These finds indicate that small elements of boatbuilding equipment and most likely metal parts of anchors were made here (Kulessa 2000, 185 ff.; 2004, 138).

On the two neighbouring plots of Wasserstraße 55 and 56, located a little further north, there were further forges, where items for shipbuilding were also produced. They were located in brick tenement houses built in the 15th century. In the ground floor of the buildings, located on the street side, on both sides of the dividing wall, remains of brick walls were discovered, which were parts of the same high hearth. Probably the smoke from both parts of the hearth could have been discharged through a common chimney. In addition to the devices described, in both workshops there were flat brick hearths placed on the dirt floors, and also barrels buried in the ground (Kulessa 2004, 136 ff., Fig. 9), as well as numerous pieces of iron slag and pieces of coal. There was probably also a warehouse for this raw material in the forge at Wasserstraße 56, as evidenced by the large accumulation in this place of coal fragments.[11] The coal found in the workshops on Wasserstraße most likely came from northern England. It was a raw material of poor quality, with a high content of gases, which also emitted poisonous smoke when burned. However, its use with appropriate ventilation ensured that high temperatures could be achieved and maintained (Kulessa 2004, 132 ff.).

11 The connection between this stored coal and the smithy is further indicated by the presence of numerous iron particles in the cracks on the lumps of coal (see Kulessa 2004, 137).

The Stralsund forges are the few workshops for which it was possible to reconstruct the equipment and almost exactly determine the assortment of items made in them. The analysis of production sites does not always allow us to specify the specializations of the craftsmen associated with them or the leading set of manufactured products. Sometimes, based on indirect evidence, the nature of the business can only be suggested. This is the case of one of the Rostock forges, uncovered on a corner plot at Wollenweberstraße 33 (Mulsow 2008). The blacksmith's workshop was located in the basement of a brick building, measuring 16 × 8 m, to which there were three entrances. Two of them, located in the longer wall, led directly to the street. In the north-west corner of the basement, there was a four-sided (1.50 × 1.30 m) hearth made of bricks laid flat. This device was used for a long time, as evidenced by traces of its expansion. It was slightly extended towards the east, and another slab was added on the south side. It had an elongated outline (dimensions 3.0 × 0.9 m) and partially overlapped the older hearth. Its surface was formed in a trough shape. There were eight round pits (35–55 cm in diameter) around the hearth, most of which were created in the earlier phase of its use. They were filled with charcoal, slag and burnt and crushed clay (Mulsow 2008, 95–97, Figs. 4; 5). In the middle part of the cellar there were two more hearths. Unfortunately, they were largely destroyed by later features, which makes it difficult to reconstruct their original dimensions. The hearth base showed traces of fire and very high temperatures, and around them there were small, round pits into which production waste was discarded (Mulsow 2008, 97).

The forge was connected to a small above-ground building located on the eastern side of the tenement house. Within it, the remains of two brick pillars were uncovered, set on a stone foundation reaching into a wide (2.20 m) recess located in the partition wall between both buildings (Mulsow 2008, 99–100, Figs. 3; 6). The remains of a brick-built hearth were recorded between the pillars. These features are interpreted as the remains of a forge with a chimney (Mulsow 2008, 100). Just as in the basement of the corner building, there were waste pits here too. Within both rooms, over 100 kg of slag and several pieces of coal were found.

Unfortunately, it is difficult to indicate the products of this forge. This was probably the workshop of so-called 'small-work blacksmiths' of the written sources, as evidenced by the medieval name of the street, Kleinschmiedestraße (now called Sackpfeife) (Münch, Mulsow 2010, 73 ff.). Four cylindrical padlocks were discovered in the workshop in question. Although they differ in dimensions, they all have identically formed keyholes and a similar finish, which may suggest that they were made by the same craftsman (Mulsow 2008, 102 f., Fig. 10). The production of padlocks also seems to be confirmed by the finds of pieces of iron sheets. Moreover, the

excavated material included numerous nails, shipbuilding clasps and fragments of unspecified destroyed iron objects. These finds should rather be considered scrap collected for the purpose of reforging, although this does not exclude the possibility that, in addition to padlocks, small iron items (e.g., nails, household items) were made here.

The buildings occupied by the forge were built in the second quarter of the 14th century. They mark a later phase of use of the workshop, which existed here already in the second half of the 13th century. This is evidenced by the numerous pieces of slag found in latrines and pits excavated in the yard dating to that period (Mulsow 2008, 92 ff). At that time, the forge was probably also located in the front part of the property. However, the older buildings located here were almost completely destroyed during work related to the construction of later brick buildings. The workshop at Wollenweberstraße 33 operated for several hundred years, until the end of the 17th century (Mulsow 2008, 105).

Another Rostock forge, probably occupied by a 'small-work blacksmith was located on the property at the current Fischbank 9 (Mulsow 2000a, 207, 217; 2005b, 305). In the yard of the plot, a layer of clay was exposed, the upper part of which was covered with numerous charcoal fragments. However, it is not known whether they mark the working surface of the forge or are the remains of a fire. However, it is striking that numerous iron objects were found in this layer in several clusters. Six forged bars were discovered here (most likely door hinge blanks), as well as over 150 nails, including 130 unfinished pieces (Mulsow 2005b, 305, Fig. 8). The remaining nails were bent and broken. They can therefore be considered as accumulated scrap intended for reforging (Mulsow 2005b, 305). Among the artefacts found were, for example, spade fittings, knives, a horseshoe, a hinge, candle-holders and single bars of grates as well as woodworking tools (a carpenter's hammer, spoon drill and axe). It is difficult to clearly determine whether these are finished products or items intended for reforging. However, it is highly probable that nails, home furnishing items and tools were produced in this workshop (see Mulsow 2000a, 207; 2005b, 305). The period of its activity fell in the second half of the 13th century. Unfortunately, no remains of the hearth of the forge were recorded in the excavated section of the back of the Fischbank 9 property. It is possible that this had been sited in the part of the yard not covered by the research or in the front part of the property.[12]

12 The archaeological excavation covered only a small part of the yard, with an area of only 20 m² (see Mulsow 2005b. 305).

The operation of a blacksmith's forge in Greifswald is evidenced primarily by numerous finds of slag. A dumping site for production waste that was deposited at the end of the 13th or the beginning of the 14th centuries was discovered in the quarter located on the southern section of Lappstraße. A large amount (nearly two tonnes) of slag was extracted from several pits, including small pieces of coal. This waste could have come from a blacksmith's workshop (or workshops) located somewhere nearby (Schäfer H. 2000a, 63; 2006, 353, Fig. 1).

Remains of a forge from the second half of the 13th century were discovered in the yard of the plot at Nr 26a Steinbecker Straße. It was located in a small building with a post-built structure, with internal dimensions of 5 × 5 m (Schäfer H. 1997a, Fig. 7; 2000a, 63; 2006, 351 ff.). Inside there was a layer of charcoal, in which 200 pieces of iron slag were found (Schäfer H. 2004d; 2006, 350). This building was probably used bya 'small-work blacksmith.' Confirming this assumption is the fact that the quarter in which the described workshop was located was bordered on the south by the medieval Kleinschmiedestraße (Schäfer H. 2006, 350 f.).[13] In the same building block, on the property Lange Straße 72 located on the medieval Kleinschmiedestraße, another thirteenth-century workshop was identified (Schäfer H. 2006, 351, further literature there). The remains of blacksmith's workshops were also recorded in the quarter located on the eastern side of the market square and on the plot at the corner of Brüggstraße and Mühlenstraße (Schäfer H. 2000a, 64; 2006, 351).

The Greifswald forges discussed above were located among dense buildings. The workshop operating near the Mill Gate (Mühlentor) identified on the Schuhhagen 1 property (Schäfer C. 1997a) was distinguished by a different location. There was a small wooden building associated with this workshop, in which there was a clay hearth. Within it, 38 large pieces of slag and a chisel were found (Schäfer C. 1997a, 50, Fig. 42h). However, over 3,000 pieces of slag were recovered from the layers around the building and from nearby features (Schäfer C. 1997a, tab 6). This complex is dated to the period between 1278 and 1290 (Schäfer C. 1997a, 54). The collected material does not allow a clear definition of the assortment of products manufactured in this workshop, though its location may suggest that this activity was subordinated to servicing transit traffic.

One of the Kołobrzeg forges was situated in a similar location. It was on the ground floor of a tenement house at the corner of Budowlana and Rzeczna Streets.

13 The medieval Kleinschmiedstraße coincided with the eastern section of the current Lange Straße, reaching the market square, stretching between Fischbecker Straße and Steinbecker Straße (see Kattinger 2000a, 88).

This workshop was founded in the 15th century and operated well into the next century. During such a long period of operation, the hearths used in the atelier were worn out. They were successively renovated or new ones were built in their place. During the research, the remains of as many as fourteen hearths were recorded, built of bricks laid on a patch of clay, sometimes on a sand bed (Wywrot-Wyszkowska, Polak, in press). They had quadrilateral plans and varied sizes. The largest of these hearths was 1.80 × 1.40 m. This structure had a clearly separated kerb and the hearth base was recessed below its edge. Around the hearths there were layers of sand mixed with clay, with a significant admixture of charcoal in their upper parts.

The forge was also equipped with barrels installed a short distance from the hearths. The free space between the barrels and the hearths was partially paved with a brick floor (Fig. 9). Unfortunately, no tools were found in the workshop, only a few pieces of slag. It should be assumed that production waste was intentionally removed from it.[14] The siting of the workshop on the street leading from the Mill Gate to the city centre may indicate that the blacksmiths associated with it produced horseshoes and provided other services connected with transport, which of course does not exclude the production of items used in other spheres of everyday life.

Another blacksmith's workshop was discovered on the plot of Nr 16–17 Narutowicza Street, located near the medieval fish market. The workshop's activity took place in the second half of the 14th and 15th centuries. It was equipped with two fireplaces located in an open space. One of them was characterized by an exceptionally solid construction. It was placed on a wooden platform. Its construction was made of bricks laid on a sand bed. The hearth was in use for a very long time, as evidenced by traces of repeated repairs and reconstruction involving the installation of a new hearth base. This feature was also distinguished by its exceptionally large size. Its length was 2.5 m and its width was 1.5 m. Around the hearths there were layers of compacted sand and clay, saturated with charcoal fragments, and the upper surface was heavily baked and burnt orange (Dworaczyk, Wywrot-Wyszkowska 2016, 499 ff.). The workshop in question was connected with a brick structure sunk into the ground (dimensions: 4.30 × 2.80–3.10 m), which was most likely the cellar of the frame-built house on the front of the plot (Polak 2016, 25 ff.). The entrance to this cellar was from the side of the hearths and led through a corridor extending outside. A water channel led into the cellar and at its outlet

14 This would be supported by orders issued by the Kołobrzeg Council regarding maintaining order in the city, including obliging blacksmiths to take their waste outside the city ramparts. It was to be left near the chapel of St James (Riemann 1924, 48).

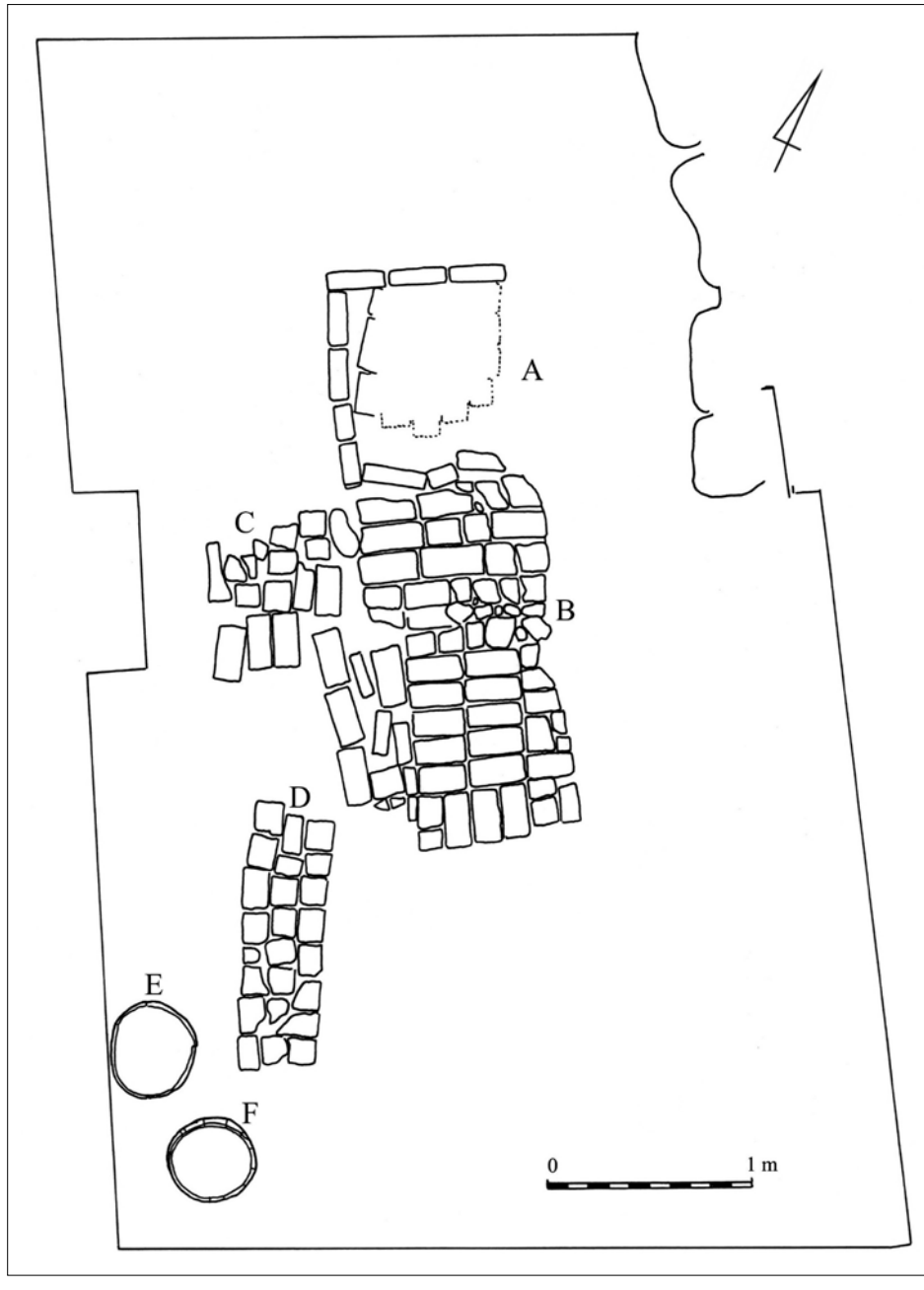

Fig. 9. Kołobrzeg, Budowlana/Rzeczna Streets. Plan of features in the blacksmith's workshop. A–B – hearths, C–D – brick floor, E–F – barrels (after Wywrot-Wyszkowska 2017, Fig. 4)

a water tank was installed. Continuing the line of the water supply canal, there was a wooden platform made of barrel elements (staves and bottoms), leading towards the exit. In the corner of the basement, right next to its exit, there was a barrel dug into the ground (Fig. 10).

No tools or production waste were found in the workshop. Most likely, waste, including slag, was systematically removed from it, which would be supported by the above-mentioned orders of the Kołobrzeg Council regarding maintaining order in the city. The premise confirming the existence of a blacksmith's workshop on the plot of Nr 16–17 Narutowicza Street is information in written records referring to a Benedictine monastery which was built in the same quarter. Particularly interesting is the mention that the monastery buildings were located near the plots of two blacksmiths (Wachsen 1767, 499, 505 ff.).

In Stargard, traces of blacksmith production, perhaps marking the location of a forge, were found in the north-eastern part of the city, between Szewska, Włosiennicza and Cyrulików streets (Rogosz 1980). During archaeological supervision during redevelopment carried out there, observations included a construction excavation located in the north-western part of the quarter, where objects confirming iron processing were recorded. They were located in one layer and included a knife, a fragment of a sickle, a nail, an iron bar (semi-finished product?), a punch and slag (Rogosz 1980, 171, 187, tab. 8.1; tab. 8.I:5–9). Based on the analysis of ceramic material, these finds are dated to the first half of the 14th century (Rogosz 1980, 190).

In Elbląg too, archaeological sources confirm the activity of blacksmiths. Numerous groups of metal products and production waste were found at various places in the Old Town. During excavations carried out in Kowalska [Blacksmith] Street, in deposits from the end of the 13th century, a relatively high number of pieces of iron slag were discovered (Nawrolscy 1985, 400). It is believed that in the 13th century blacksmiths may indeed have lived and worked in the area of Kowalska Street (Czaja 1992a, 96).

In the oldest period of the functioning of the chartered city of Riga, iron processing took place in its north-western region. During excavations in the cemetery near the cathedral, a significant concentration of pieces of slag, accompanied by huge amounts of charcoal, was recorded. In total, over 500 slag fragments were collected, weighing approximately 170 kg (Caune, Ose 2006, 466, further literature there). This waste was probably removed from nearby forges. They may have been located somewhere near the research site on Rozena Street, which in the 13th–14th centuries was called Schmiedestraße (Caune, Ose 2006, 466, further literature there).

A significant concentration of slag (over two tonnes) was recorded during excavations in Tartu, at Lossi Street (Metsallik 1995). In the Middle Ages, this street

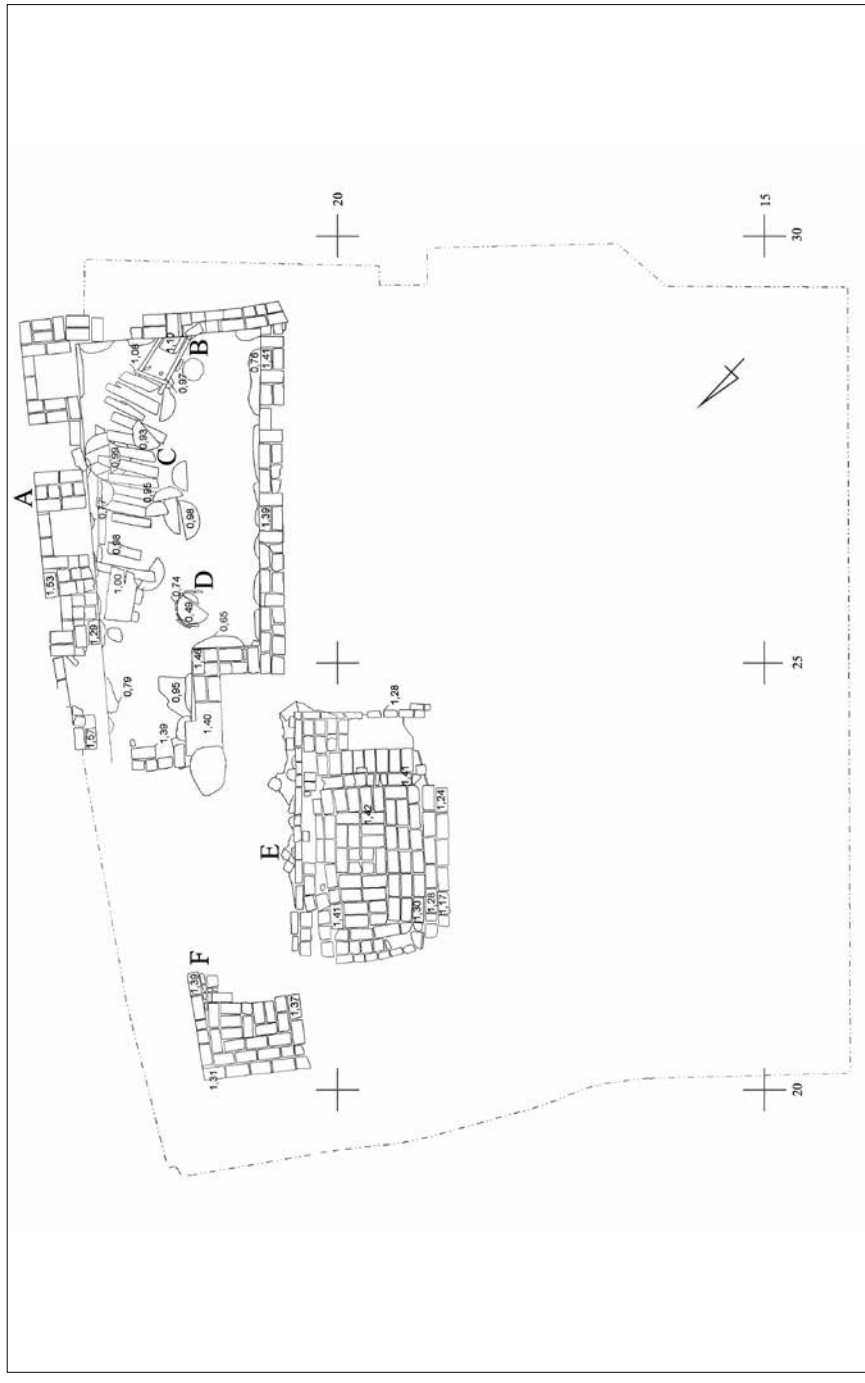

Fig. 10. Kołobrzeg. Nrs 16–17 Narutowicza Street. Plan of features in the blacksmith workshop. A – brick cellar wall, B – water supply canal and water tank, C – wooden paving, D – barrel, E–F – hearths (after Wywrot-Wyszkowska 2017, Fig. 6)

was called Schmiedestraße (Peets 2003, 180). In the examined quarter, the lower parts of three wooden buildings with clay floors, interpreted as forges, were uncovered. There were hearths within and near the buildings, including an iron smelting furnace made of stones and pieces of bricks. In addition, several large stones were discovered that were believed to be anvils. Unfortunately, no iron-working tools were found. The remains of this workshop and accompanying equipment date back to the 13th–15th centuries (Metsallik 1995, 28 ff.; see also Peets 2003, 180 ff.). The nature of the finds does not allow for a precise definition of the assortment of products produced in these forges. In turn, city records from the mid-16th century mention locksmiths, swordsmiths and a knife maker operating in the area (see Mäesalu 2006, 473 ff., there further literature).

The location of the discovered forges in the urban space and the equipment, production waste, semi-finished products and finished products recorded within them indicate that they could have been the workplace of such craftsmen as heavy-duty blacksmiths (including shoesmiths), 'small-scale blacksmiths' (including locksmiths and nailers) and producers of anchors and other elements of boatbuilding equipment. Archaeological sources also confirm the activity of knife-producers. In the course of research to date, numerous assemblages of knives distinguished by high quality workmanship have been obtained.[15] They include both universal-purpose pieces and those used for more specialized activities (e.g. wood and leather processing), as well as combat knives. The Lübeck discoveries are very interesting in this context. On a plot of land at the corner of Schmiedestraße and Kohlmarkt, a latrine was uncovered, from which eight wooden handles of kidney puginals were recovered. What is particularly interesting is that these were defective products (Mührenberg 2002b, 21, Fig. 1). These finds prove the local production of puginals. It is highly probable that this activity could have been limited only to the final stage of production, that is the final finishing of the blade and the manufacture and assembly of the handle. This would be supported by the mention of trade in puginal blades manufactured in Nuremberg and Solingen, which were sold in their raw state, among other places, to Hamburg and Lübeck (see Rech 1993, 76, further literature there). Based on the relatively numerous finds of kidney puginals and their wooden handles from Rostock (Kleibscheidel 1999, 385, Fig. 6:3; Schäfer 2004e, 608, Fig. 89:3), Stralsund (Brüggemann 2013, 568, Fig. 275:2–4) and Greifswald (Ansorge

15 See, for example, studies on finds of knives from Kołobrzeg (Polak 1996a, 234–235; 1997a, 175; 1998a, 212–213; 1999a, 222–224; Janowski 2016a, 66–67), Stargard (Janowski 2012, 161 ff.; 2017a, 134–135), Puck (Michalik 2007; Miścicki 2017a, 211–212) and Gdańsk (Trawicka 2010; Jędrzejczak-Szkutnik 2020).

et al. 2003, 132, Fig. 11:4, 7; Kaute, Schindler 2004, 589, Fig. 78:2; 2006, 201, Fig. 7), it can be assumed that similar activity took place in these towns as well.

It is generally assumed that the basic set of blacksmith tools consisted of various types of hammers, chisels, tongs, punches and files (Mulsow 2005b, 305, further literature there). Such items are very rarely recorded in the excavated material. A chisel was found in the workshop at Schuhhagen 1 in Greifswald. Hammers, chisels and punches are known from Schleswig (Saggau 2000, 66 ff., Figs. 45:11; 46; 48: 3–7) and Gdańsk (Trawicka 2004; 2010, 98, Fig. 3:1820; Paner 2006b, 430 n. Fig. 11). Blacksmith's tongs were discovered in Lübeck (Stephan 1978, 79, Fig. 23:2). In Kołobrzeg, a small anvil and a fragment of an iron shovel for manipulating hot coals in the forge were found (Polak 1998a, 217, tab. 108: 1; 109:7).

The blacksmith's workshops presented above were characterized by a similar layout and equipment. They were most often located on the ground floors of front buildings, initially wooden (but later, with the spread of brick buildings, in brick buildings). They were equipped with flat hearths made of bricks or, less often, clay. The presence of high forges equipped with chimneys was found only in the Strasund smithies at Wasserstraße and in the Rostock workshop on the property at Wollenweberstraße 33. The hearths were usually located in closed rooms. However, in the Kołobrzeg forge discovered on the plot of Nr 16–17 Narutowicza Street, they were located in the open. It is possible that hearths were arranged in a similar way in the workshop at Steinbecker Straße 26a in Greifswald, as no traces of such devices were recorded in the wooden building associated with it. A similar situation could also have occurred in the case of the Rostock workshop on plot Fischbank 9, where traces of production were identified in the yard. Several workshops have preserved devices used to cool the items being worked on after heat treatment. Barrels sunk into the ground or sometimes more complex devices consisting of a brick gutter and barrels were used for this purpose. It is worth emphasizing the presence of a water supply connection in the Kołobrzeg atelier at Nr 16–17 Narutowicza Street. This is, so far, the only forge known to the writer that was connected to the municipal water supply.

A separate issue related to blacksmithing is the source of the raw materials. Iron could have been smelted from local bog ores; the processing of such raw material seems to be confirmed by archaeological sources obtained in Riga (see Caune, Ose 2006, 465). However, it is not known whether ore from local deposits was also used in other urban centres and on what scale. It should be noted that bog or swamp ores produced only low-grade iron (see, for example, Gan 2016, 86). The material analysis of metal products from Kołobrzeg – although a small collection – indicated that these items had been made of iron with a low phosphorus content,

typical of mined mineral ores. The blacksmiths of Kołobrzeg must therefore have had access to such raw material (Gan 2016, 86). Research on artefacts from Puck also confirms the use by local craftsmen of high-quality iron obtained from mined mineral ores (Garbacz-Klempka et al. 2017, 239 ff.).

The cited findings, as well as the information imparted by the written sources, indicate that the demand for iron in late medieval Baltic coastal towns had to be met primarily by import. It was brought to the areas located in the western part of the southern Baltic Sea from the mountainous areas of southern Germany and from Sweden (Mulsow 2005b, 301, further literature there). We are informed about the import of this raw material from Sweden by records from the 15th and early 16th centuries from Gdańsk (Bogucka 1962, 103) and Kołobrzeg (Lesiński 1960, 28). In the 15th century, there were workshops near Gdańsk where Swedish osmund (i.e., raw iron) was forged into bars, which were an important export product (Bogucka 1962, 103). The raw material used by the blacksmiths in Puck most likely came from Sweden (Garbacz-Klempka et al. 2017, 248).

Iron could have reached the Baltic coastal towns in the form of processed bars (see for example Mulsow 2005b, 301; Röber 2008, 114 ff.). The excavations in Schleswig recorded the presence of bars intended for further processing (Saggau 2000, 67, Figs. 1–8). During research on Granary Island in Gdańsk, 14 unprocessed flat bars were found (Trawicka 2010, 126). Some of the material, especially that used for the production of puginals and knives, was imported in the form of semi-finished products, i.e., in the form of the raw blades (Rech 1993, 76; Röber 2008, 115). The secondary use of iron products was also important, as evidenced by the accumulation of used nails and other objects recorded in the Rostock forge at Fischbank 9 (see Mulsow 2005b, 305). The use of iron scrap is also confirmed in Kołobrzeg (Polak 1998a, 217).

A supply of fuel material of appropriate quality played an important role in the work of a blacksmith. Charcoal was the fuel that was generally used, enabling the smith to obtain and maintain appropriately high temperatures easily. Already in the 13th century, coal was imported from northern England to some towns located in the western part of the region discussed here (Rostock, Stralsund and Greifswald). A particularly high concentration of such fuel material was found in the Stralsund workshops located in the Port Suburb.

3. 3. Bronze Foundry

The casting of copper and its bronze alloy was a significant branch of craft production in the late medieval urban centres of the southern Baltic coast. The dynamic

development of bronze-founding was caused by the growing demand for various items, on the one hand, related to the furnishing of sacred buildings (for example bells for churches or chapels), and, on the other, to various items for the furnishing of households and craft workshops (Müller 2005a, 88). In the Baltic towns, a particularly important aspect of bronze foundry was the creation of three-legged cauldrons (grapens). Due to the ability to be hung or placed over an open fire, these vessels played an important role not only in households, but also in crafts. Only the abandonment of the use of open hearths in homes in the modern period resulted in the collapse of mass production of three-legged cauldrons (Rütz 2005, 295). Apart from these cauldrons, medieval craftsmen also cast many other objects, including mortars, buckets, jugs, candlesticks, censers, baking moulds, etc. (Rütz 2005, 295; Majewski 2013, 57).

Finds related to bronze founding mainly consist of production waste in the form of broken foundry moulds.[16] Waste resulting from the production of three-legged cauldrons was discovered in Neubrandenburg (Kaute 2006) and Pasewalk (Hoffmann V. 2006). Numerous clusters of such material have also been recorded during research in Stralsund. On the Lobshagen 8 plot, remains of a wooden building were discovered, from the backfill of which 1,395 fragments of foundry moulds were excavated (Kaute Schäfer 2000, 198, Figs. 3; 6a–m). Another assemblage of such waste (70 items) was discovered at the southern end of the same street (see Kaute, Schäfer 2000, 201 Figs. 2; 6n–p). Also on the plot at Mühlenstraße 22, a quite large group of fragments of clay foundry moulds (521 items) related to tripod cauldon production was recorded (Samariter 2000, 243 f., Fig. 3). Similar waste was discovered in a fifteenth-century levelling layer on the Katharinenberg 36 plot, located in the southwestern part of the city, right next to the city wall (see Ansorge 2005a, 127 f., Fig. 3). This collection included two examples with marks. One of them bears an arrow, which is the coat of arms of Stralsund, and the other bears a hook-like maker's mark (Fig. 11:1–2).

The above-mentioned Stralsund finds of fragments of foundry moulds should in most cases be interpreted not as the remains of foundry workshops *in situ*, but, as indicated by the context of their discovery, rather as the places where production waste was dumped. This material was exposed in the backfill layers located

16 Clay moulds were prepared separately for each casting of individual objects. After the cast had cooled, they were broken up and thrown away. Therefore, huge amounts of such waste were created in workshops where bronze objects were being cast. Due to their volume, they had to be at least partially removed from the working area. The material was dumped in various parts of the urban centres, and it is possible that the fragments of waste were transported beyond their borders (for more on this topic, see Rütz 2005, 296).

within various plots and even in the street. Moreover, these artefacts were not accompanied by other traces of bell-founding production, such as remains of hearths or furnaces for melting metal, foundry pits, or characteristic 'nest-like' clusters of fragments of clay moulds discovered *in situ*, indicating the places where vessels were cast.[17] The workshops from which this waste came must have been located in other places. It is worth noting that the concentrations of production waste were concentrated in the southwestern and western parts of the city (see Möller 2006, Fig. 1), where the workshops of the 'grapengiser' (tripod cauldron casters) attested in written sources were located (Möller 2006, 248, Fig. 7). It is a possibility that should for now be treated with great caution that the broken casting moulds discovered on the plot at Lobshagen 8, within the wooden, thirteenth-century front building, were related to a workshop operating there. However, the small scope of excavations makes it impossible to clearly resolve this issue.[18]

Archaeological research has resulted in the discovery of the remains of various features relating to bronze casting, accompanied by finds of raw materials and production waste, as well as fragments of damaged products. They should undoubtedly be considered the remains of workshops where vessels and other bronze objects were cast. In the area we are interested in, traces of the oldest – so far – workshop have been identified in Lübeck. On the property at Breite Straße 26, relics of a bell-founding workshop operating in the first half of the 13th century were discovered (Gläser 1989b; Drescher 2017). The production equipment was located just behind the front building (Fig. 12). They included two ovens for drying clay moulds. From the older structure, of which only a small part was exposed, two walls have been preserved, 50 cm apart, made of bricks, on a bed of burnt clay, which was also the concave floor of the oven (Fig. 13:2). Next to it was a pit most likely used to store clay used for the production of foundry moulds (Gläser 1989b, 292). The later oven had a circular outline (1.9 m in diameter) and bricks were also used for its construction. A metal melting furnace was also associated with the later phase of the workshop's activity. It had dimensions of 2.4 × 2.0 m, and its walls have survived to a height of approximately 1 m (Fig. 13:1). On the eastern side of the furnace, the remains of the posts surrounding it were recorded. They could have been elements of the scaffolding on which the bellows were installed. A trough made of planks filled with

17 Such casting pits with remains of clay moulds were recorded in bronze-founding workshops discovered in Rostock (Mulsow 2000b) and Stargard (Majewski 2013). See below.

18 Excavations on this plot were limited to a small trial pit, with an area of only a few square metres, in the front part of the plot (Kaute, Schäfer 2000, 152, Figs. 2–3). It is possible that other features related to this workshop could have been located outside the area covered by the excavation.

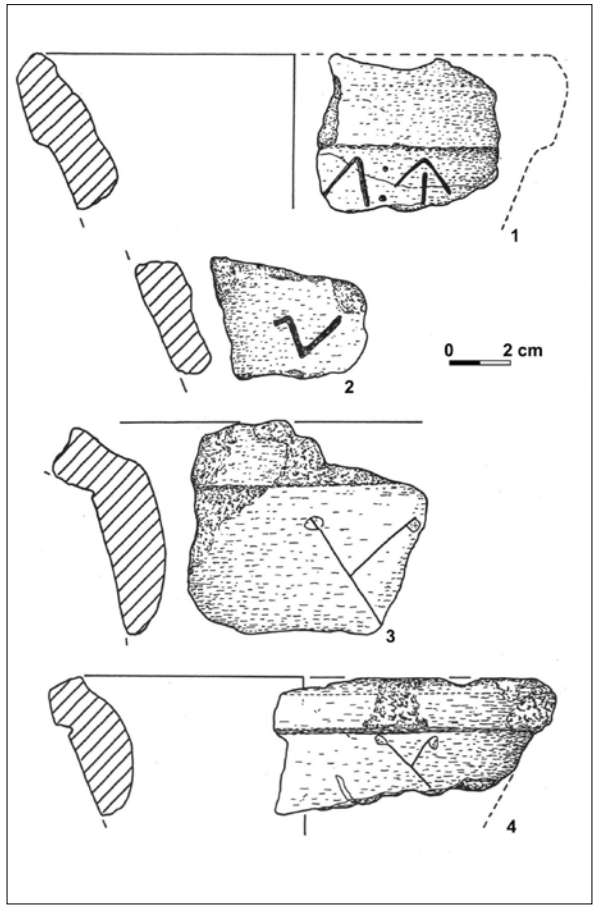

Fig. 11. Fragments of casting moulds with marks. 1–2 – Stralsund, Katharinenberg 36 (after Ansorge 2005a, Fig. 11), 3–4 – Anklam (after Hohe, Fries 2004, Fig. 66)

clean, yellow clay and a water barrel were also recorded in the workshop (Gläser 1989b, 292 f., Fig. 2.1, Beilage 8; Mührenberg 2000, 227 f.; Drescher 2017, 15 f., 137).

The finds made within the workshop included numerous fragments of foundry moulds, pieces of slag, as well as semi-finished products (for example cast bronze buckles and belt fittings), pieces of semi-raw material in the form of small copper ingots, pieces of wire and copper sheets, lead bars and fragments of damaged objects (Drescher 2017, 20 ff.). This workshop had clearly produced mainly three-legged cauldrons. The number of fragments of foundry moulds excavated there could have been the result of the production of at least 300 such vessels. Fragments of moulds used to cast a candlestick and a censer, as well as a small bell, were also identified (Drescher 2017, 54). In addition, bronze buckles and belt fittings were cast here. However, also processed here was copper sheet, used to make rivets, various decorations, and possibly cauldrons (Drescher 2017, 54). Iron items were also produced on a small scale, including the pins for buckles and probably the handles for cauldrons (Drescher 2017, 54, 138 ff.).

The atelier on the plot at Breite Straße 26 was far north of the city centre. It was located in a marshy area with deposits of clay used by local potters and probably bronze-founders (Gläser 1989b, 298). Also on the neighbouring plots at Breite

Straße 24 and 28, as well as a property located slightly further away (at Breite Straße 20), traces of foundry activities in the form of pieces of slag, fragments of clay moulds and layers of ash were identified (Gläser, Mührenberg 1998, 229). Moreover, in the area of Großen Gröpelgrube, numerous pieces of slag and fragments of clay moulds, as well as the remains of a furnace, were recorded, proving the existence of a foundry workshop there too (Gläser, Mührenberg 1998, 229).

The remains of two foundry workshops were discovered in Rostock in the block between Alter Markt, Amberg, Wollenweberstraße and Sackpfeife. One of them was located on the corner plot of Wollenweberstraße/Amberg, where a significant concentration (approx. 225 items) was noted of various types of bronze: pieces of sheet metal, rivets, broken off cauldron legs, damaged applications, handles, etc., which can be considered as scrap accumulated for remelting (Mulsow 2006, 295, Fig. 11). These finds were accompanied by lumps of bronze slag (Mulsow 2000a, 216). Additionally, a waste pit was discovered filled with fragments (1,225 pieces) of foundry moulds created during the production of cast cauldrons.[19] The obtained material proves the existence of a workshop on this property specializing in the casting of bronze cauldrons. There was also a bell casting site on its premises, built of bricks and equipped with a casting pit. As indicated by the dimensions of this feature, the bell cast in the workshop could have had a diameter of about 1 m (Mulsow 2000a, 216, Fig. 5; 2006, 295, Fig. 12). The period of activity of the workshop at Wollenweberstraße/Amberg was the second half of the 13th century (Mulsow 2006, 295).

The second atelier was located on the property at Wollenweberstraße 33/Sackpfeife (Mulsow 2000b). In the ground floor of a wooden building (dimensions 8 × 4.6–4.9 m) built parallel to the Sackpfeife alley, fragments (c. 500 items) of broken casting moulds for making three-legged cauldrons were recorded. The majority of them were discovered deposited in characteristic nest-like clusters, indicating the places of casting of vessels. The workshop was equipped with a domed clay furnace (Mulsow 2000b, 255 f.). In the north-west corner of the building and just behind its western wall there were pits from which clay had been obtained for making foundry moulds (Mulsow 2000b; see also Mulsow 2008, 92 f. Fig. 2).

In this workshop, apart from three-legged cauldrons, decorations and appliqués were also made, as evidenced by the finds of four foundry moulds of stone, most likely limestone (Mulsow 2000a, Figs. 6:2–3; 7; 8; 2000b, 256 f., Figs. 7.a–c; 8). Casting of vessels and decorations was not the only activity carried out in the

19 Detailed data on the type and number of finds from this property were taken from inventory lists published in Ortsakten zum Fundplatz HRO 400 untere Denkmalschutzbehörde Rostock.

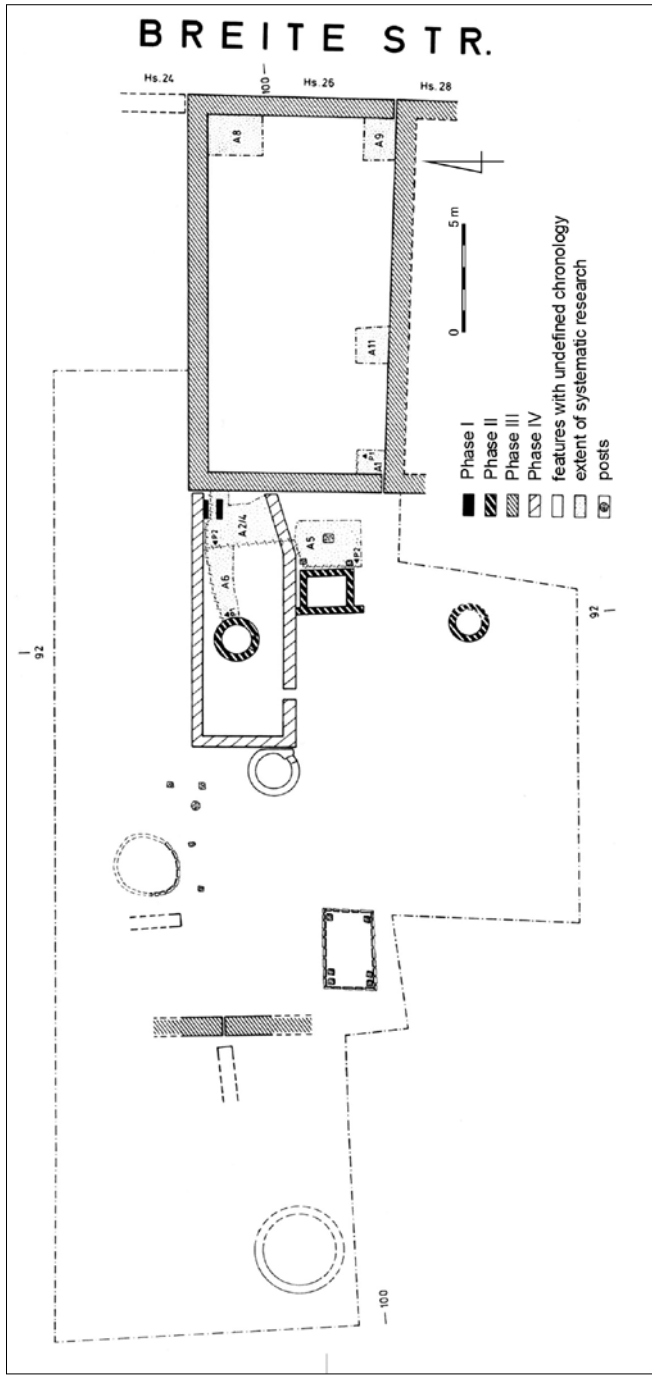

Fig. 12. Lübeck, Breite Straße 26. Collective feature plan. The features associated with the bell-foundry workshop date to the first and second phases of the property's use (after Gläser 1989b, Beilage 8)

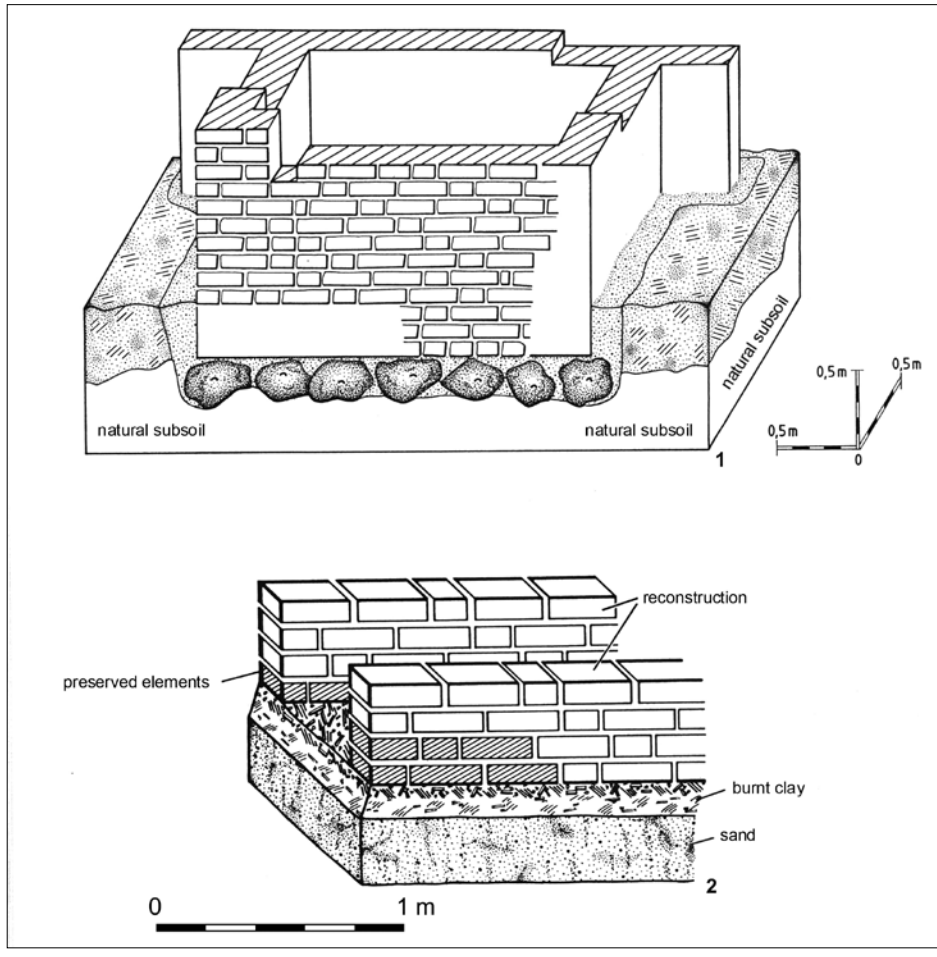

Fig. 13. Lübeck, Breite Straße 26. 1 – isometric representation of a furnace for melting metal (phase II), 2 – isometric representation of an oven for drying casting moulds (phase 1) (after Gläser 1989b, Fig. 2)

workshop in question. About 100 items related to the production of bone dice were also found there. This assemblage included waste (sawed bone epiphyses, bone plates) and semi-raw material in the form of four-sided strips with traces of planing and sawing (Mulsow 2000b, 257, Fig. 9). It seems that some stone whetstones found on the site were also associated with the production of bone objects (Mulsow 2000b, 253, Fig. 6:a–c). This workshop operated in the first half, and most likely in the second quarter of the 13th century. The end of its activity was brought about

by a huge fire that also destroyed the buildings on the neighbouring plots located at Wollenweberstraße. It is possible that this was a fire that the written records indicate occurred in 1252 (Mulsow 2000b, 258).

In a block located in the northern part of the Old Town, over 100 fragments of bronze slag, as well as fragments of legs and walls of three-legged cauldrons and nearly 50 fragments of clay casting moulds for such vessels were discovered (Schäfer C. and H. 1994, 150 ff., Fig. 7: a–c). In addition, pieces of slag, iron bars and fragments of finished products, including nails showing no traces of use, were recorded (Schäfer C. and H. 1994, 154; see also Mulsow 2000a, 215). All finds were found in layers with high concentrations of charcoal, indicating the intensive use of fire. The soil containing this material had been brought in to raise the level of the ground in the 1340s, shortly before the construction of the Franciscan monastery buildings in this place (Schäfer C. and H. 1994, 157). The finds described could have come from a workshop (or workshops) where bronze cauldrons were cast and iron objects also were produced.

In Greifswald, the remains of several bronze foundries have been identified. Two of them were located in the quarter located on the western side of the church of St Nicholas, between Lange Straße, Domstraße and Rotgerberstraße. A bronze-founding workshop from the second half of the 14th century was discovered on the plot at Lange Straße 47 (Ansorge, Rütz 1999). This workshop was located in the brick-built front building. It was equipped with flat hearths and a furnace for melting metal (Fig. 14). This structure had brick walls set on a stone foundation and a clay floor. Its interior was 1.60 m wide and at least 1.70 m long (Ansorge, Rütz 1999, 311 f., Fig. 11). In such devices, the metal was most likely melted in iron pans, additionally covered with clay (Ansorge, Rütz 1999, 313, there further literature). The area between the furnace and the hearths was partially paved with a brick floor. Around 1,200 pieces of casting moulds for three-legged cauldrons were collected within the workshop. The vast majority of them were lying in the fill of a small cellar, located on the eastern side of the fireplaces. They include fragments of the walls, spouts, triangular legs, as well as pouring holes of the moulds and clay plugs with which the latter were closed after pouring the metal into the mould, leaving them until the casting had cooled down (Ansorge, Rütz 1999, 310). Among the fragments of clay moulds, specimens were found with the coat of arms of Greifswald – a triangular shield with tripartite divisions (Ansorge, Rütz 1999, 310, Fig. 10:2).

The workshop discovered on a neighbouring plot, at Lange Straße 51, has a slightly later chronology. It started operation at the end of the 14th century in

the building of the then closed chapel of the Holy Spirit Hospital.[20] In the southern part of the aisled hall, a line of pits stretching east–west was discovered. Their lengths were up to 4 m and their widths were 2–3 m. These features were filled with fragments of burnt casting moulds (Rütz 2002, 89 ff., Fig. 13). In total, about 5,000 such fragments were found, mainly from the production of three-legged cauldrons. Two examples bore the coat of arms of Greifswald and twelve very small fragments had hard-to-read characters, probably the manufacturers' markings (Rütz 2002, 95 f., Fig. 36). In addition, approximately 2,600 pieces of slag and 900 pieces of bronze with a total weight of nearly 6.5 kg were collected (Rütz 2002, 97). Among them were identifiedragments of three-legged cauldrons and other vessels (Fig. 15), as well as rivets, rhomboid plates and scraps of sheet metal (see Rütz 2002, 97 f., Figs. 40–41; 2005, 296, Fig. 5). In the workshop in question, the remains of a bell casting site were also recorded in the form of a pit with perpendicular walls, sunk approximately 80 cm into the ground. Its filling consisted of pieces of slag covered with clay and pieces of clay moulds (Rütz 2002, 90 f., Figs. 21:5, 37 and 38). At the bottom of the pit there were remains of a brick base on which the mould had been placed. No remains of hearths or furnaces were discovered in the examined area. However, it can be assumed that metal was melted on site. This is evidenced by traces of burning and the impact of high temperatures visible on the brick floor, which had been renovated many times. This workshop operated until the mid-15th century.

In the same town block, on the property at Domstraße 53, a significant concentration of production waste, mainly fragments of foundry moulds, was recorded. They were located in the backfill of the foundation trench of a fifteenth-century building (Schäfer H. 1996, 146, Fig. 8). This material probably came from one of the workshops discussed above. Similar waste found on a plot of land at Rubenowstraße 5, approximately 200 m away to the south, could also have originated from these same workshops (Rütz 2005, 296, further literature there). A very large concentration of waste in the form of broken foundry moulds was also discovered in the square next to St Mary's Church (Ansorge 1998, 161).

In the eastern part of Greifswald, on the property at Brüggstraße 25a, another bronze-founding workshop was discovered. Its activity dates to the second half of the 14th century. It was located on the ground floor of the wooden front building

20 In the first half of the 14th century, the Greifswald Hospital of the Holy Spirit was moved outside the city walls. The new hospital buildings were built in front of the Stralsund Gate (Stralsunder Tor), in the immediate vicinity of the Ryck River (see Rütz 2002, 61, further literature there).

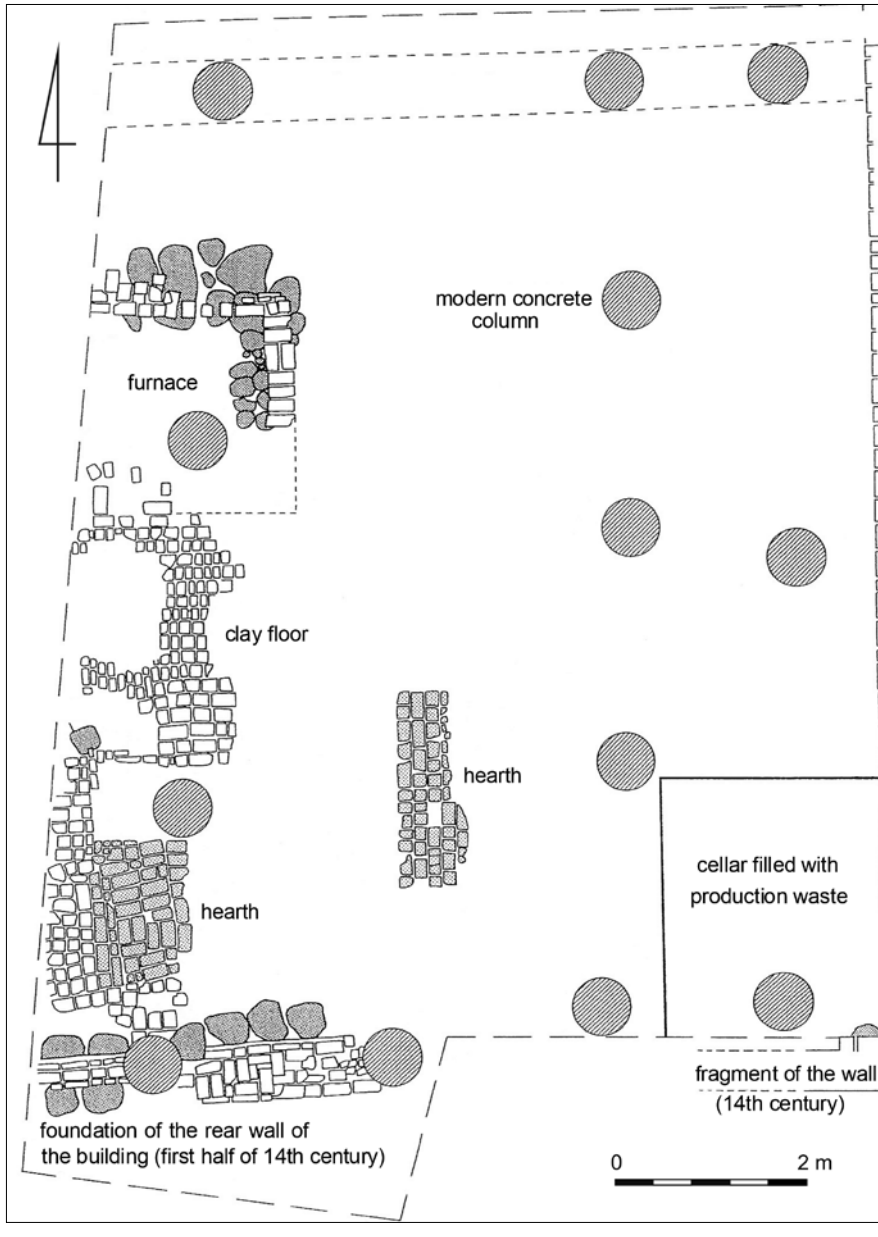

Fig. 14. Greifswald, Lange Straße 47. Plan of features in the bronze-founding workshop (after Ansorge, Rütz 1999, Fig. 9)

of the plot (Schäfer H. 1995). The workshop equipment included two flat hearths made of bricks placed on a patch of clay. They had rectangular outlines and dimensions of 1.05 × 0.90 and 0.90 × 0.75 m. Both devices were used at the same time. Within the workshop, slag (330 pieces), bronze scrap (121 fragments, including the legs and parts of the walls of three-legged cauldrons) and fragments of the casting moulds for the production of such vessels (almost 7,400 fragments) were recorded – fragments with the impression of the vessel walls, but also pouring holes of moulds and the plugs used to close the latter (see Schäfer H. 1995, 160, 167, table 1). This assemblage included nineteen items with the Greifswald coat of arms and the manufacturer's coat of arms marked (Fig. 16).

It is possible that foundry activity was carried out on the plot at Brüggstraße 25a already in an earlier period, i.e. at the end of the 13th to the first third of the 14th centuries, although it may have been quite limited in scope (Schäfer H. 1995, 166). Within the older front building, built in the final third of the 13th century, a brick hearth (dimensions 1.05 × 0.65 m) was recorded, showing traces of intensive use. At its southwestern corner, there was a circular pit with a diameter of 90 cm, sunk 80 cm into the ground. Its lower part was filled with tiny lumps of bronze slag. In addition, in a latrine located in the yard of the plot, a small bellows was found, which could have been used by a craftsman working on this site (Schäfer H. 1995, 154 f. Fig. 4).

In Stargard, in the front part of the property at Nr 12 Bolesława Chrobrego Street, a bronze-founding workshop was identified, which operated in the period from the second half of the 13th to the third quarter of the 14th centuries. Within it, remains of a metal melting furnace were discovered (Fig. 17) and fragments of bronze objects, most likely scrap, as well as numerous fragments (1,722 items) of clay foundry moulds were found (Fig. 18). Many of them were found in nest-like clusters in foundry pits (Majewski 2013, 48 ff.). The brick furnace for melting metal was built on a rectangular plan (2.20 × 1.60 m), open on the shorter side. On the eastern side of the furnace there was a casting pit, and a little further from it there was a place for obtaining clay (Majewski 2013, 51 f., figs. 7–8). In this workshop, mainly three-legged cauldrons were made, and to a lesser extent, candlesticks. A bell had probably also been cast here. This activity was complemented by cold repairs of vessels, as evidenced by the finds of patches with rivets (Majewski 2013, 57).

From the above-presented overview of the activities of bronze-founding workshops confirmed in archaeological sources it can be deduced that they were focused primarily on the production of cast three-legged cauldrons. Other items (including candlesticks, censers, and only occasionally small bells) were produced on a much smaller scale. Some workshops also made bronze buckles and belt

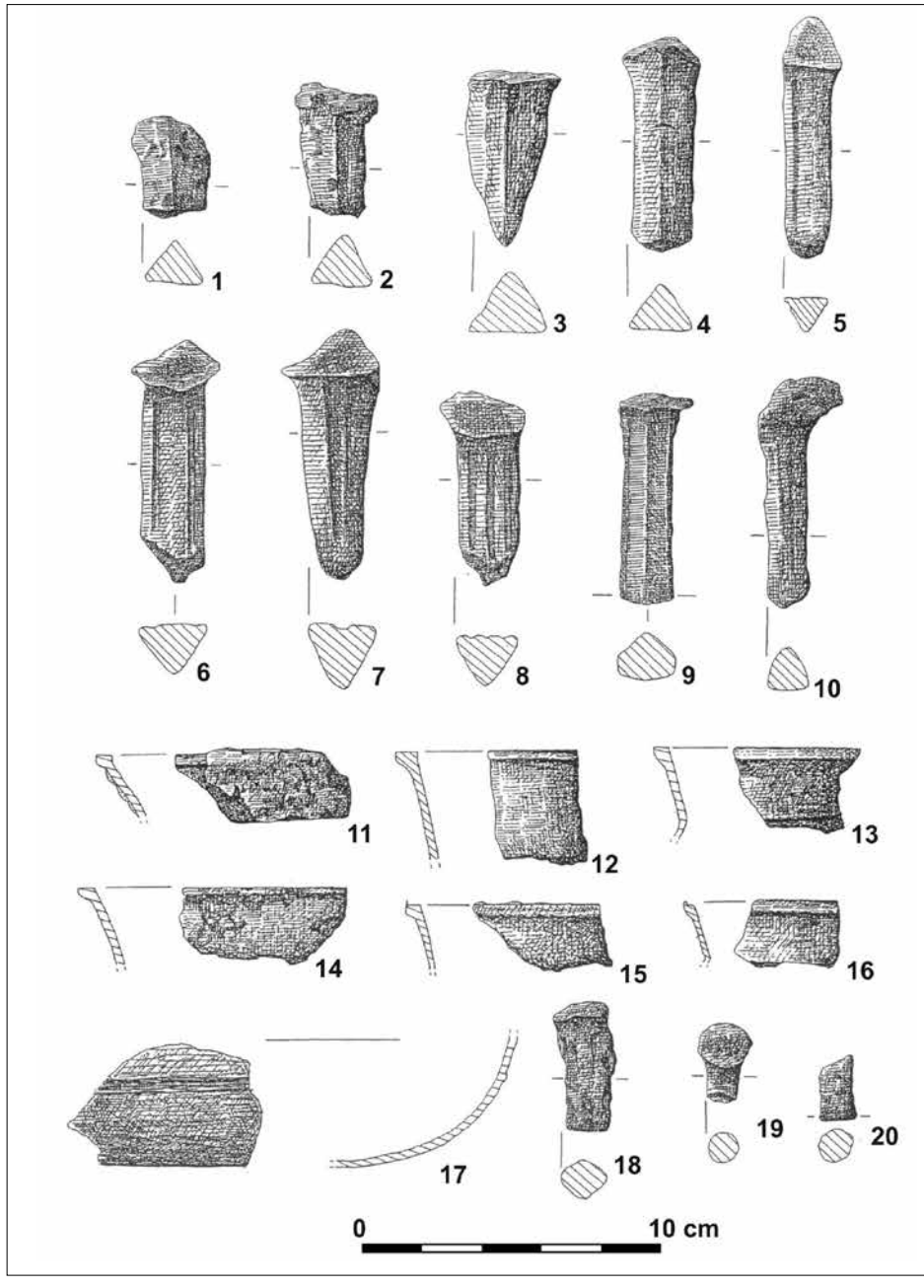

Fig. 15. Greifswald, Lange Straße 51. Finds of bronze scrap from the foundry workshop (after Rütz 2002, Fig. 40)

fittings (such as the Lübeck workshop at Breite Straße 26), as well as decorations and various applications, and in at least one (the Rostock workshop at Wollenweberstraße 33/Sackpfeife), bone objects were made.

Taking into account the diameters of three-legged cauldrons reconstructed on the basis of measurements of the diameters of the rims of the impressions in the clay casting moulds used for their manufacture, it can be assumed that quite a diverse assortment of such vessels was produced in the towns in question. The diameters of the rims of the three-legged cauldrons cast in Rostock, Stralsund, Greifswald and Stargard ranged between 13 and 43 cm (see Schäfer H. 1995, 162; Samariter 2000, 243; Ansorge 2005a, 127; Majewski 2013, 55), although they were most often in the range of 15–18 cm, which may suggest that vessels of such standardized sizes were commonly produced by late medieval craftsmen. The above is confirmed by the finds of such cauldrons from Lübeck (Drescher 2017, Fig. 5), Greifswald (see for example, Ansorge et al. 2006, 178, Figs. 9:a, 11:c) and Rostock (Schäfer H. 1992, 59, 60, Fig. 4a).

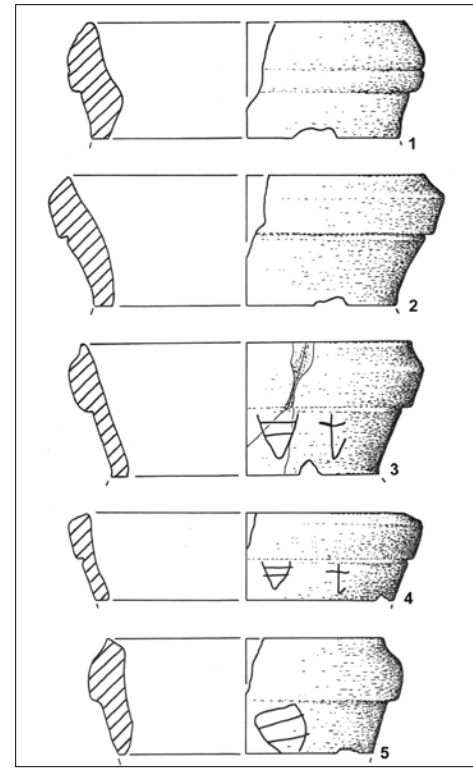

Fig. 16. Greifswald, Brüggstraße 25a. Fragments of casting moulds from the foundry workshop (after Schäfer H. 1995, Fig. 10)

A separate issue is the presence of signs in relief on the surfaces of some casting moulds depicting the coats of arms of towns and manufacturers' emblems. Generally, product marking is related to legal regulations regarding the economy of urban centres associated in the Hanseatic League (see Schäfer H. 1995, 162; Ansorge, Rütz 1999, 310 f.; Ansorge 2005a, 127; Majewski 2005, 43 f.; 2013, 57). At meeting of representatives from several towns in 1354, in 1368 and in 1375, in which Hamburg, Lübeck, Wismar, Rostock, Stralsund, Greifswald and Stettin participated, appropriate regulations were issued regarding the production and marking of cauldrons, as well as concerning trade in these products (Wehrmann 1872, 225 ff.;

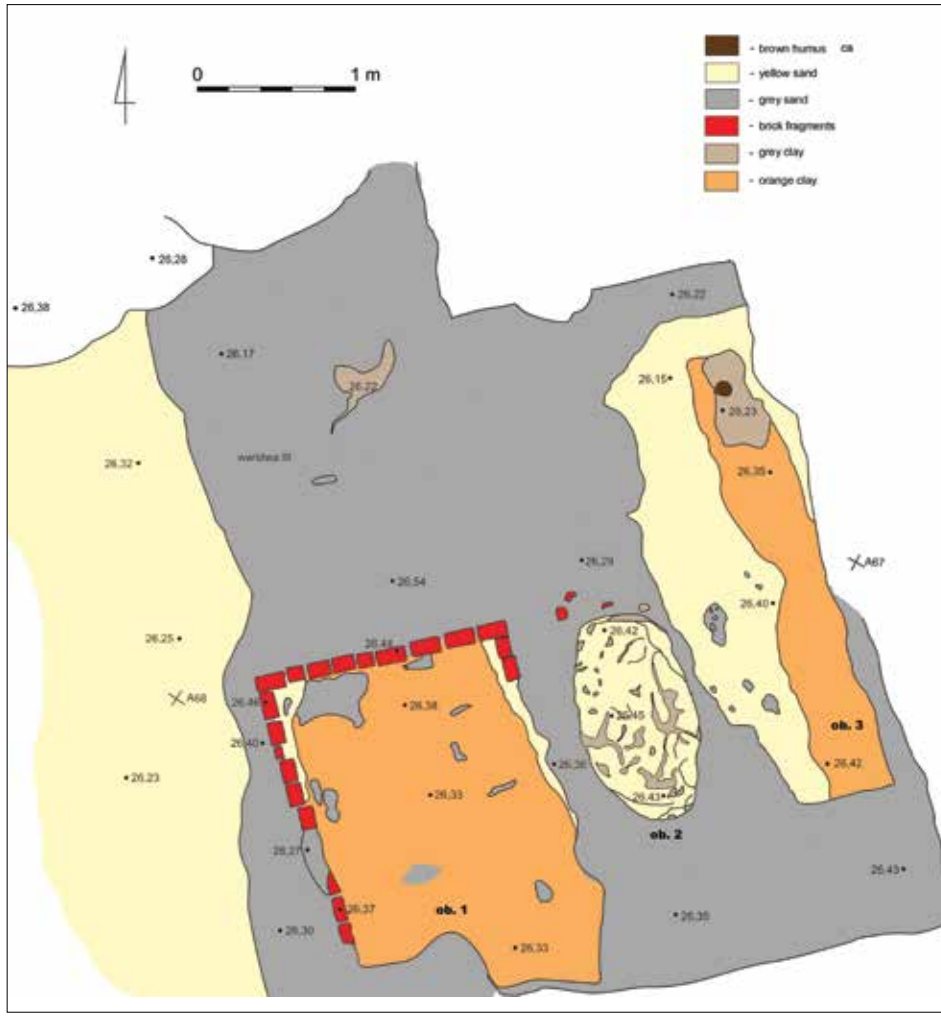

Fig. 17. Stargard, ul. Bolesława Chrobrego 12. Plan of features in the bronze-foundry. 1 – furnace for melting metals, 2 – place for casting moulds, 3 – clay for making (after Majewski 2013, Fig. 7)

Blümcke 1884, 88; Semrau 1918, 37 f.; Drescher 1968, 165). Compliance with these regulations was confirmed by archaeological finds from Stralsund and Greifswald dating to the second half of the 14th and 15th centuries. Finds of bronze cauldrons with the coat of arms of Lübeck and Stralsund are also known from Denmark and Germany (Vellev 1998, 218 ff., Figs. 39–41; Ansorge 2005a, 127 f., Fig. 12). Most likely, marking products was common practice and was one of the requirements for

their wider sale. This is supported by the fragments of foundry moulds with makers' marks engraved on them, also recorded in other towns, such as Anklam (see Fig. 11:3–4; Hoche, Fries 2004, 578) and Güstrow (Fries 2014, 108, Fig. 2:a–b).

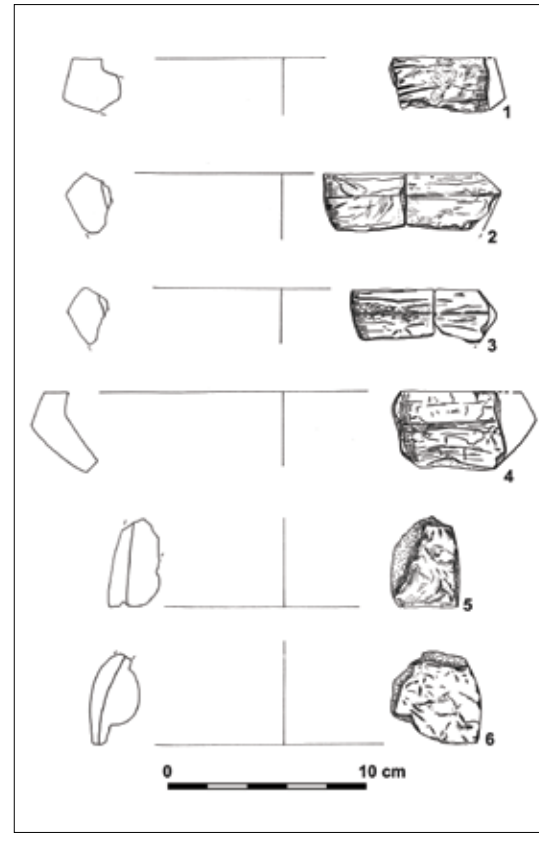

Fig. 18. Stargard, Nr 12 Bolesława Chrobrego Street. Selection of fragments of casting moulds for grapens (after Majewski 2013, Fig. 14)

In Wismar, during research carried out in the courtyard of the castle of the Dukes of Mecklenburg, ten metal melting furnaces were discovered, as well as six foundry pits and several waste pits, filled with, among other things, fragments of broken clay moulds, pieces of bronze and lumps of slag (Grabowski 2002a, 256 ff., Fig. 2). Almost all the furnaces exposed in the castle square were shaft furnaces, of which there were two types. The first variant, represented by one example (Fig. 19:1) , is a so-called basket furnace (German: Korbofen). It had a circular plan and walls made of clay, covered with wicker on the outside. The metal was most probably melted in an iron pan placed inside the furnace. At its base there was a hole through which molten metal was drained through a channel made of inverted ridge tiles into a mould placed in the casting pit (Grabowski 2002a, 279 f., Fig. 15). The shaft furnaces of the second type (Fig. 19:2) had brick floors and clay walls, which were additionally braced with boards fastened with hoops (German: Faßofen). In these devices, the metal was smelted directly on their basin-shaped bottom. The exit channel was located in the lower part of the furnace. The melting temperature in shaft furnaces was raised and maintained using bellows (Grabowski 2002a, 279, 281, Fig. 11).

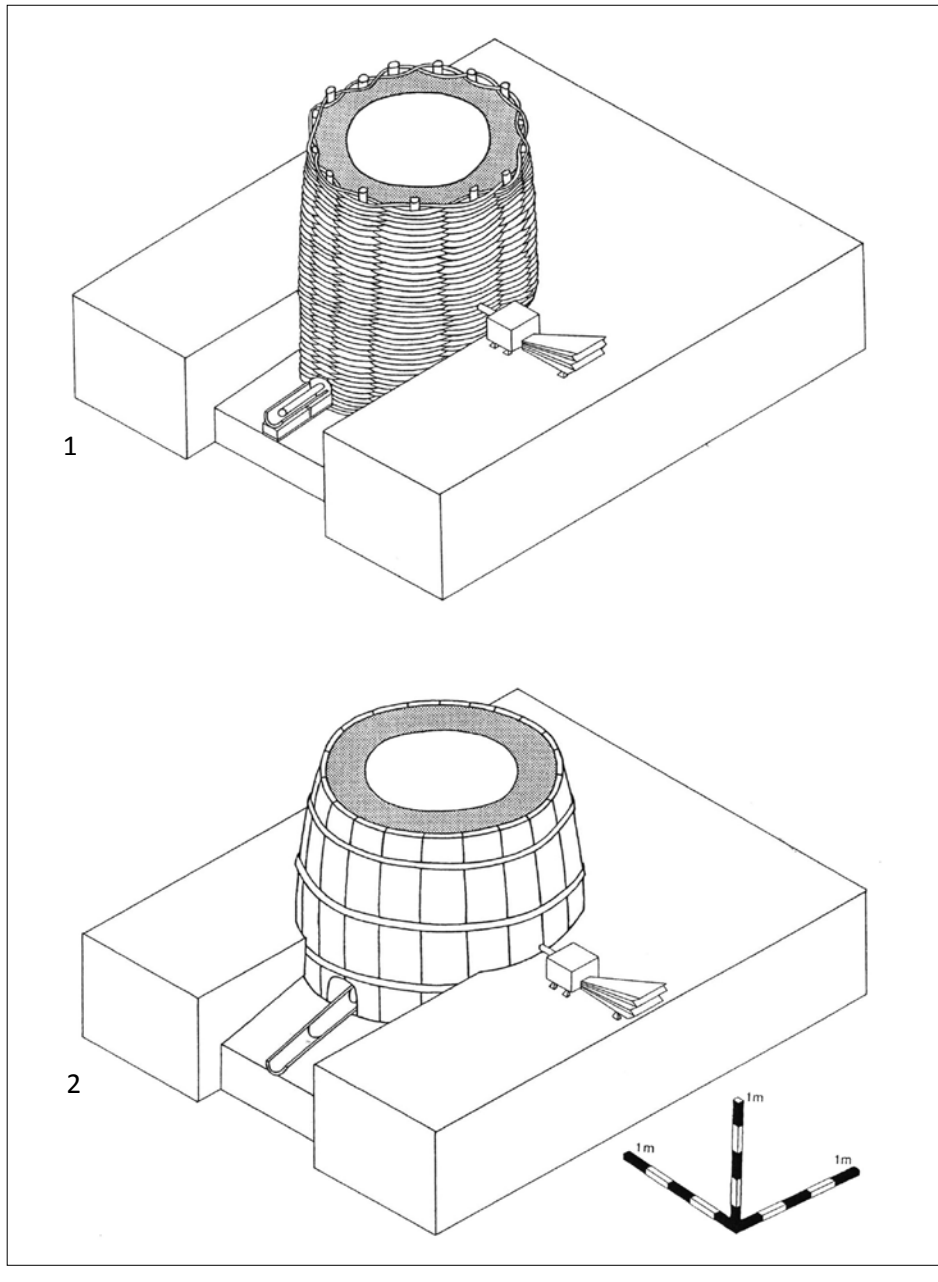

Fig. 19. Wismar, courtyard of the castle of the Dukes of Mecklenburg. Reconstruction of shaft furnaces. 1 – basket furnace (Feature 6), 2 – barrel furnace (Feature 3) (after Grabowski 2002a, Figs. 11; 15)

The foundry pits discovered in the workshop were characterized by large sizes and straight walls. They included features with a quadrilateral plan, up to 8.5–11.5 m long and up to 2.8 m deep (Grabowski 2002a, 257, 277, Fig. 3). Next to them, circular pits with diameters ranging from 1.5 to 3 m were recorded, which were related to the casting of bells.[21] Bell-founding activities in the castle courtyard were carried out in the period from the first half of the 14th century to about the mid-17th century, but later only cannons were probably made here (Grabowski 2002a, 277, 280).

Another bell casting site was identified in Güstrow. It was located in the northern part of the city, in the district between Baustraße, Armesünderstraße and Schnoienstraße (Fries 2014, 107, Fig. 1). In its south-eastern part, relics of a metal melting furnace, a metal-pouring channel and a casting pit were discovered, in the fill of which there were fragments of a broken clay mould (Fries 2014, 110, Figs. 5–8). The bell was cast in the second half of the 14th century, probably for one of the local churches, although it was not possible to determine which of them it was intended for (Fries 2014, 114 ff.). Fragments of clay moulds used to cast three-legged cauldrons were also recorded in the investigated area. It is therefore highly probable that this part of the city also housed a bronze foundry or foundries (Fries 2014, 108–109).

Traces of bell casting were discovered on the market square in Ribnitz. There were the remains of three shaft furnaces built between the second half of the 13th century and the turn of the 14th and 15th centuries. They all had oval shapes (1.5 × 0.85, 1.5 × 1 and 1.5 × 0.8 m) and were slightly sunk into the ground. Their walls, wrapped in wickerwork, were made of clay containing an admixture of gravel, fragments of brick and small stones. One of the furnaces has been preserved with a fragment of an exit channel made of inverted ridge tiles. On its western side, at a distance of approx. 1.2 m, there was a foundry pit (Konze, Rütz 2008, 155–160).

The bell casting sites in Stargard were similarly located. Two shaft furnaces and a waste pit filled with charcoal and droplets of bronze alloy were discovered in the market square. The walls of both furnaces were made of clay and wrapped in basketwork. The metal was melted directly on their bottom made of clay (Majewski, Ogiewa-Sejnota 2017, 315 f., figs. 7–10). It is believed that two medium-sized bells for St Mary's Church were cast here at the turn of the first and second quarter of the 14th century (Majewski, Ogiewa-Sejnota 2017, 316).

21 In written sources, there are mentions from 1464 and 1486 about the casting of bells for the church of St Nicholas in the castle courtyard. In 1494, a bell was made for the church of St Mary. It is possible that the bell for the clock in the church of St Nicholas was also cast here in 1479. (Grabowski 2002a, 276, further literature there).

The metals used in bronze-founding were imported to the Baltic towns from the mining centres of the times. In Central Europe, in the both Middle Ages and modern times, copper deposits were intensively exploited in the Lower and Upper Harz, Mansfeld, Upper Saxony, Vogtland, Thuringia, Fichtelgebirge, Tyrol, Carinthia, Czechia, Moravia, Slovakia and Transylvania (Majewski 2005, 31, there further literature). Copper would have been imported to the Baltic towns mainly from Sweden, where there were mines controlled by Hanseatic merchants near Falun (Drescher 2017, 140). Tin was imported from Czechia, Saxony and Sweden (Majewski 2005, 31, further literature there).

The reprocessing of damaged objects played an important role in obtaining raw material for bronze-founding. It is significant that bronze three-legged cauldrons are very rare finds in Baltic towns, in contrast to the numerous foundries and production waste dumps. These observations clearly indicate that old or damaged products were melted down on a mass scale (Rütz 2005, 295, 297). This is confirmed by the finds of bronze scrap recorded in workshops discovered in Lübeck, Rostock and Greifswald. The raw material obtained from used or destroyed bronze, copper and tin objects was also of great importance when casting bells. The implementation of such projects was sometimes preceded by public collection of scrap or purchase of old objects for recasting (Majewski 2005, 31).

3. 4. Casting of non-ferrous and precious metals

In the towns discussed here, a wide array of small metal items (such as buckles, decorative mounts and appliqués, fibulae and clasps, various types of pendants, and other decorations) were produced. They were cast from bronze, copper, lead, pewter, and precious metals. This was done not only using ceramic investment moulds, but also single- or multi-piece stone moulds. The stone moulds, unlike clay ones (such as those used in bronze-founding), could be used for multiple castings (see Rütz 2005, 299). Moulds and their fragments are not very common finds, although they are known from many cities, such as finds from Wismar (Kaute, Schindler 2005, 726, Fig. 112:2), Rostock (Burrows 1999, 124 f., Fig. 2; Mulsow 2000b, 256ff., Figs. 7–8), Stralsund (Ansorge 2013, 563 f., Fig. 270), Greifswald (Rütz 2005, 299, Fig. 12), Ribnitz, Anklam (Schäfer H. 2000a, 68 f., Figs. 11; 12:6), Neubrandenburg (Schmidt 2000, 300, Fig. 3c; Ansorge 2010, 513, Fig. 133), Kołobrzeg (Rębkowski

1999b, 280, Fig. X-7; Polak et al. 2010, 122 f., Fig. V-3) and Tallinn.[22] A relatively large collection of these objects (Fig. 20:1–7) was excavated in Riga (Svarāne 1994; 2002).

Stone moulds discovered in cities located on the western coast of the Baltic Sea, including in Rostock and Kołobrzeg, were made of sandstone and limestone (see Rębkowski 1999b, 280; Mulsow 2000b, 256–257). A mould made of soapstone was found in Greifswald (see Rütz 2005, 299). Dolomite was used to produce almost all the casting moulds excavated in Riga (see Caune, Ose 2006, 466), but there was even an example (Fig. 20:4) of a wooden one (see Svarāne 1994). In the group of artefacts from Riga, two items were recorded (Fig. 20:2–3) that were considered imported from the Kyiv region (Svarāne 1994, 102). Casting moulds were sometimes made from raw materials that were imported from distant areas. Raw materials such as sandstone, limestone and soapstone were imported to the parts of Pomerania and Mecklenburg at the mouth of the Oder from Scandinavia (see Ansorge 2005c, 129ff.). The dolomite used to produce the moulds found in Riga came from local deposits (Caune, Ose 2006, 466).

Various types of ceramic crucibles were essential tools used in the casting of non-ferrous and precious metals (Fig. 20:8–11). Such items have been identified from Lübeck (Drenkhahn 2017a, 255 f., Figs. 42:10, 12; 43:1–3; 2017b, 337, Fig. 35), Rostock (Kaute, Schäfer 2003), Stralsund (Ernst 1999, 451, Fig. 5:1–13), Greifswald (Schäfer, Ansorge 1995), Güstrow (Wietrzichowski 1997, 164 f., Fig. 5.a–c), Riga (Svarāne 1994; 2000; 2002) and Tallinn (Vissak 2006, 500, Fig. 5).

In Greifswald, in the plot Markt 12b, a very large collection of crucibles was discovered (Schäfer, Ansorge 1995, table 1). Some of them – tiny vessels or so-called testing crucibles (only 3 cm high) and specimens with spouts – were made of white clay refined with a coarse-grained admixture. These vessels have quite thick walls (Fig. 21:4, 6). However, the thin-walled crucibles with triangular spouts deserve special attention (Fig. 21:1–3). A ceramic fabric with a significant admixture of graphite was used to make them (Schäfer, Ansorge 1995, 174 ff.). Many examples bear symbols in the form of various variants of a Greek cross and a key (Schäfer, Ansorge 1995, 174ff., Fig. 3). These crucibles were brought to Greifswald from the area of the upper Danube (Schäfer, Ansorge 1995, 187).

Graphite crucibles were most often used by goldsmiths and minters (Schäfer, Ansorge 1995, 179, there further literature; see also: Svarāne 2000, 300), although they were also used for melting copper and its alloys (Rütz 2005, 300). No traces of copper processing were recorded on the site concerned. However, a silver bar was

22 Finds of moulds discovered at Nr 10 Sauna Street (these items, kept at the Institute of History of Tallinn University, are known to me from personal examination).

found, 99 mm long and weighing almost 14 g (Fig. 21:5). It is therefore probable that a jeweller's workshop operated here. This assumption seems to be confirmed by the results of a specialist examination of the crucibles. The presence of trace amounts of lead and copper were found on their walls. Lead was used in melting copper and silver in the process of separating these metals from a melted mixture. Traces of lead and copper particles were also found in the chemical composition of the silver bar, which is probably the final product of such a process (Schäfer, Ansorge 1995, 182).

Crucibles were found in several parts of the city of Riga as well, including graphite ones with triangular spouts, dating back to the 15th–17th centuries (Svarne 2000, 173ff.; 2002). As specialist research has shown, they were used, among other things, to separate gold from silver. Some of them could have served as testing crucibles (Svarāne 2002, 105). A particular concentration of crucibles was noted near the market square (Svarāne 2000, 182), which may suggest the existence of jewellers' workshops there.

In Rostock, in investigations at Altschmiedestraße 19, remains of a wooden building sunk into the ground were discovered, in the fill of which a fragment of a sandstone casting mould was identified. This had engraved on it the negatives of objects, most likely bars with a length of at least 115 mm and a cross-section of 3 × 6 mm (Kaute, Schäfer 2003, 159, Fig. 3:b). Silver bars could have been cast in this mould. The dimensions of the negatives on it are similar to those of the previously mentioned ingot (see Fig. 21:5) discovered in the goldsmith's workshop in investigations at the Markt 12b site in Greifswald (Kaute, Schäfer 2003, 159). On the southern side of the building, there was a pit from which 22 fragments of crucibles made of white clay tempered with a coarse-grained admixture were excavated. They included two vessels with spouts placed at the rim (Kaute, Schäfer 2003, 159, Fig. 3:c–d). Similar crucibles were also discovered in the previously mentioned goldsmith's workshop at Markt 12b in Greifswald. In the fill of a pit there were fragments of the so-called technical ceramics, among which sherds of two thick-walled greyware pots were recorded (Kaute, Schäfer 2003, 159, Fig. 3:e–f). Finds of crucibles and other technical vessels as well as a casting mould support the existence of a goldsmith's or minter's workshop on the Altschmiedestraße 19 plot. This workshop was active in the mid- or second half of the 13th century (Kaute, Schäfer 2003, 159).

Crucibles found on the property at Jacobiturmstraße 5 in Stralsund can also be connected to a minting workshop. This plot was located near the mint mentioned in thirteenth-century written sources (Ernst 1999, 451 ff.; see also Müller 2005b, 126 f.).

In the late medieval towns of the Baltic coastal region, the production (including casting) of non-ferrous metal ornaments, buckles and various accessories used for decoration (including of leather goods and clothing) was carried out as

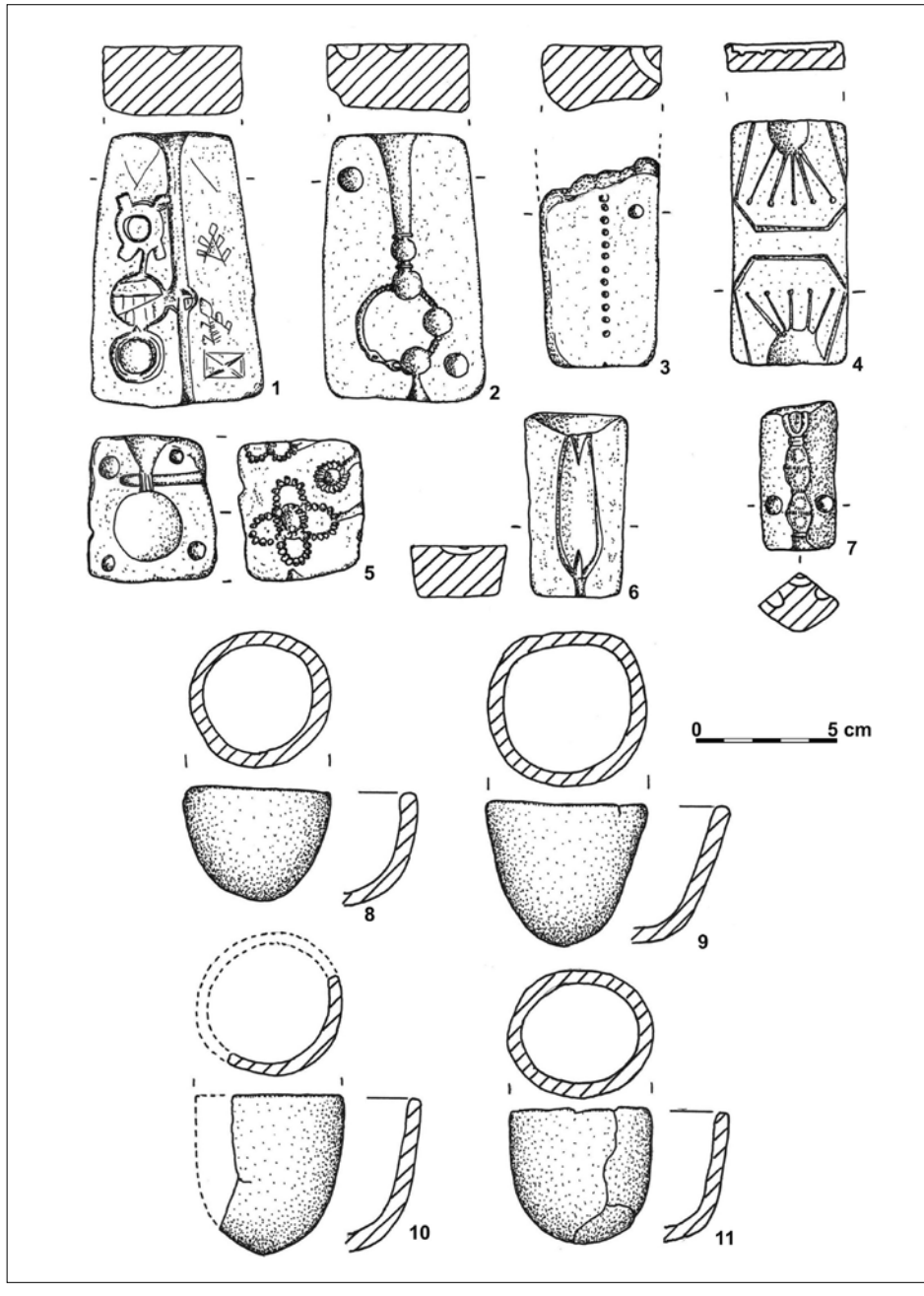

Fig. 20. Riga. Casting moulds and crucibles (after Svarāne 1994, Figs. 1; 3)

a side-activity to, or in combination with, other types of craft activity. An example of the above may be the finds of four stone casting moulds recorded within the previously discussed bronze-founding workshop on the plot at Wollenweberstraße 33/Sackpfeife in Rostock (see Mulsow 2000b, 256–257, Figs. 7–8). It can therefore be assumed that, as a sideline to the main activity, which was the production of bronze cauldrons, the craftsmen of this workshop also engaged in the casting of bronze decorations and applications for ornamenting other objects. There seems to have been a similar situation in Greifswald, where a fragment of a mould used for casting application or mounts was found in the bronze-foundry at Lange Straße 51 (see Rütz 2005, 299, there further literature).

Artefacts evidencing diversified craft production carried out within one workshop were also recorded in the structures located on the southern side of the Greifswald town hall. This complex, dating back to the second half of the 15th century, included stone moulds used for casting small pendants used to decorate leather goods or clothing items, as well as fragments of bronze and lead objects and pieces of metalworking slag. Additionally, the presence of fragments of flat bones with the cut-out negatives of beads or buttons was recorded (Schäfer C. 2005, 34ff., Figs. 17.e, g–h; 18:a–b). According to written records, there were cloth cutters' shacks on the southern side of the town hall. They were rented by various craftsmen, and their name may have derived from the largest group of specialists operating here (Igel 2010, 107 ff.). It is therefore quite probable that one such room was used for some time by a craftsman involved in casting ornaments and producing bone beads for rosaries and possibly bone buttons.

In Stralsund, in a trench located by one of the gates leading to the port (Semlower Tor), a fourteenth-century pit was discovered from which two limestone casting moulds were excavated. On one of them there were engraved the negatives of a buckle and three applications in the form of chevrons, and on the other negatives of circles (Samariter 2010, 59, Figs. 8–9). These artefacts were accompanied by other objects (lumps of raw material, semi-finished products, unfinished products and waste) related to the production of bone (Fig. 22) and amber (Fig. 23) rosary beads (Samariter 2010, 61 f.). In the filling of the pit, there were also found Jew's harps cast from a copper alloy, one still unfinished, as evidenced by the presence of a casting seam on its bow. A relatively large group of metal artefacts was also recovered in the studied area, including pieces of copper sheets, applications, as well as buckles and decorative fittings. Some of them, such as sheet metal scraps, were probably production waste. However, the buckles and applications showing traces of use should be considered scrap collected for the purpose of remelting (Samariter 2010, 59, Fig. 6). It is not known where the workshop (or workshops) from which

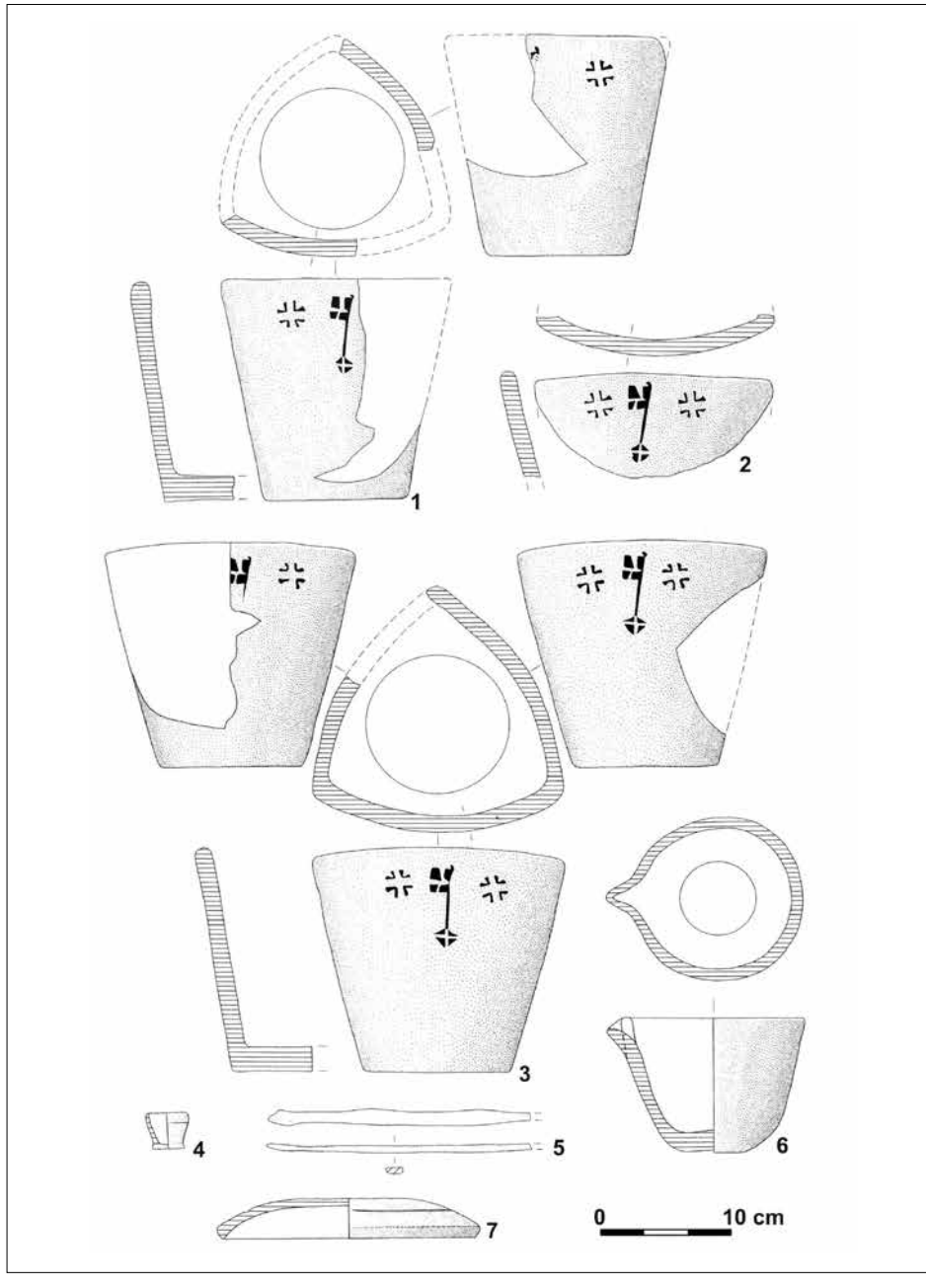

Fig. 21. Greifswald, Markt 12b. A selection of finds from the goldsmith's workshop (after Schäfer, Ansorge 1995, Figs. 4; 5)

Fig. 22. Stralsund, Semlower Tor. Waste from the production of bone rosary beads (after Samariter 2010, Fig. 11)

these items came were located. It is possible that it was located in the gate itself or near it.[23] It can only be said that this workshop was engaged in the production of personal ornaments and other items (including Jew's harps), made of copper and its alloys, as well as amber and bone rosary beads. This discovery also leads to the

23 In the Middle Ages, this gate housed rented living and storage rooms (Samariter 2010, 58, further literature there).

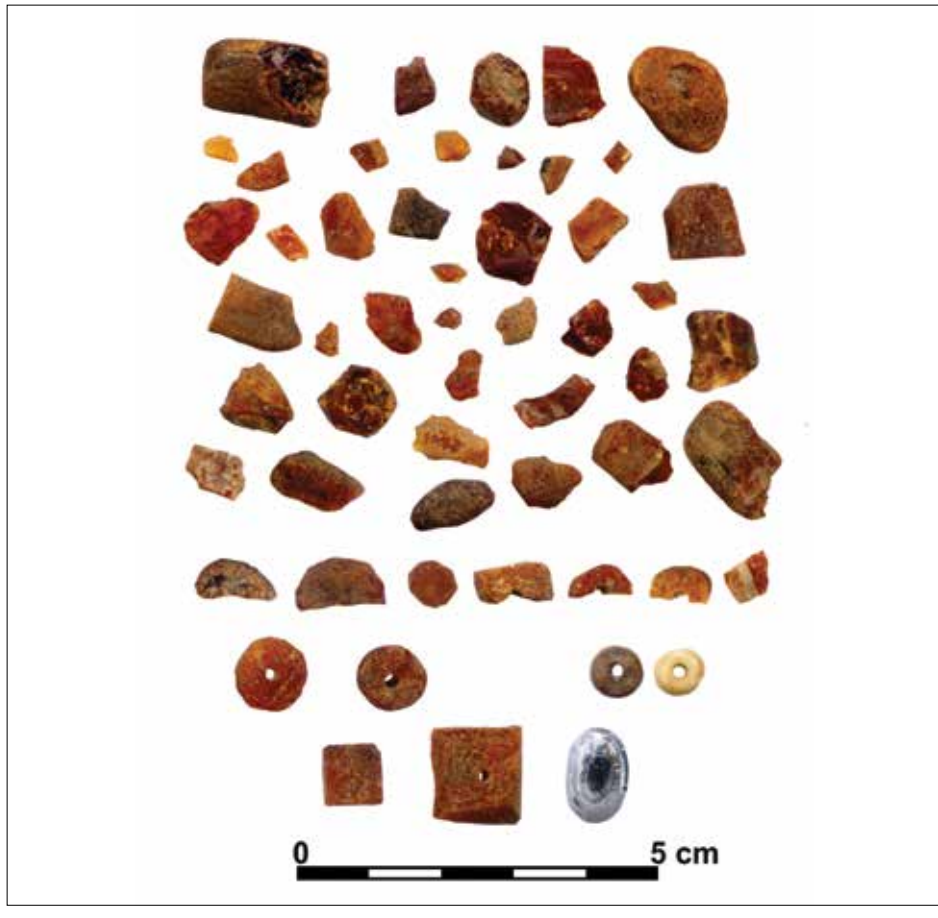

Fig. 23. Stralsund, Semlower Tor. Raw material lumps, semi-finished products and finished products related to the production of amber rosary beads and glass beads (after Samariter 2010, Fig. 12)

assumption that in the case of small workshops, where casting was carried out simultaneously with the production of items made from other raw materials, the non-ferrous metals used for their needs could have been obtained almost exclusively from the recycling of used but damaged items.

Another assemblage of artefacts related to the production of non-ferrous metal decorations and bone objects was excavated in the Port Suburb in Stralsund. From the backfill of a fourteenth-century well located on Wasserstraße, production waste was recovered in the form of pieces of brass sheets, with negatives of cut-out

round fittings or other decorations. In addition, nearly 400 bone fragments with traces of processing were recorded, including 105 pieces (production waste, semi-raw materials and semi-finished products) created during the production of cubic dice (Samariter 2007, 161ff. tab 2, Figs. 3; 9). These artefacts are probably the waste from a workshop located somewhere nearby.

In the market square in Tartu, a wooden structure sunk into the ground was discovered, dated to the second half of the 15th century. Inside there was workshop waste in the form of pieces of tin or pewter sheets with negatives of cut out objects and finished products. They included belt fittings, decorative applications, and elements of tiny bells. Most of the fittings were cut from metal sheets containing a small admixture of silver (Vissak 1994, 76, Taf. XXIX–XXX; see also Mäesalu 2006, 475, Figs. 2–3). Traces of the production of copper alloy ornaments and buckles were identified in the Riga Suburb (Vissak, Heinloo 2003, 160). Due to the lack of more detailed information about the above discoveries, it is difficult to say unequivocally whether in addition to metal decorations and costume accessories, items were also produced from other raw materials in the workshops from which the described finds came.

3. 5. Woodworking

Wood, thanks to its properties, is a raw material with universal uses. It has served not only as a building material and for fuel, but is also used in various areas of craft production. In late medieval towns, many specialists dealt with woodworking, including sawmen, carpenters, furniture makers, wheelwrights (and wagon-makers), turners, coopers, box makers and basket makers (Bogucka 1962, 81–84; Mulsow 2005a, 269, further literature there). Wood was also used by craftsmen processing other raw materials, who used it to make some parts of manufactured products or work utensils, including shoemakers who used wooden lasts[24] and saddlemakers who made saddle frames from wood.[25] In the excavated material, traces of the activity of woodworking craftsmen are recorded primarily in the form of finished products. Tools are much less frequently recovered, and only occasionally remains of production sites are recognised. Due to the widespread occurrence of

24 Wooden shoemaker's lasts were found, among other places, in Schleswig (Saggau 2006), Rostock (Mulsow 2000a), Greifswald (Kaute 1998; Schäfer H. 2000a; Ansorge 2005b), Kołobrzeg (Polak 1999b) and Gdańsk (Paner 2006b).

25 Fragments of wooden saddle frames were discovered in Schleswig (see Mayer-Küster 2006).

various vessels and containers made of staves, or their fragments, archaeological sources provide the best evidence of cooperage. The work of lathe turners, especially of various vessels and other containers, is equally well confirmed. For other crafts, we only have random data.

A significant role in the economy of the towns of the southern Baltic coast, mainly port centres, was played by the production of barrels, which were universal packaging used in the transport and storage of various goods (Baran 2003, 133; Mulsow 2005a, 271; Robben 2008, 77).[26] During archaeological research, barrels are most often discovered in contexts where they, or their elements, have been reused. Reused barrels are most often discovered buried in the ground as part of water supply and drainage systems or as some form of production equipment, but also used as water tanks, or well linings, and even latrines. Loose fragments – staves, bottoms and covers – are also found in the cultural layers lying individually or in larger clusters, for example as elements of various wooden pavings.[27]

The discoveries made in Rostock are of particular importance for these studies. In the old town quarter between Grubenstraße and Fischbank, in a layer dating to the 13th century, a significant number of semi-finished bottoms and the tops of barrels, as well as pieces with the characteristic wooden tenons with which their elements were connected, were recorded. Moreover, the layer contained a number of loose staves (Mulsow 2000a, 201, 214; 2005a, 271 ff., Fig. 6). Similar sets of finds were obtained in the Middle Town, on plots located on Wokrenterstraße, and these artefacts were accompanied by tools related to woodworking – two axes and an adze (see Schäfer, Paasch 1989, 146; Mulsow 2000a, 214, Fig. 3; 2005a, 272, Fig. 7). During the Middle Ages, the quarter between Wokrenterstraße and Lagerstraße was inhabited mainly by brewers. It is therefore probable that the semi-finished barrel elements and woodworking tools registered on the properties on Wokrenterstraße come from coopers' workshops located there, working for the needs of the breweries (Mulsow 2005a, 272, further literature there). Also, the remains of barrel production

26 Barrels are relatively durable and easy to transport containers. Their characteristic shape means that a force that is 2,000 times greater than that required to break a single stave is needed to break the same stave that is one of those fitted into the wall of a barrel. Therefore, the barrel staves can be relatively thin, and therefore the barrel's weight is small in relation to its volume. Other advantages of barrels are the ease of sealing and rolling them (Polak 1999b, 253, further literature there; see also Mulsow 2005a, 271).

27 Numerous finds of barrels are known, including from Schleswig (Ulbricht 2006b), Rostock (Mulsow 2000a; 2006), Greifswald (Robben 2006; 2009; Enzenberger 2007), Szczecin (Baran 2003), Kołobrzeg (Polak 1996 b; 1997b; 1998b, 1999b; Bobik 2016), Puck (Starski 2017a), Gdańsk (Barnycz-Gupieniec 1961; Kasprzak 2010a; 2010b), Elbląg (Nawrolscy 1989) and Riga (material known to me from personal examination).

identified in the Old Town quarter between Grubenstraße and Fischbank may indicate the existence of a cooper's workshop (or workshops) in this area too. This hypothesis seems to be confirmed by the medieval name of the eastern section of the current Fischbank Street, which was called Größe Böttcherstraße (Münch, Mulsow 2010, 66 ff.).

A separate field of the cooper's craft was the production of small stave-built vessels (bowls, cups) and containers (buckets, buckets) interlocking wth a round base and held together by external bands or hoops. Stave-built bowls or their fragments constitute the largest category of wooden artefacts obtained in the towns of the southern Baltic coast (Fig. 24:2).[28] For the production of stave-built vessels, mainly wood from coniferous trees (primarily pine and spruce, as well as fir and larch) was used (Polak 1996b, 331; 1997b, 231; Baran 2003, 111; Ulbricht 2006b, 158 ff, tab. 3; Bobik 2012, 190; 2016, 152; Kozakiewicz 2017, 180, tab. VII.2). The number of hoops was variable – the excavated material includes single-, double-, and rarely three-hooped vessels. Products with single hoops dominate among the finds from Lübeck (Neugebauer 1954, 178), Kołobrzeg (Polak 1997b, 230; 1999b, 255; Bobik 2016, 151), Stargard (Bobik 2012, 189) and Puck (Starski 2017a, 128), while two-hooped vessels are predominant in Schleswig (Ulbricht 2006b, 154), Wismar (Buchholz 1994, 64) and Szczecin (Baran 2003, 110). Vessels with three hoops are rare finds – they are known from Lübeck (Neugebauer 1954, 178), Schleswig (Ulbricht 2006b, 151), Greifswald (Schäfer, Schäfer 1998, 282) and Szczecin (Baran 2003, 110).

Remains from the production of small stave-built vessels are very rarely recorded in the Baltic coastal towns discussed here. Single semi-finished staves were discovered in Schleswig (Ulbricht 2006b, 108–120, Fig. 7; Müller 2008, 185 f. Fig. 17). In Gdańsk, on properties located in the region at the intersection of Łagiewniki and Rybaki Górne Streets, a relatively large concentration of semi-finished vessel bases, the edges of which had not yet been thinned, was recorded (about 20 items). Their diameters ranged from 55 to 200 mm, although most often they were in the range of 135–170 mm.[29] These items were probably related to the production of small stave-built vessels. Semi-finished bottoms may support the existence of a workshop (or workshops) specializing in the production of such vessels in the area in question.

28 See the analysis of the finds from: Schleswig (Ulbricht 2006b); Lübeck (Neugebaer 1954; Falk 1987); Greifswald (Schäfer, Schäfer 1998); Szczecin (Baran 2003); Stargard (Bobik 2012; Bucka 2017); Kołobrzeg (Polak 1996b; 1997b; 1998b; 1999b; Bobik 2016); Puck (Starski 2017a); Gdańsk (Barnycz-Gupieniec 1961; Kasprzak 2010a; 2010b; Miścicki 2022b) and Tartu (Vissak 1994; 2002).

29 I took the above data from the database of the Archaeological Museum in Gdańsk. These finds were identified on the properties of Nrs 37–40 Łagiewniki Street and Nr 33a Rybaki Górne Street.

A concentration of stave-built bowls was also recorded on one of the market plots in Kołobrzeg. In the yard of the property at Nr 2B Rynek, the remains of a small wooden building sunk into the ground were uncovered, inside which were fragments of stave-built bowls. Taking into account the number of preserved bases, it can be assumed that there had been at least 65 vessels there (Rębkowski et al. 1997, 71–80; Polak 1997b, 230). It is difficult to clearly interpret this find. Such a significant accumulation of elements of stave-built vessels, with the simultaneous lack of production waste and semi-finished products, indicates that we are probably dealing here with a place of storage (Rębkowski 2000, 46).

Another branch of crafts producing wooden vessels was turning. As in the case of stave-built containers, lathe-turned products, primarily bowls, plates, and to a lesser extent cups, goblets, cylindrical containers, canteens, gaming pieces, and furniture elements, are relatively numerous archaeological finds.[30] The basic raw material used in the production of turned dishes was ash and maple wood. To a lesser extent, alder, beech, birch, linden and poplar wood were used (see Ulbricht 2006a, 71–75, tab. 1; Polak 1997b, 229; 1998, 254; Baran 2003, 183; Bobik 2012, 188; Kozakiewicz 2017, 180, tab. VII.2).

One of the main products of the turner that appear as excavated finds are wooden bowls. Two main varieties of medieval lathe-turned bowls occur in the archaeological record. The first are those that are completely turned (inside and outside), hemispherical in shape, with straight-cut or slightly bevelled rims, sometimes with a thickened bottom. These vessels were already produced in the early Middle Ages, and their production continued in many towns located in the area discussed here (see, for example, Barnycz-Gupeniec 1961, 393–394; Polak 1997b, 229; 1999b, 256; Baran 2003, 72–79; Ulbricht 2006a, 40–51; Vissak 2006, 505; Kasprzak 2007, 9; 2010a, 155; 2010b, 176).

Among the class of vessels turned inside and out, attention is drawn to the so-called stellate bowls, which have everted or slightly upturned rims that have cutouts on the edges to produce a stellate pattern (Fig. 25). These products are known primarily from urban centres located in the western part of the area discussed here, that is, Lübeck (Neugebauer 1954, 183, Fig. 4; Falk 1987, 39, Fig. 50:15), Wismar (Gralow, Hoppe 1989, Taf. 14:126; Buchholz 1994, 66, Fig. 6;

30 See finds from Schleswig (Ulbricht 2006a); Lübeck (Neugebauer 1954; Falk 1987); Wismar (Buchholz 1994); Greifswald (Schäfer, Schäfer 1998; Ansorge 2005b; Ansorge et al. 2003); Szczecin (Baran 2003); Stargard (Bobik 2012); Pyrzyce (Cnotliwy, Nawrolski 1996); Kołobrzeg (Polak 1996b; 1997b; 1998b; 1999b; Bobik 2016); Puck (Starski 2015; 2017a); Gdańsk (Barnycz-Gupieniec 1961; Kasprzak 2007a; 2010a; 2010b; Miścicki 2022b); Elbląg (Nawrolska 2006; 2009; Nawrolscy 1989) and Tallinn (Vissak 2006).

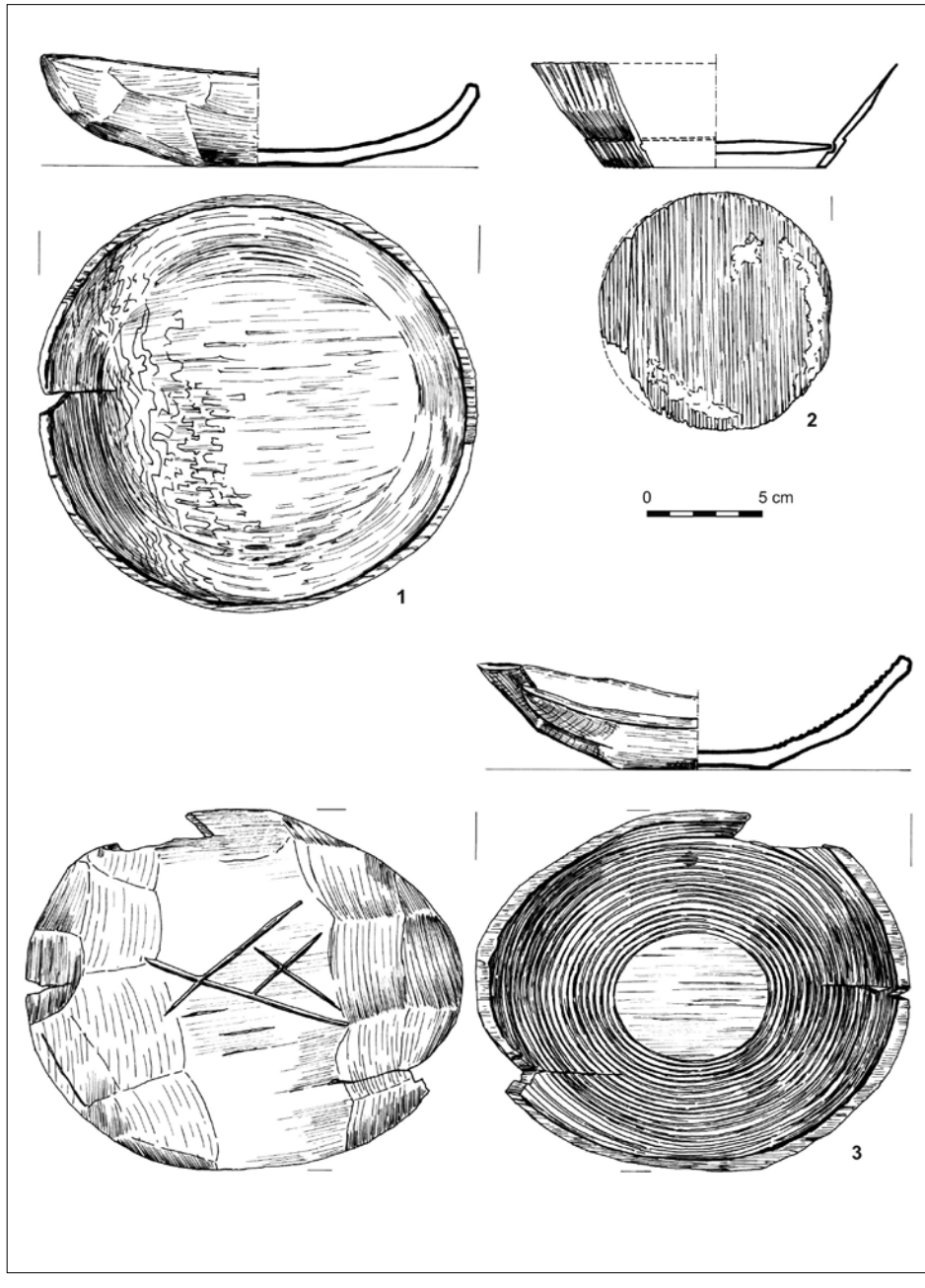

Fig. 24. Kołobrzeg. Selection of wooden dishes. 1, 3 – bowls turned on one side, 2 – stave-built vessel (after Archeologia Kołobrzegu 2, tab. 73)

Kaute et al. 2006, 108, Fig. 7h) and Rostock (Schäfer, Lange 1988, 223). However, such vessels were not recorded among the finds from Schleswig (see Ulbricht 2006a), which may be due to the relatively early chronology of the assemblages of wooden products discovered there. The beginnings of the production of bowls with star-shaped rims generally date to the turn of the 13th and 14th centuries or even the beginning of the 14th century (see Neugebauer 1954, 183; Buchholz 1994, 62; Baran 2003, 77). Two such specimens were discovered in Szczecin, but they were considered imports (Baran 2003, 76 f.). The products in question, despite the good state of research of large collections of wooden vessels, were not found, for example, in the excavated material from Greifswald (see Schäfer, Schäfer 1998; 1999; Ansorge et al. 2003; Samariter et al. 2003), Kołobrzeg (Polak 1996b; 1997b; 1998b; 1999b; Bobik 2016), Puck (Starski 2015; 2017), Gdańsk (see Barnycz-Gupieniec 1961; Kasprzak 2010a; 2010b) and Elbląg (Nawrolska 2009). In the light of current research, these stellate bowls were therefore produced mainly in towns located in Schleswig-Holstein and western Mecklenburg, i.e. Lübeck and Wismar, and perhaps also in Rostock. They were used mainly in the 14th and 15th centuries, and possibly even in the 16th century (Baran 2003, 77, further references there).

Another characteristic product of late medieval lathe turning in the region were so-called single-sided bowls. These have a turned interior but somewhat roughly-cut exterior (Figs. 24:1, 3; 26). This type of vessel most likely appeared around the mid-13th century in northern Germany (Baran 2003, 84; Ulbricht 2006a, 75). The manufacturing process of these vessels was highly unified. The production of a single-sided bowl was several times faster than the production of a double-sided bowl made on a lathe. This contributed to significant time savings, which translated into increased production efficiency and, subsequently, reduced product prices (see Polak 1997b, 229; Baran 2003, 81). It should be emphasized, however, that these vessels, apart from perhaps slightly reduced aesthetic values, did not differ from fully-turned products in terms of the raw materials used in their production and functional parameters (Baran 2003, 82). These factors caused the new type of bowl to spread over a large area of the northern zone of Central Europe in a relatively short time. This phenomenon is reflected in the exceptionally numerous finds of such products in almost all the towns located on the southern coast of the Baltic Sea.[31] The scale of production of these single-sided bowls can be proven

31 See finds of these products from: Schleswig (Ulbricht 2006a); Lübeck (Neugebauer 1954); Wismar (Buchholz 1994); Rostock (Schäfer H. 1992; Schäfer, Patzelt 1992); Greifswald (Schäfer, Schäfer 1998; Schäfer H. 1998; Ansorge et al. 2003; 2006); Szczecin (Baran 2003); Pyrzyce (Cnot-

by the discovery of a warehouse used for their storage in Elbląg. In the cellar of an outbuilding on the property at Nr 23 Garbary Street, over 200 of these bowls were found, being kept there before sale. This complex dates to the 14th century (Nawrolscy 1986, 632; Nawrolska 2009, 90, Fig. 14).

In the towns discussed in this work, it was not possible to clearly identify traces of turners' workshops or the remains of lathes. In the excavated material from Schleswig, the presence of several semi-finished bowls and waste in the form of characteristic turning cores was recorded (Ulbricht 2006a, 21–23, Figs. 1, 2:1–5). Semi-finished bowls were also found in Lübeck (Müller 2008, 182, Fig. 12:3, further literature there) and Gdańsk (Miścicki 2022b, 402, Fig. XI.5:7). In Szczecin also, several turning cores were recorded. This waste was discovered in Podzamcze, in an excavation located in quarter 6. It comes from different stratification contexts, therefore it is impossible to identify them with a specific craft workshop (Baran 2003). A significant collection of artefacts related to the production of turned vessels was obtained during excavations in Gdańsk, in the quarter at the corner of Łagiewniki and Rybaki Górne streets. They included characteristic turning cores (almost 60 items) and semi-finished bowls (26 items).[32] These items were found on several plots, and their largest concentrations were recorded on the properties of Nrs 37, 38 and 39/40 Łagiewniki Street and Nr 33a Rybaki Górne Street. It can be assumed that they mark the places of production of turned vessels. Due to their imprecise dating to the Middle Ages and modern times, however, it is currently impossible to determine the period of operation of these workshops.[33]

Turning was not the only technique used to produce wooden artefacts. Various types of wooden products that had been hollowed out or carved with tools such as gouges are also quite common finds. Most of them are the types of items found in household equipment, including bowls, basins, scoops, spoons, spatulas and other such items.[34] Many of them were made extremely carefully, which may indicate that they were the product of craft workshops. The above remarks apply primarily

liwy, Nawrolski 1996); Kołobrzeg (Polak 1997b; 1998b; 1999b; Bobik 2016); Stargard (Bobik 2012); Puck (Starski 2015; 2017a); Gdańsk (Barnycz-Gupieniec 1961; Kasprzak 2007; 2010a; 2010b) and Elbląg (Nawrolscy 1986).

32 This information about the type and number of finds has been taken from the database of the Archaeological Museum in Gdańsk.

33 The results of the investigations at Łagiewniki Street have not yet been fully processed. Perhaps a detailed analysis of the findings will allow us to clarify the given chronology.

34 A very good overview of the range of various containers and other wooden objects used in burghers' households is provided by studies of wooden finds from: Schleswig (Saggau 2006); Lübeck (Neugebauer 1954); Greifswald (Schäfer; Schäfer 1999; Ansorge et al. 2003); Szczecin

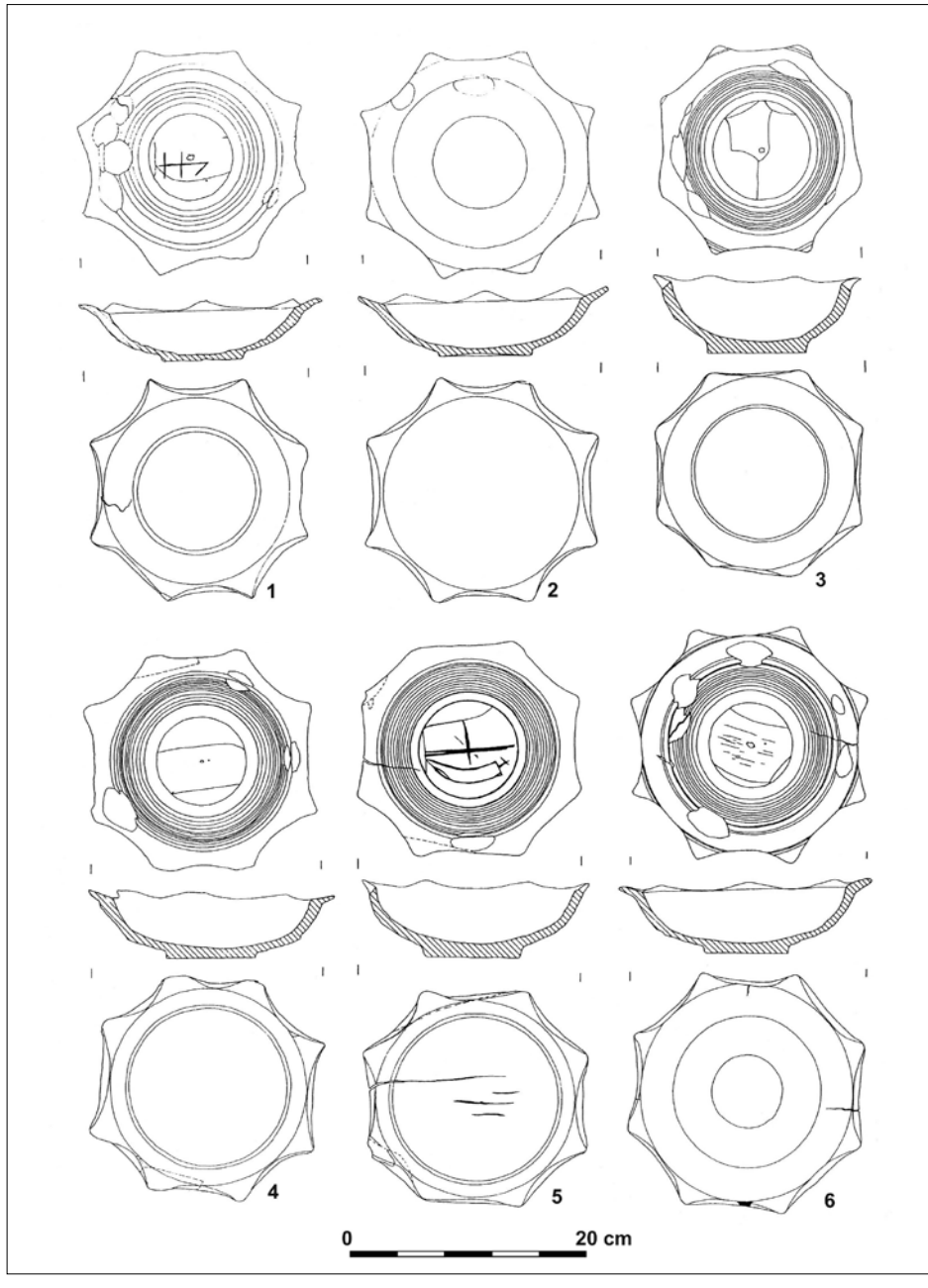

Fig. 25. Wismar. A selection of double-sided bowls with stellate rims (after Buchholz 1994, Fig. 6)

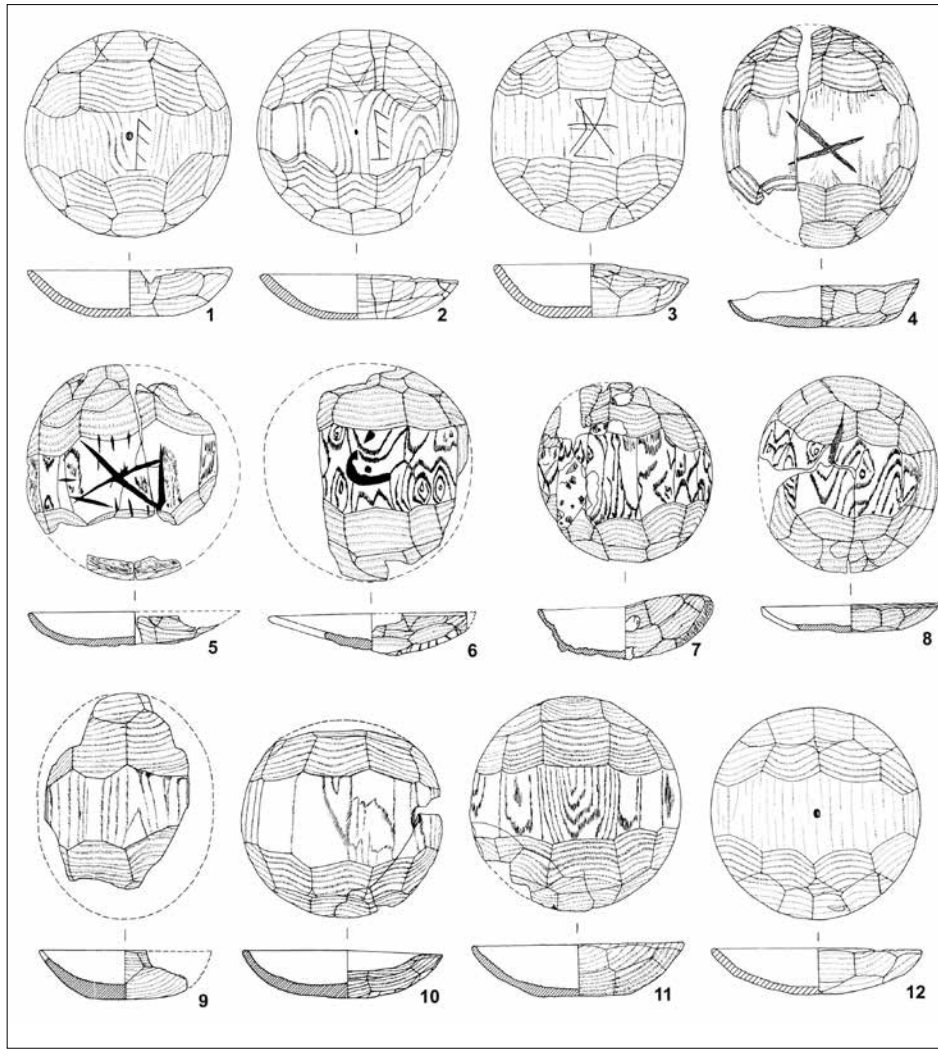

Fig. 26. Greifswald, Markt 12b–13. A selection of bowls turned on one side (after Schäfer H. 1998, Fig. 4)

to large vessels, such as troughs and shallow bowls, but also smaller containers, including scoops. The production of such vessels required not only considerable

(Baran 2003); Kołobrzeg (Polak 1996b; Bobik 2016); Puck (Starski 2017a); Gdańsk (Kasprzak 2010a; 2010b; Miścicki 2022b) and Riga (Bebre 2000; 2003).

skill, but also the use of raw materials of appropriate quality. Very carefully-made troughs can be found in excavated material from Schleswig (Saggau 2006, 216–220, Figs. 12–15), Lübeck (Neugebauer 1954, 188, Fig. 7f) and Szczecin (Baran 2003, 144–145, tab. XXX). Analogous objects are also known from Kołobrzeg (Polak 1996b, 332, tab. 67:5) and Puck (Starski 2017a, 145, Fig. VI.20:3). Probably a significant part of them, if not most of them, were made in craft workshops. This assumption is confirmed by mentions in late medieval documents from Szczecin about the trade in troughs (Baran 2003, 145, further literature there).[35] Therefore, they had to be products of appropriate quality, guaranteed by specialized craft production.

Among the carved vessels, a specific group of finds are the so-called hollowed-out bowls with protrusions, characterized by a polygonal outline of the rim (Fig. 27). So far, the largest assemblage of such products was obtained by investigations in Greifswald (Schäfer, Schäfer 1999, Ansorge et al. 2003; Samariter et al. 2003, 192, Figs. 9:6, 10:8). Their presence has also been recorded in excavated material from Rostock, Stralsund, Anklam, Prenzlau (Schäfer, Schäfer 1999, tab. 2, Figs. 12; 13; 15) and Szczecin (Baran 2003, 142–144). Bowls of this type are characterized by very careful workmanship, which indicates that they were created in specialized craft workshops.

Similar observations arise in the case of spoons, which include relatively long series of products with unified shapes, carefully designed and sometimes decorated (Buchholz 1994; Bebre 2000; Baran 2003, 147–158; Saggau 2006, 205–209; Kasprzak 2010a, 156; 2010b, 177 f.). Traces of the artisanal production of spoons were recorded in the excavated material from Schleswig (see for example Saggau 2006, 293). This activity is also confirmed by the results of the analysis of the assemblage (52 items) of spoons and their semi-finished products from Riga (Bebre 2000). The products discovered there are extremely carefully crafted, and some of them are also decorated (Fig. 28). They were produced in at least three size categories (see Bebre 2000, 116–118, 128 f.). These observations lead to the assumption that their production was not made-to-order, but aimed at selling to anonymous customers.

A relatively large collection (20 items) of spoons made of yew wood was excavated in Szczecin. All these specimens are characterized by identically worked handles (Baran 2003, 147 ff.). The type of raw material used[36] and the similarity

35 Trade in basins manufactured in Szczecin is also confirmed in later sources (see Möller 2008, 542, further lit. there).

36 It should be emphasized here that yew wood has poisonous properties. The use of such material to make spoons required appropriate treatments to remove harmful substances. Such

of form were the basis for the hypothesis that they were mass-produced in local craft workshops (Baran 2003, 153). Similar spoons were recorded in the excavated material from Pyrzyce (Cnotliwy, Nawrolski 1996, 320, Fig. 8.33:3) and Kołobrzeg (Bobik 2016, 154, tab. 79:4). What is particularly interesting is that the Kołobrzeg specimen was also made of yew wood (Bobik 2016, 154, tab. 79:4). In the opinion of I. Bobik (2016, 154), the spoons found in both of these towns could have been products of Szczecin workshops.

It is possible that another handicraft product are the characteristic cylindrical containers, usually equipped with lids, made of birch bark. These items are known mainly from urban centres located in the eastern coastal zone of the Baltic Sea, such as Riga (Fig. 29), Tallinn and Tartu.[37] Numerous finds of such containers recorded in the excavation material prove their widespread use by the inhabitants of these towns.

Excavations so far have provided relatively modest evidence for research on furniture making and related areas of woodworking, although traces of such craft activity – mainly fragments of finished products – have been recorded in almost all the Baltic coastal towns discussed here. The most comprehensive material on the basis of which we can attempt to create a set of products manufactured by woodworkers is the case of Schleswig. Carpenters could produce furniture (tables, chests, chairs, stools) and other household equipment, for example cradles, lamp hangers, milkmaid's yokes, and perhaps also various types of tools, such as shovels, forks, mallets, etc., and possibly more complicated devices such as looms (see Saggau 2006). Among other carpentry crafts, the manufacture of doors and shutters were recorded (see Gläser et al. 1992, 226 f., Fig. 13.1; Rulewicz 1999, 251, Fig. 10; Saggau 2006, 243, 245, Fig. 33).

Material traces of the activity of wheelwrights and wagon builders are the finds of a few cart wheels which have been preserved to varying degrees. These items or their elements have been discovered, among other places, in: Schleswig (Saggau 2006, 258 f. Fig. 43:1–4); Lübeck (Hahn 1978, 128, Fig. 58); Greifswald (Ansorge 2005b, 551-554, tab. 1; Figs. 6; 7); Kołobrzeg (Polak 1996b, 335, tab. 33:6; 46:3; 91:1; Bobik 2016, 157, Fig. VIII-3) and Puck (Starski 2017a, 154, Fig. VI.19). The diameters of the wheels found in Kołobrzeg were approximately 110–118 cm, in Greifswald

activities had to be carried out by people with appropriate knowledge and skills, most likely specialized craftsmen (see Bobik 2016, 158).

37 These products have not been the subject of separate publications so far. I know the containers made of birch bark from personal examination. Numerous collections of such products are kept, among other places, in the Riga Museum of Urban History and Navigation, in the collections of the Institute of History of Tallinn University and the Tartu Museum.

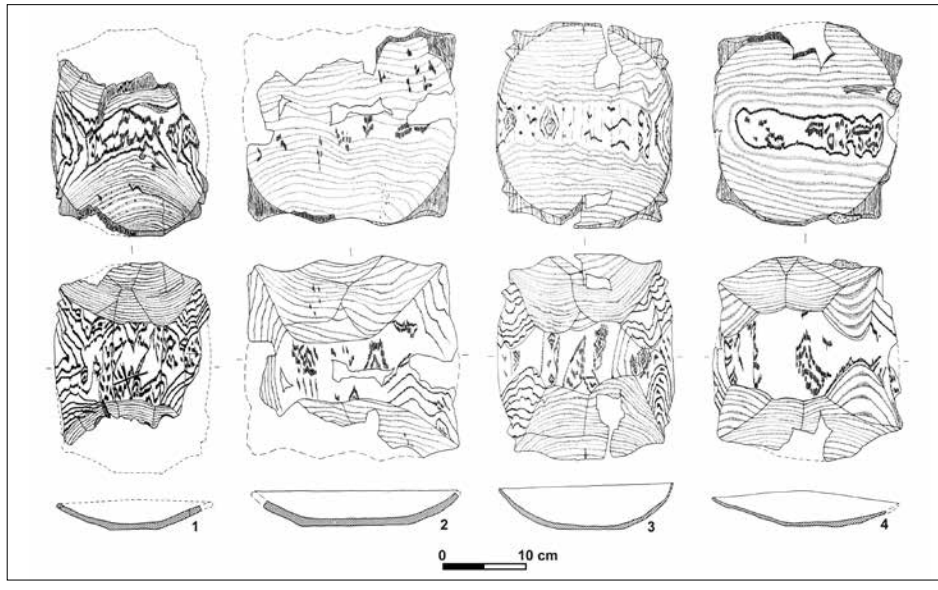

Fig. 27. Greifswald, Badestraße 2. Selection of hollowed-out bowls with protrusions (after Schäfer, Schäfer 1999, Figs. 5; 6)

120 cm and in Puck112 cm. They were all made according to the same pattern. Their bodies were made of 5-6 felloes, connected with wooden pegs. There were two spokes for each felloe (see Ansorge 2005, 551 f.; Bobik 2016, 157; Starski 2017a, 154). Depending on the number of felloes, the wheels could be equipped with 10 or 12 spokes. Beech wood was most often used to make wheel elements, but oak, ash, birch, alder were used less frequently, and coniferous wood was employed rarely (Polak 1996b, 335; Ansorge 2005, 552; Saggau 2006, 256, 258–260; Bobik 2016, 157; Starski 2017, 154; Kozakiewicz 2017, tab. VII:2).

Based on the analysis of the diameter of the wheels found in Greifswald, it was shown that they came from carts whose length was approximately 4–5 m and the wheelbase was approximately 1.10–1.20 m (Ansorge 2005b, 554, further literature there). The diameters of the wheels found in Kołobrzeg and Puck are only slightly smaller, which may suggest that they were also elements of such vehicles. It can therefore be suggested that all these towns produced vehicles with similar dimensions and load capacity. In addition to the wagons, wheelwrights also made equipment necessary for their use, such as yokes. A fragment of such an item was found in Schleswig (Saggau 2006, 260, Fig. 43:5). Another important element of

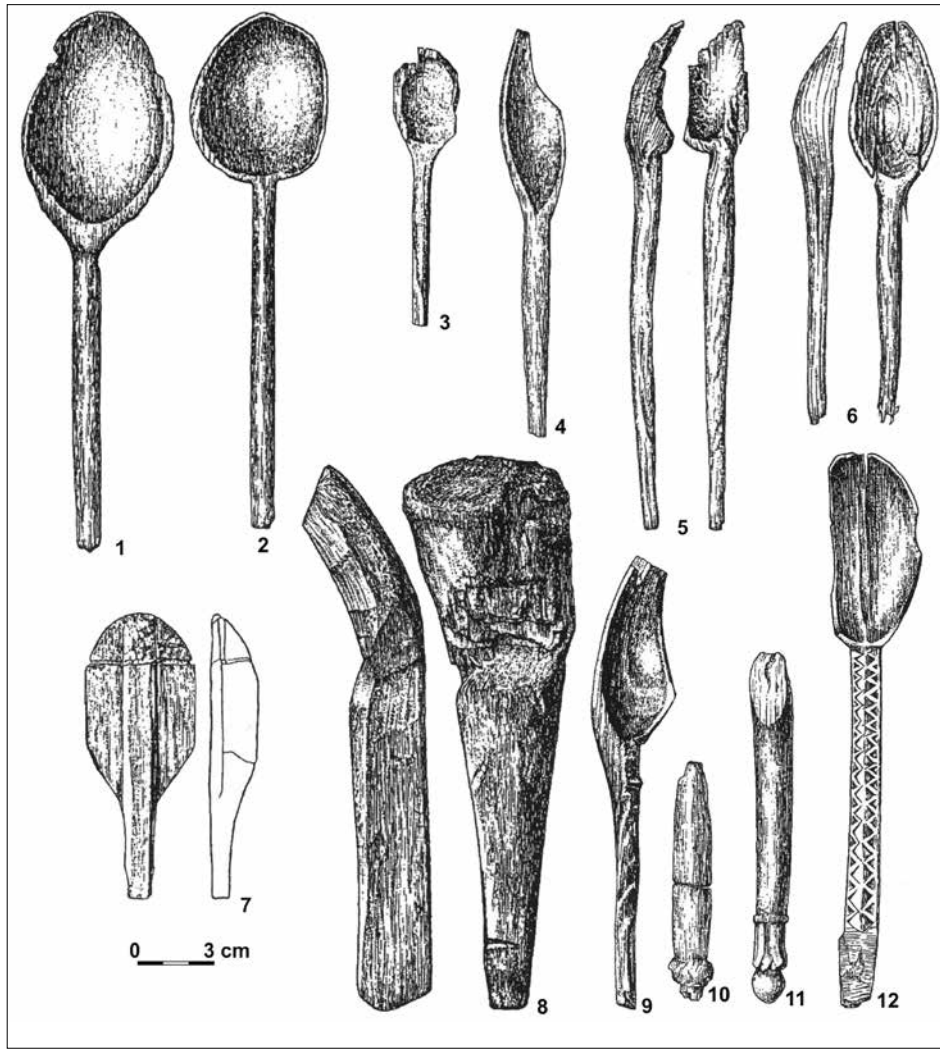

Fig. 28. Riga. Selection of wooden spoons and semi-finished products (after Bebre 2000, Figs. 1; 3; 4)

the wheelwrights' activities was also the servicing of vehicles, for example by replacing wheels and performing various repairs (Wiesiołowski 1997, 273).

Another issue that can be considered through the prism of archaeological finds is the set of tools used for woodworking. Clearly assigning specific types of tools to particular craft specializations poses many difficulties, especially since many of

Fig. 29. Riga. Elements of birch bark containers from the collections of the Museum of the History of the City and Navigation (photo by B. Wywrot-Wyszkowska)

them potentially could equally have been part of the equipment of a household. The excavated material includes axes, adzes, hatchets and saws, which were tools that were used by all the specialists discussed here during the initial processing of the raw material. The next group consists of drawknives, planes, spokeshaves and chisels. Next, we should mention various types of knives and other cutting or shaving tools (including spoon gouges, hollowing planes and grooving planes). Woodworking craftsmen also used at least two types of drills, i.e. spoonbits and auger drills. Craft workshops were equipped with various types of hammers, including the claw hammer with its characteristically shaped head, as well as wooden mallets and wedges.[38]

3. 6. Processing of leather

Tanning animal skins and producing products from this raw material were common craft activities in late medieval cities. In the period under discussion here, the craft of tanning had a number of specializations within it (Turnau 1975a). Besides the so-called simple tanners, there were those who produced so-called red-skin leather (usually with vegetable tannins) and those who manufactured so-called white-skin leather (usually employing mineral tanning agents). There were also furriers and parchment makers. The specific nature of archaeological finds makes it impossible, on the basis of the analysis of the material found, to study all the specializations mentioned in the documentary sources. So far, no clear traces of furrier production or parchment production have been recorded in the excavated material. Although archaeological work has provided much evidence confirming the tanning of grain leather (that is, where the hair has been removed, as opposed to processed fur leather), the state of preservation does not always allow the possibility to determine the methods of tanning the raw material, which would indicate the activity of specific specialists, i.e. red-skin tanners or white-skin tanners.

The excavated evidence related to tanning from the northern part of Greifswald is unique in the entire region. This came from the so-called craft quarter located

38 The tools mentioned above are known from: Schleswig (see Saggau 2000, 67–74, Figs. 46; 47; 48; 49:1; Gloy 2006); Rostock, Wismar (Mulsow 2005a, 269–270, Figs, 2; 3; 2005b, 305); Greifswald (Schäfer H. 2000a, 53–55, Fig. 2:2; Ansorge et al. 2003, 132–133, Fig. 11:1–2); Szczecin (Rulewicz 1999, 268, Fig. 20:5; Baran 2003, 50–56, tab. I; II); Kołobrzeg (Polak 1996a, 234–235, tab. 8:9; 28:10; 89:9; 1997a, 175, tab. 60:5; 1998a, 216, tab. 116:8; Janowski 2016a, 62, tab. 21:10; 83:7126:1; 135:11); Stargard (Janowski 2017a, 135 f. Fig. 13:2); Puck (Miścicki 2017a, 203 ff., Figs. VIII.7:1–3, 6–8; VIII.14.1–2, 4) and Gdańsk (Paner 2006b, 420–422, Figs. 2; 3; Trawicka 2010, 98, Fig. 3).

between Weißgerberstraße, Rotgerberstraße, Friedrich-Loeffler-Straße and Lange Straße (Enzenberger 2000; 2007). According to written sources this area was inhabited in the 14th and 15th centuries, among others, by craftsmen from the leather industry - tanners, shoemakers, furriers and saddlers. One of the city baths was also located there (see Bulach 2006, 98 ff.; 2013, 231 ff.; Igel 2010, 288 ff.).[39] Originally, on the east side of this block of buildings was the city moat dividing the Old and New Towns (Enzenberger 2000, 101; 2007, 25; see also Bulach 2006, 95 ff.). The research covered the northern part of the quarter, where remains of tanneries were discovered on three properties (Fig. 30). These workshops were established in the second half of the 13th century and continued to function in the following century (Enzenberger 2000, 112; 2007, 89f). In their area and from the fill of the moat, numerous finds of bones were recovered, mainly fragments of skulls preserved with horn-cores and individual horn-cores of cattle (7,144 items) and sheep (3,361 items). In addition, various pieces of tanning and leather waste were found, including scraps with preserved hair remnants (Enzenberger 2000, 103; 2007, 58, Fig. 24). The excavations also recovered tanning tools – scissors, knives and special drawknives for cleaning hides (Enzenberger 2000, Fig. 4; 2007, Fig. 68:1–2). A specific group of finds are elongated, narrow pieces of wood, 5 to 22 cm long and 1.1–1.6 cm wide, sharpened at both ends (Enzenberger 2000, 110, Fig. 5; 2007, Figs. 54:2–11, 13–16; 55:1–10; 57:6–10; 64:2–8). These objects were probably used to secure spread skins while drying them (Enzenberger 2007, 84; see also Wywrot-Wyszkowska 2008, 97). In the backyards of the plots, there were layers consisting of decomposed organic remains, characterized by a red-brown colour, resulting from their intense saturation with tannin in the form of crushed bark. In places, as in the plot at Rotgerberstraße 23, there were deposits of spent tanning agents, and their thickness was up to 1.2 m (Enzenberger 2000, 102, 108–109).

The very good condition of preservation of the features excavated on the Rotgerberstraße 23 site (see Fig. 30) allows the reconstruction of the layout of the tanner's residence and the identification of the equipment in the workshop (Enzenberger 2000, 104–110; 2007, 34–39). In the front part of the plot there was a wooden building, probably residential, with its gable facing the street. It did not occupy the entire width of the plot, and on its southern side there was a passage leading to the yard behind. Later, on the side facing the yard, a small brick annex with a cellar was added to it; the cellar was connected to the front building. In both rooms there were brick hearths and stave-built containers sunk into the ground.

39 Remains of the building of this bathhouse were discovered during excavations (Enzenberger 1997; 2007). For more on this topic, see below.

The yard behind the annex was enclosed on the north side by a property boundary fence of woven wattles,[40] and on the east by a frame-built structure. One of the longer walls of this complex was built directly on the western edge of the moat, reinforced with a wooden structure. The building consisted of two parts. The eastern part, sunk into the ground approximately 0.8–1.0 m, was closed. Within it there was a small room with a hearth. The western part of the building took the form of a roofed shed, open to the yard, in which a 1.5 m diameter vat was installed. Slightly smaller containers were located in the yard, where there were also two pits. The older structure, associated with the initial phase of the workshop's activity, had a roughly quadrilateral plan (3 × 2.5 m), and its bottom and walls were lined with beams. After it was no longer used, it was filled with various types of waste, including used tanning agents, leather scraps and animal bones. Almost in the same place, another pit with a quadrilateral outline and dimensions of 3.6 × 2.7 m was located. This feature was also filled with used tanning agents. In the south-eastern corner of the plot, next to the southern wall of the workshop building, there was a structure consisting of a container in the form of a box with dimensions of 2 × 1.5 m, to which gutters supplying water and other ones draining it away were connected. This device was installed in the later phase of the operation of the tannery, dating to the beginning of the 14th century, and was used for rinsing leather (Enzeberger 2000, 108–109, Fig. 2; 2007, Fig. 12). Within the moat, near the plot at Rotgerberstraße 23, remains of a wooden platform measuring 7 × 7 m were discovered. It was only two metres away from the workshop buildings. Here, tanners probably cleaned dirt from and rinsed the leather (Enzenberger 2000, 109, Figs. 2, 6; 2007, 35, Figs. 34–36).

Another workshop was located on the neighbouring plot, Rotgerberstraße 24. What is noteworthy is the almost identical layout of the buildings as on the Rotgerberstraße 23 plot (see Fig. 30). The front part of the property was occupied by a residential building with its gable facing the street, and production activities took place in the rear part. There was a small wooden building, oriented with its longer side along the moat. It contained large vats with diameters of up to 1.8 m and smaller barrels. Similar containers and tannery pits dug into the ground were also located in the yard. There was also a well dug there. Water was also supplied to the workshop via a wooden gutter with a cover that ran from Rotgerberstraße, on the northern boundary of the plot. Also along the northern border of the plot,

40 It is possible that a similar fence was located on the southern border, although this is only an assumption, as this part of the plot was located outside the archaeological excavation (see Enzenberger 2000, 107).

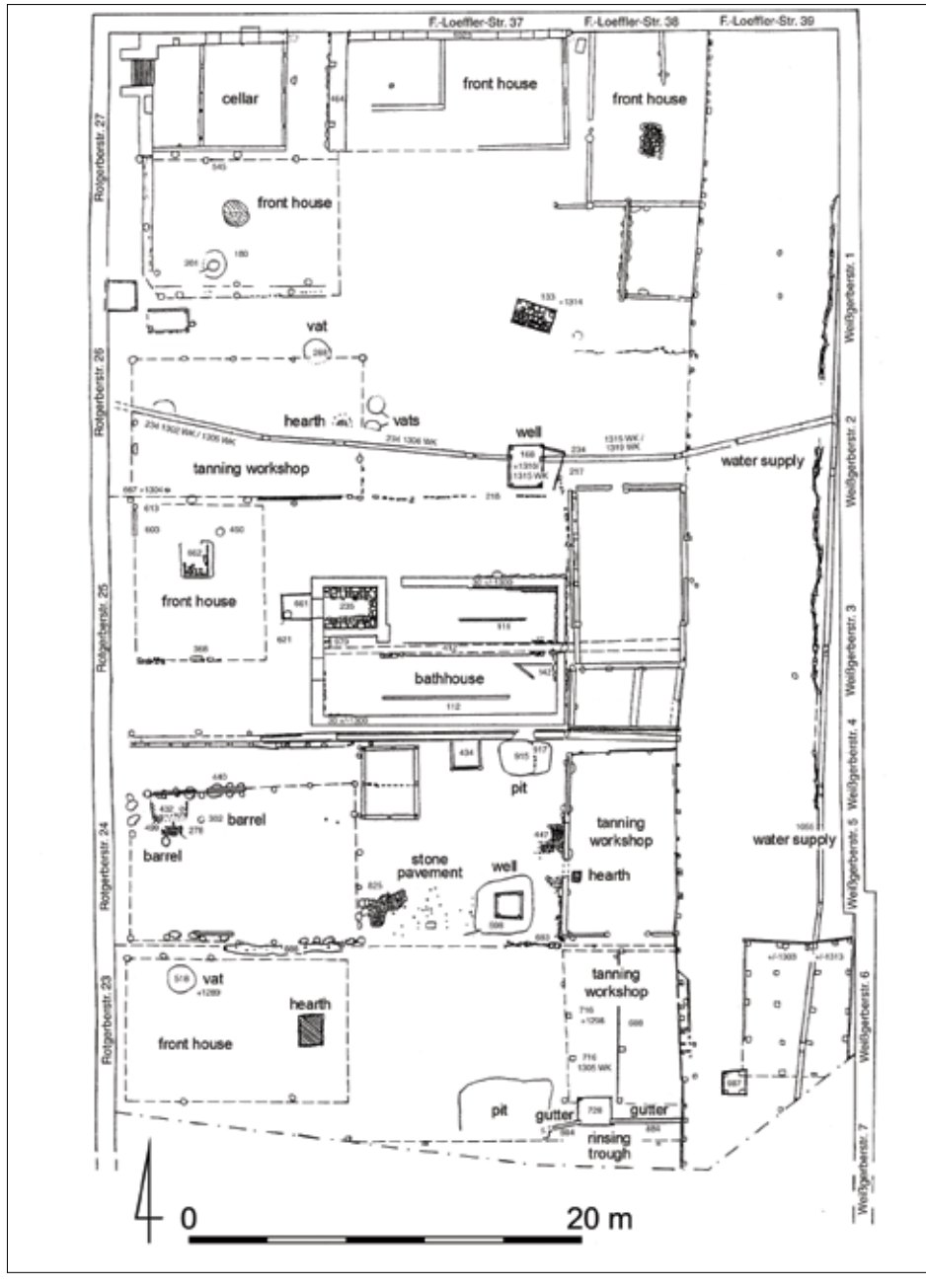

Fig. 30. Greifswald. The quarter between Rotgerberstraße and Weißgerberstraße. Collective plan of buildings from the beginning of the 14th century (after Enzenberger 2007, Fig. 35)

beside the workshop building, an open gutter was installed to drain used water into the moat. The surface of the yard was partially paved with stone (Enzenberger 2007, 37–40, Figs. 33–37).

The tannery discovered on the corner plot of Rotgerberstraße 27/Friedrich-Loeffler-Straße was also located in its rear part (see Fig. 30). It was located in a wooden building with a hearth and a vat dug into the ground. The various types of production equipment (vats, boxes and pits) were also installed outside this room, along the northern and eastern walls. As in the case of the property at Rotgerberstraße 24, there was a well dug in the yard of this plot too. Later (i.e., in the first half of the 14th century), a water supply was installed in its place, supplied by a water pipeline running on the eastern side of the quarter (Enzenberger 2000, Fig. 6; 2007, 44–50, Figs. 33–37).

The workshops discussed above had similar layout and equipment. Each of them had a detached building with an area ranging from approx. 45–57 m² (plots Rotgerbestraße 23 and 24) to approx. 70 m² (the corner of Rotgerberstraße 27/Friedrich-Loeffler-Straße the largest on these streets). Production equipment – vats, barrels, wooden boxes and pits – were installed both in closed rooms and in yards. Wells and water pipes, as well as water drainage gutters, were integral elements of the workshops. Initially, the tanners had used water from the moat and from dug wells. In the first years of the 14th century, however, the moat was completely filled. This circumstance, however, did not affect the further development of the workshops, because water was supplied to them by pipes, and dug wells were still in use (Enzenberger 2007, 56–58, 72, 79; see also Bulach 2013, 230).

The presence of layers saturated with remains of shredded bark indicates that these workshops were operated by red-skin tanners, specializing in plant-based processing of leather raw materials. According to written sources, in the second half of the 14th century, in the quarter between Rotgerberstraße and Weißgerberberstraße, white-leather tanners also had their establishments (Igel 2010, 298; Bulach 2013, 232 f.). In this context, the results of research on the corner plot of Rotgerberstraße 27/Friedriech-Loeffler-Straße are very interesting. Among the features related to the latest phase of the workshop's use were what seemed to be tanning equipment. These were two-part structures, the lower element being a stave-built container sunk into the ground, and the upper element a wooden box or barrel (Enzenberger 2007, 49, Fig. 18. 1–2). A similar device, dating back to the 16th century, was discovered near the investigated site on the plot of Weißgerberstraße 12, where traces of white-leather tanning were found (Mangelsdorf 1992, 175; 1993, 110; see also Enzenberger 2007, 74). The workshop on the plot at Rostgerberstraße 23 could also have been used by white-leather producers from the second half of the 14th century.

Only the property at Rotgerberstraße 24 was still in use by red-leather producers (Enzenberger 2007, 74).

Remains of further tannery workshops were recorded in the southern part of Greifswald. On the plot at Rakower Straße 4, a pit was discovered filled with used tanning material in the form of disintegrated bark. This feature could have been associated with a red-leather tannery (Schäfer H. 2006, 355). Interesting discoveries were made on the plot at Domstraße 25. There was a pit filled with animal bones, mainly cattle, goat and sheep horn-cores, among which a white-coloured mineral substance with was identified. Tannery waste was also lying around the post-built structure located in the front part of the property (Schäfer C. 1997b, 124, Fig. 2a). This workshop operated around the mid-13th century (Schäfer C 1997b, 128) and is considered the workplace of a white-leather tanner (see Schäfer H. 2000a, 73; 2006, 355; Enzenberger 2007, 11, Fig. 5). In the available study of the research results on the Domstraße 25 plot there is no mention of any findings indicating the use of other types of tannins, for example crushed bark (see Schäfer C 1997b), which rather excludes the possibility of using a plant dressing.

In the oldest period of the development of the Kołobrzeg chartered town, production of leather took place in its north-eastern part, a short distance from the moat. The remains of tanneries were identified on plots located at Nr 1 Giełdowa Street and Nrs 35 and 36 Giełdowa Street (Rębkowski 2006b, 451 ff.; Wywrot-Wyszkowska 2008, 89 ff., Fig. 37). Both workshops were located in the front parts of the plots and occupied a relatively large area, and they were in operation from around the end of the 13th century to the first half of the next century. On the Giełdowa 1 property, layers of lime and/or ash mixed with hair or fur were exposed, covering an area of approximately 4 m², one above the other (Fig. 31). Additionally, a stave-built vat with a diameter of c. 80 cm and two pits with regular outlines, diameters of c. 1.4 and 2.0 m and depths of up to 0.5 m were discovered, which could have been pits that had held wooden containers dug into the ground. Between the vat and layers of lime and/or ash mixed with hair, there were remains of a wattle panel, 2.6 m long. It was probably the remains of a building in which the tanning equipment was installed (Wywrot-Wyszkowska 2008, 89–91). In the workshop, apart from visible traces of hair removal from the skins, no fragments of crushed bark used for tanning of 'red' leather were recorded. These observations allow us to assume that the craftsmen working here used mineral substances (prepared from aluminium alum, etc.) used in the production of white leather. It is also possible that the hides were tanned with fats (Wywrot-Wyszkowska 2008, 99, 133).

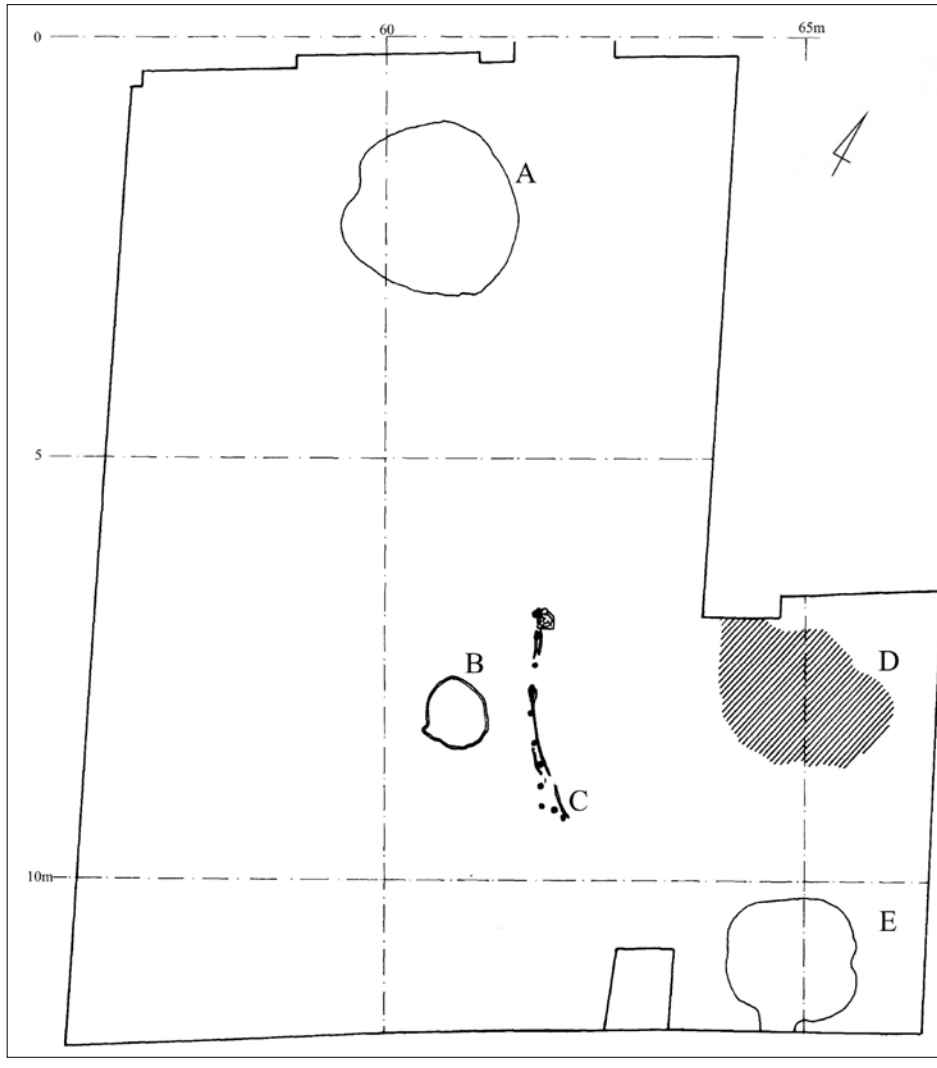

Fig. 31. Kołobrzeg, Nr 1 Giełdowa Street. Plan of features in the tannery workshop. A, E – pits for wooden containers dug into the ground (?), B – wooden vat, C – relics of a wattle wall, D – layers of slaked lime (ash?) and hair mixed with mulch (after Wywrot-Wyszkowska 2008, Fig. 38)

Within the workshop, on plots Nrs 35 and 35 Giełdowa Street, a basin-shaped vessel hollowed out of a tree trunk, measuring 0.9 × 0.8 m, probably a mortar for pounding bark, and five pits sunk into the underlying natural subsoil were discovered (Fig. 32). In their fills, layers of brown mulch, lime mixed with ash and

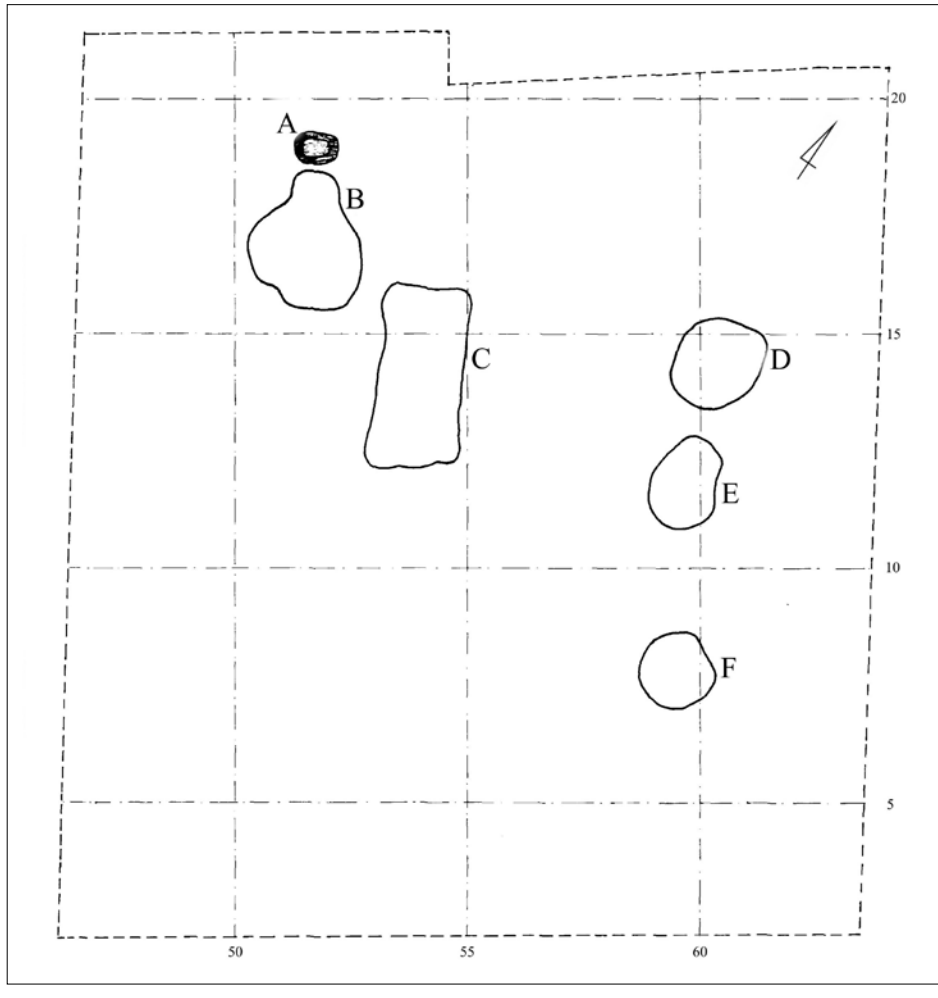

Fig. 32. Kołobrzeg, Nrs 35–36 Giełdowa Street. Plan of features in the tannery. A – wooden vessel for grinding bark (fragment of a mortar?), B–F – remains of pits for tannery equipment (after Wywrot-Wyszkowska 2008, Fig. 39)

hair remains, as well as crushed bark were recorded. Three features close to oval in plan and of diameters ranging from 1.6 to 2.0 m were located in one row. There were further pits approximately 4 m to the west. One of them had a plan similar to a quadrilateral (3.9 × 1.8–2.0 m), while the other was distinguished by its irregular shape and considerable dimensions (3.00 × 2.50 m).

The filling of the pits, consisting of layers of mulch, lime mixed with ash and hair remains, as well as crushed bark, was probably the result of the secondary accumulation of waste found in the workshop premises after its operation had ceased. These features should be considered the pits from which containers used for limeing or tanning hides had been removed. What is worth emphasizing is the regular layout and the relatively large number of these devices. There are no traces of buildings preserved in the workshop area,[41] although it can be assumed that there must have been a building in which at least some of the production equipment was installed. Finds of crushed bark and the presence of a mortar used for pounding it indicate that leather was tanned with vegetable tannins in the workshop (Wywrot-Wyszkowska 2008, 91–99).

Around the mid-14th century, with the appearance of permanent buildings in the north-eastern part of the city, both workshops were moved to another place. According to written records, later leather production was concentrated in tanneries in the southern part of the riverside area,[42] in the region of today's Budowlana Street (Riemann 1924, 99; Merten 1939, 111). In turn, during archaeological research conducted in its northern part, on the plot at Nr 14 Narutowicza Street, finds of leather raw materials were recorded. In its central part, remains of a wooden building were uncovered, inside which there was a trough hollowed out of a tree trunk and numerous lenses of lime (Polak 2016, 18; Dworaczyk, Wywrot-Wyszkowska 2016, 450 f., Fig. 3). A relatively large number of bone remains were recovered from the plot in question, which in anatomical terms represent head bones, including the horn-cores of cattle, sheep and goats (see Gręzak 2016, 207 ff., tab. XII-6). Features related to tanning date to the first half of the 14th century. They should be associated with the oldest phase of use of this part of the riverside area, preceding its parcellation (Polak 2016, 18).

In Stralsund, archaeological evidence identified a tannery in the rear part of the plot at Lobshagen 10, located in the New Town (Kaute, Schäfer 2000). Due to the limited scope of the excavations, only a small part of this workshop was uncovered. Within the excavation, a pit was found filled with production waste related to plant-based leather dressing and near it a water pipe with a water tank at

41 This area was levelled before the brick tenement houses were built. During these works, the buildings associated with the workshop were demolished and its equipment removed. This is evidenced by the fact that the lowest parts of the pits dug for the tannery equipment were recorded only at the base of the cultural layers dug into the upper part of the natural layers under the site (Wywrot-Wyszkowska 2008, 93).

42 This area was incorporated into the city around the mid-14th century (Riemann 1924, 44–45; Rębkowski 1989, 466).

the outlet (Kaute, Schäfer 2000, 199, fig 3). This workshop operated in the period from approximately 1320/30 to the mid-15th century (Kaute, Schäfer 2000, 200). In the 14th century, the area of the New Town was eagerly settled by tanners. In the written records, mentions of about 20 craftsmen involved in leather processing (tanners, leather workers and furriers) date back to this period. Their ateliers were concentrated at Lobshagen, as well as on Frankenstraße, through which there was a road to the pond (Frankenteich) located on the southern side of the city (Bulach 2013, 224 ff., there also further literature).

Interesting discoveries were made during archaeological and architectural research carried out in connection with the renovation of the Stralsund town hall, where huge amounts of used and dried tanning agent[43] and animal bones (mainly fragments of skulls, horn-cores and bones of the lower limbs of cattle and goats) were recorded. This waste had been used as building material to fill the vaults of several rooms of the town hall (Ansorge et al. 2003, 269 f.). The total area of the vaulted rooms was approximately 1,120 m², and the volume of the vaulted spaces was approximately 515 m³, of which approximately 170 m³ was filled with used tanning agents and other waste from leather production (Ansorge et al. 2003, 269). This construction work took place at the end of the 14th century. There is no reason to doubt that the waste discovered in the town hall came from local workshops. What is noteworthy is the huge quantity of material, which may reflect the scale of tanning production in fourteenth-century Stralsund. It must have been significant, since dozens of cubic meters of used tannin and other waste were collected during a single operation.

In Pasewalk, in the northern part of the Lower Town, near the buildings of the Holy Spirit Hospital, remains were uncovered of features, including vats and pits, related to a tannery dating to the turn of the 13th and 14th centuries (Hoffmann V. 2000, 271, 275, Fig. 1; see also Lehmkuhl and Muslow 2005, 280, Fig. 3). Unfortunately, apart from laconic mentions in the archaeological literature, we currently do not have more detailed data regarding these discoveries. There is a little more information about another workshop in this town, located a little further south, at Mühlenstraße 13. Archaeological work covered only a small part of the plot (Hoffmann V. 2000, 271 ff.), and the excavation uncovered the southern part of a wooden building that housed a stave-built vat dug into the ground. The entire complex is dated to the second half of the 13th century (Hoffmann V. 2000, 275, Fig. 3).

43 As archaeobotanical research has shown, the tanning agent at this site was crushed oak bark (Ansorge et al. 2003, 274 ff., tab. 1; 3).

Traces of tanners' activity, mainly in the form of places where production waste was deposited, were also recorded in Rostock (Schäfer H. 2000a, 73). One of them was located on a property located on the southern section of Grubenstraße, where a pit filled with animal bones, leather scraps and hair remains was discovered, dating to the second half of the 13th century. Also found within it were wooden pegs with sharpened ends that are known from other sites to have been tannery utensils (Mulsow 2000a, 202; 2006, 287 ff.). The bone material (755 fragments) was dominated by horn-cores and skull bones mainly of goats and cattle, and much less frequently from sheep (Lehmkuhl 2003, 29, Table 2). During recent archaeological research in this area, an iron drawknife used for cleaning skins was found on the property at Grubenstraße 51 (Konze 2015, 410, Fig. 205:2).

The current Grubenstraße was laid out on the line of a watercourse that ran between the Old and Middle Towns (Mulsow 2006, 287; Bulach 2013, 220). The southern part of the stream was called Pelzergrube, possibly a reference to the skins that were processed there (Koppmann 1902, 4; Münch, Mulsow 2010, 24). In the 14th century, there were also furriers' workshops there (Lehmkuhl 2003, 31 ff., further literature there; see also Mulsow 2006, 287). On the western side of the stream, in the area of the Central Town, there are documentary mentions of the residences of white-leather tanners. They were located along the line initially referred to as Gerberstraße, later called Weißgerberstraße (Mulsow 2006, 287 ff.; Münch, Mulsow 2010, 138 ff.). In the yard of the plot at Weißgerberstraße 4, a significant number of characteristic tanning tools were recorded in the form of wooden pegs sharpened at both ends and a pair of shoemaker's lasts (Schäfer H. 2004e, 608).

In Güstrow, during research in the quarter located in the southwestern part of the city, right next to the walls, remains of wattle structures built on a quadrilateral plan were found (Wietrzichowski 1997; Demuth 2010). Within them and in the immediate vicinity there were thin layers of fine, alluvial sand, indicating that water once flowed there (Wietrzichowski 1997, 168 ff., Figs. 2a; 11; 13). The way they were made, and, above all, their location in a shallow stream, became the basis for the assumption that they were devices used for processing leather raw materials (Wietrzichowski 1997, 169; see also Demuth 2010, 90).[44] These structures were built in the second half of the 13th century (Wietrzichowski 1997, 170) and could still have been in use in the first quarter of the next century (Demuth 2010, 88). They were located in a marshy basin, which was covered with urban fortifications

44 To support this thesis, F. Wietrzichowski (1997, 169, Fig. 12, therein further literature) quotes a sixteenth-century woodcut depicting the work of furriers. There is shown a similar wattlework pen installed in a small stream, in which skins were soaked.

relatively late, only at the end of the 13th century (Wietrzichowski 1997, 159). Their location and construction indicate that we are dealing with devices located outside the workshops, used by tanners and/or furriers to wash or soften leather.[45]

In the light of the information summarised above from the investigation of these sites, it can be seen that the workshops of tanners, especially those engaged in vegetable tanning, were characterized by their large area and similar layout. In each of them there were a number of vats and tannery pits installed in closed buildings and partly in the yards, and sometimes also facilities (wells or water pipes, etc.) for obtaining water, as well as for leading water away from the working area (such as open gutters). Production facilities were usually located at the rear of the plots. Only in the case of workshops in Kołobrzeg was the tannery equipment found near the street. This arrangement may have resulted from the circumstances of their functioning. This is especially visible in relation to the ateliers discovered in the north-eastern part of the city, on today's Giełdowa Street. The results of excavations indicate that in the initial period of the development of Kołobrzeg, this region where the above-mentioned workshops were operating remained largely undeveloped and could have been used for economic purposes or constituted a construction reserve (see Rębkowski 1995, 102; Wywrot -Wyszkowska 2008, 138). It is therefore highly probable that this part of the city remained undeveloped at that time. The plots were probably marked out just before the appearance of permanent buildings, which also brought an end to the activities of the workshops existing here. Despite the rather unusual location conditions of the Kołobrzeg workshops, it can be assumed that if the workshop operated within a designated plot, the associated building (or buildings) and production equipment were located in its rear. Due to the specificity of the tanning process, some of the work took place outside the workshop, on a nearby stream or other body of water. These places stood out in the landscape of the cities of that time by the presence of open piers or other devices, as exemplified by the remains of such structures discovered in Greifswald and Güstrow.[46]

45 The latter activity was generally performed when previously preserved or dried hides were intended for processing, but first the preservatives had to be removed or softened appropriately. Soaking the skins lasted from several hours to several days, and soft water in open tanks was best suited for this purpose (see Jasiewicz 1964, 385 ff.; Turnau 1975a, 41 ff., 91). The long duration of the treatment therefore required appropriate protection against the skins being swept away by flowing water. Pens of woven wattlework were very suitable for this purpose, as they allowed water to flow through them, but protected the skins against accidental displacement.

46 A platform installed in the moat, most likely used by tanners, is visible on the 17th-century plan of Stralsund by Johannes Staude (Enzenberger 2000, 110, Fig. 3, therein further liter-

Osteological analyses of bone remains recorded in workshops or in places where production waste was deposited, as well as raw material analyses of leather products and scraps, indicate that in late medieval Baltic cities, it was mainly the skins of farm animals – cattle, goats and sheep – that were tanned. Only in some centres were the skins of wild animals, especially those from the deer family, used to a limited extent.[47] Craftsmen, mainly tanners and shoemakers, procured raw skins from local slaughterhouses (see for example Bogucka 1962, 183, 185; Bulach 2013, 179 ff.), which also conditioned access to the specific types of raw material used in leather production. This phenomenon is very clearly visible in Kołobrzeg. The results of comparative analyses of assemblages of leather artefacts and post-consumption bone remains from various time periods showed that the supply of specific types of leather in the city depended on the supply of individual species of slaughter animals. The significantly lower frequency of cattle bones recorded for the first half of the 14th century than in the previous century is reflected in the reduced proportion of the skins of these animals in the structure of the raw material used by craftsmen of that time. However, the increase in beef consumption recorded for the second half of the 14th century translated into a larger supply of cattle skins (Wywrot-Wyszkowska 2008, 23, Fig. 6; Grężak 2009, 128). This dependence on the supply of slaughter animals is also visible in the case of Stargard. The percentages of cattle and goat skins found in leather finds (see Wywrot-Wyszkowska 2009b, 127; Stań 2012, 171) correspond very well with the frequency of bones of these animals recorded among post-consumption waste (see Makowiecki 2012, 260 ff.).[48]

Some of the raw material was also imported to the towns.[49] It is not known, however, to what extent the skins imported to these urban centres covered the

ature; see also Bulach 2013, 225).

47 The presence of this type of leather has been determined in the excavated material from: Lübeck (van den Berg, Groenman-van Waateringe 1992, 348, Fig. 3); Szczecin (Kowalska 2013, 88, Fig. 57); Stargard (Wywrot-Wyszkowska 2009b, 127, Fig. 2; Stań 2012, 171); Kołobrzeg (Wywrot-Wyszkowska 2008, 17 f., Fig. 2; 2016a) and Puck (Blusiewicz 2017a, 311, tab. XII.4).

48 These findings should be treated with some caution, as they were based on observations of small groups of leather artefacts and bone remains from only two areas of the city, i.e. from the area of the former Augustinian monastery (Wywrot-Wyszkowska 2009b; see also Archeologia Stargardu 2016) and quarter V (Archeologia Stargardu 2012). Only the inclusion of expert analysis of the raw material in larger collections of leather artefacts and the comparison of their results with the results of osteological analyses will allow a more reliable assessment of the sources of raw material in late medieval Stargard.

49 The import of skins, including from Pomerania, Scania, Sweden and north-eastern Europe, is certified for Lübeck. In customs tariffs, in addition to fur (including ermine, beaver, marten and fox), there are also records of import of the skins of calves, goats, oxen, moose and

demand for the raw material. Information about the import of skins mainly refers to port centres that also acted as intermediaries in their trade. The raw material was also obtained as part of inter-regional exchange. In Lübeck in the 15th century, there were traders who brought skins to the city, purchased, among other places, in southern Denmark (Bulach 2013, 189). It seems, however, that in most centres the skins of animals from local breeding or those brought into the town for slaughter was of primary importance in the manufacture of grain leather.

The branch of leather production best documented in archaeological sources is shoemaking. Fragments of leather shoes are common finds in almost all analysed cities, although the state of the post-excavation processing of this material varies greatly in individual cities.[50] Research on excavated examples of footwear has provided a lot of valuable information about the manufacturing process, i.e. the selection of raw materials, methods of cutting and assembling components and finishing procedures, and has also allowed determination of the assortment of manufactured products (see, for example Schnack 1992; Wywrot-Wyszkowska 2008; 2009a; Kowalska 2013; Blusiewicz 2017a).

Shoemakers mainly used cowhides to produce shoes. They used leather from goats and sheep to a much lesser extent, and only occasionally from animals of the deer family and from horses (see Groenman-van Waateringe, Guiran 1978, 170, Fig. 73; Groenman-van Waateringe, Krauwer 1987, 77; van den Berg, Groenman-vanWaateteringe 1992, 348; Schnack 1992, 28; Volken 2002, 486, Fig, 11; Wywrot-Wyszkowska 2008, 20-21, Fig. 4; 2009a, 148; 2009b, 127; 2016a, 91, Fig. VI-2; Kowalska 2013, 90, Fig. 58; Blusiewicz 2017a, 310 f., 331, tab. XII.5-XII.7).[51] Over

reindeer (Bulach 2013, 189, 191–192). Skins were brought to Gdańsk from the territories of the Kingdom of Poland, Lithuania and Podolia (Bogucka 1962, 184 ff.).

50 To date, larger collections of excavated footwear have been published from Schleswig (Schnack 1992; van de Wall-van der Woude, Groenman-van Waateringe 2001), Lübeck (see Groenman-van Waaterinege 1978; Groenman-van Waateringe, Krauwer 1987; Vons-Comis 1982; van den Berg, Groenman-van Waateringe 1992; Volken 2002), Szczecin (Kowalska 1999; 2009; 2013), Stargard (Wywrot-Wyszkowska 2009b; Stań 2011; 2012; 2013; 2017), Kołobrzeg (Wywrot 1996; 1997; Wywrot-Wyszkowska 1998; 1999; 2016a), Puck (Blusiewicz 2013; 2017a; Starski 2015) and Gdańsk (Wiklak 1967; Wywrot-Wyszkowska 2010, Ceynowa 2020a; Blusiewicz 2022a). However, the studies on the artefacts from Elbląg (Nawrolscy 1989; Marcinkowski 2009), Riga (Bebre 1983; 1987) and Tallinn (Sarv 2000; 2006) are quite modest. Only a few items from Pyrzyce (Cnotliwy, Nawrolski 1996; Kowalska 1996) and Stralsund have been published (see Möller 2004; Brüggemann 2008). Unfortunately, there are no studies on excavated footwear from Wismar, Rostock, Greifswald, Neubrandenburg, Güstrow, Pasewalk or Anklam.

51 It should be emphasized that in Schleswig in the 11th and 12th centuries, mainly goat and sheep skins were used to produce the leather for footwear. Since the end of the 12th century, there was a steady increase in the importance of cowhides, which in the following century

time, the importance of cowhides in shoe production increased, as exemplified by shoe assemblages dating to the second half of the 14th and 15th centuries from Lübeck (Groenman-van Waateringe 1987), Kołobrzeg (Wywrot-Wyszkowska 2008; 2016a), Puck (Blusiewicz 2017a, 311, tab. XII.5–XII.7) and Gdańsk (Blusiewicz 2022a, 423 f., tab. XII.3), distinguished by a high percentage of products made of such raw material.

A characteristic feature of late medieval shoemaking was the production of multi-piece footwear, consisting of a separately cut sole and upper (see Schnack 1992; Wywrot-Wywrotowska 2008; 2009a). The technique of its production is evidence of a very rational management of raw materials. Shoe uppers were generally composed of several elements, which also allowed the use of smaller pieces of leather. The high quality of the products was guaranteed by the use of various strengthening elements which contributed to extending their durability and increasing the comfort of use. The shoes discovered in the towns on the coast of the Baltic Sea can be classified into four main categories: low shoes, medium-high shoes, high shoes and shoes with a high, full upper. Within these basic categories there are various types differing in the method of fastening, the shape of the upper, and the presence or absence of decoration (Figs. 33–35). In all the towns of the region the same styles of shoes were used, made using the same technique, which clearly indicates the standardization of the production process and the design used. The recovered material shows also the relationship between the age of users and the type of shoes they wore.[52] This phenomenon reflects certain customs and specific needs of the townspeople of that time, to which shoemakers had to adapt.

However, it is significant that in the excavated material from Riga (Bebre 1983; 1987), Tallinn (Sarv 2006, 161 ff.) and Tartu,[53] in addition to shoes manufactured according to late medieval standards, there were also products made using the techniques typical of early medieval shoemaking. The presence of such footwear in assemblages from the 13th and 14th centuries proves the survival of local traditions

became the dominant material used in shoemaking (Schnack 1992, 28). Similar observations were made in Lübeck. In the oldest period of its development, the basic raw material for making footwear was leather from the skins of small ruminants. It was only in the 13th century that cowhide became a common material (see below).

52 This mainly concerns the phenomenon of children wearing almost exclusively medium-high and high shoes. With only a few exceptions, among the various styles of low-cut footwear, there were no examples intended for the youngest urban residents. For more on this subject, see: Wywrot-Wyszkowska 2008, 125–127, there further literature.

53 This material is known to me from personal examination.

in shoe production, although it should be emphasized that these are rare finds (Sarv 2006, 161).

During the excavations in the medieval towns discussed here, relatively numerous tools related to leather production, including shoemaking, were also recovered. Knives with crescent-shaped blades, used for cutting leather, come to the fore. Such finds are known, for example, from Schleswig (Saggau 2000, 75 f., Fig. 49:1), Stralsund (Möller 2006, 244, Fig. 4) and Gdańsk (Paner 2006b, 429–430, Fig. 7:3; Trawicka 2010, 98–99, Fig. 3). Another characteristic shoemaker's tool was the cobbler's last, made of wood. Particularly large collections of such items come from Rostock (Schäfer, Patzelt 1992; Mulsow 2000a; Schäfer H. 2004e, 608, Fig. 89:1–2) and Greifswald (Kaute 1998; Ansorge 2005b). Examples have also been found in Schleswig (Saggau 2006, 251, Fig. 39:4), Kołobrzeg (Polak 1999b, 257) and Gdańsk (Paner 2006b, 429 f., Fig. 9:4, 6). Next, we should mention various awls, needles and wooden pegs identified in the excavated material from Gdańsk (Paner 2006b, 429 f. Fig. 7:1-2, 4–7; Trawicka 2010, 98, 121) and Puck (Miścicki 2017a, 207, Fig. VIII.8: 2–5; see also Blusiewicz 2013, 412; 2017a, 351 f.).

It is generally assumed that a significant concentration of various leather scraps is a trace of intensive craft production (see Wywrot-Wyszkowska 2008, 100, there further literature). However, it is not always clear whether the accumulated waste was discovered within or in the immediate vicinity of the workshops, or in a place where it was deposited as garbage removed some distance from their premises. Despite these doubts, on the basis of the available archaeological sources, supplemented with information contained in the written records and the results of specialized analyses of raw materials, it is possible to identify shoemaking workshops and even approximate the nature of their activities. A fundamental criterion for the latter determination that a specific assemblage of waste can be associated with shoemakers' activity is the presence of characteristic scraps of hard and stiff leather used to cut soles.

Significant assemblages of offcuts related to the production and repair of leather products, including footwear, were discovered in Schleswig, in the so-called Schild district (located between Rathausmarkt, Marktsraße, Plessenstraße and Hunnestraße). This waste was widely scattered. Only in the layers from the end of the 13th and the beginning of the 14th century was their greater concentration recorded. It is possible that they came from a nearby workshop, the location of which remains unknown (Schnack 1992, 162).

In Lübeck, on the Hundestraße 95 plot, an excavated assemblage of leather items and offcuts dating to the second half of the 13th century was recovered. The waste included scraps of leather of cattle and goat skins generated during the production

and repair of shoes (Volken 2002, 486, Fig. 11). In the yard of the property a pit was discovered filled with crushed bark, including oak (Grabowski 2002b, 430, Fig. 2). The nature of the above finds has led some researchers to assume that on the plot in question there was a shoemaker's workshop where raw materials were also processed (see Becker et al. 2004, 107). According to the written sources, the lower section of Hundestraße already at the end of the 13th century was the centre of the area where the ateliers of craftsmen dealing with leather processing were sited (Hammel 1987, 212).

Among the leather offcuts obtained in Rostock, noteworthy are groups of such waste excavated in the plots at Kröpeliner Straße, Lagerstraße and Grubenstraße (Mulsow 2000a, 199, 212–213) that can most likely be considered the remains of the workshops of shoemakers.[54] The previously mentioned discoveries on the property at Weißgerberstraße 4 were of a slightly different nature, where wooden shoemaker's lasts and their semi-finished products, as well as evidence relating to tanning have been recorded (Schäfer H. 2004e, 608, Fig. 89:1–2). Perhaps these items were part of the equipment of the shoemaker's workshop, who also tanned the raw material on his own behalf.[55]

Places of concentration of leather products and scraps generated during their production, interpreted as the remains of leather workshops, were discovered in Greifswald on the properties of Steinbecker Straße 26a, Brüggstraße 24 and Markt 11 (Schäfer H. 2006, 355). However, there are no further data enabling the scope of their activities to be ascertained. However, a similar assemblage of finds from the plot at Rakower Straße 11 is associated with shoe production (Ernst 2000, 312, 314 ff.). Another shoemaker's workshop was probably located on the plot of land at 12–13 Rakower Straße. In the excavated material obtained from this plot, in addition to numerous leather finds, the presence of knives, awls and shoemaker's lasts was recorded (Kaute 1998, 131–134, Figs. 1–3; see also Schäfer H. 2006, 355).

54 Some of the material from the research at Grubenstraße is known to me from personal examination. In one of the layers, over 4,200 leather artefacts were found, of which as many as 3,013 are various types of offcuts. They include scraps of hard sole leather and soft upper leather, as well as secondary scraps and fragments of shoes with traces of cutting. This waste should be associated with the production of footwear and repairs and modifications of used products, especially shoes, as well as with the secondary acquisition of raw materials.

55 The results of the archaeological research on the Weißgerberstraße 4 plot were made available only in the form of a short announcement. Therefore, it is not known whether, apart from the above-mentioned finds, there was also production waste here that could be clearly associated with shoemaking (see Schäfer H. 2004e).

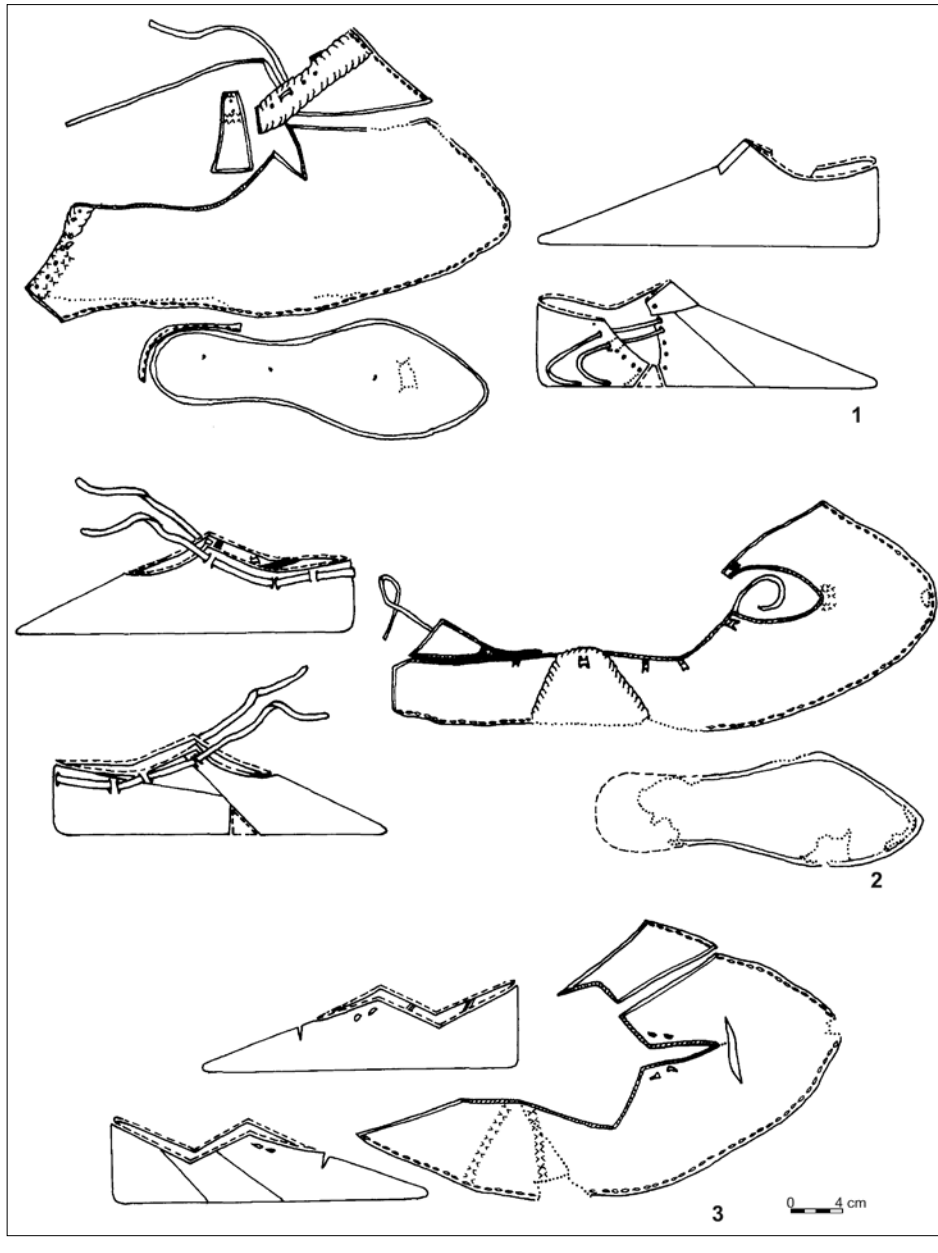

Fig. 33. Kołobrzeg. Selection of leather footwear (after Wywrot-Wyszkowska 2008, tab. VIII; XII; XV)

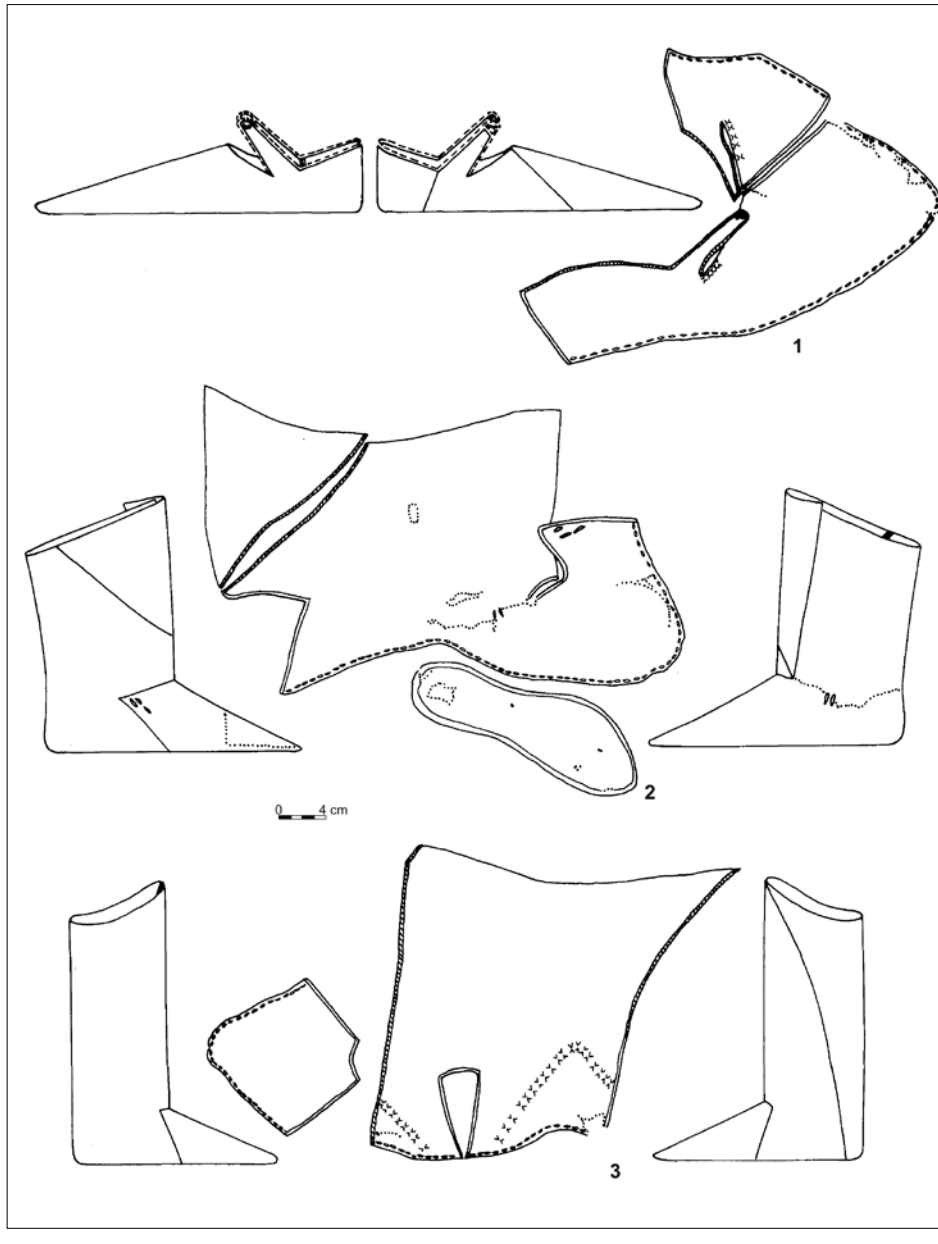

Fig. 34. Kołobrzeg. Selection of leather footwear
(after Wywrot-Wyszkowska 2008, tab. XIX; XXIII; XXIX)

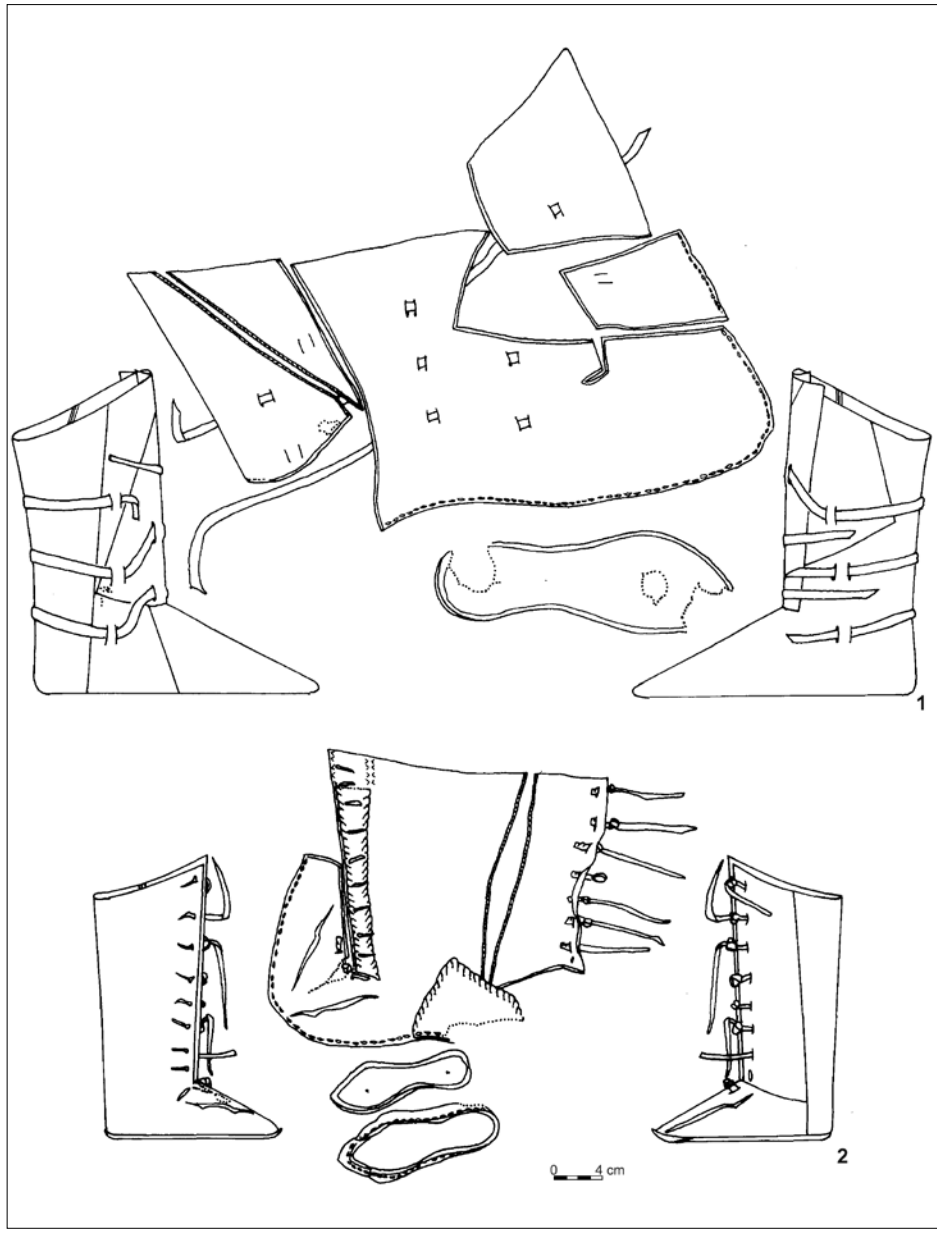

Fig. 35. Kołobrzeg. Selection of leather footwear
(after Wywrot-Wyszkowska 2008, tab. XXVI; XXVIII)

During the recent excavations in Elbląg, two shoemaking workshops were identified. One of them, dating to the second half of the 13th century, was located within the shoemaker's houses next to the church of St Nicholas (see Marcinkowski 2009, 168; Nawrolska 2009, 89). The second atelier was located in the southwestern part of the city, near the buildings of the Holy Spirit Hospital (Marcinkowski 2009, 168, Fig. 1). In several excavations located in Stary Rynek, Nad Kumielą, Sukiennicza and Wałowa Streets, a very high concentration of leather artefacts was recorded (Marcinkowski 2009, 168 ff., Fig. 1).[56] Unfortunately, there is no further information on the nature of these finds, especially concerning the quantity of production waste or their structure. Only in relation to the groups exposed in the north-eastern part of the Old Town was it emphasized that they were distinguished by a high proportion of cuttings (Nawrolska 2009, 89, see also Marcinkowski 2014, 177).

In the market square in Tartu, the remains of a thirteenth-century wooden building approximately 30 m long were excavated. The interior of the building had been divided into several rooms, each of which had a separate entrance. Numerous groups of leather offcuts were recorded within the building. The presence of wooden shoemaker's lasts among these finds indicates that a shoemaker's workshop (or workshops) could have been located here (Mäesalu 2006, 479).

Only a few collections of production waste identified with shoemaking workshops have been the subject of detailed analyses. We have such studies for Kołobrzeg and Puck. They constitute an interesting contribution to learning about the assortment of products manufactured, the raw materials used and the changes taking place in these fields, therefore a more complete presentation of their results seems justified.

Two shoemaking workshops have so far been identified in Kołobrzeg. One of them was located on the plot of Nr 7 Gierczak Street, adjacent to Mariacka Street, which was called Schuhstraße in the Middle Ages (Riemann 1924, 52). This workshop existed already in the 13th century, but its greatest development took place in the first half of the next century. Although archaeological research has covered only a small part of the property (40 m²), it has provided interesting data on the basis of which an attempt could be made to reconstruct the scope of the workshop's activities (Wywrot-Wyszkowska 2008, 102–105). The nature of some of the layers, especially the presence of clusters of hair mixed with lime and/or ash, which are traces

56 As a result of the critical analysis of the archaeological material, it was established that both workshops were engaged in the production of shoes and their repairs. This is evidenced by the presence of scraps of sole leather and secondary offcuts in the assemblage (resulting, among other things, from the secondary extraction of raw material from shoe uppers), as well as shoe elements with traces of cutting off of the better-preserved parts of the leather.

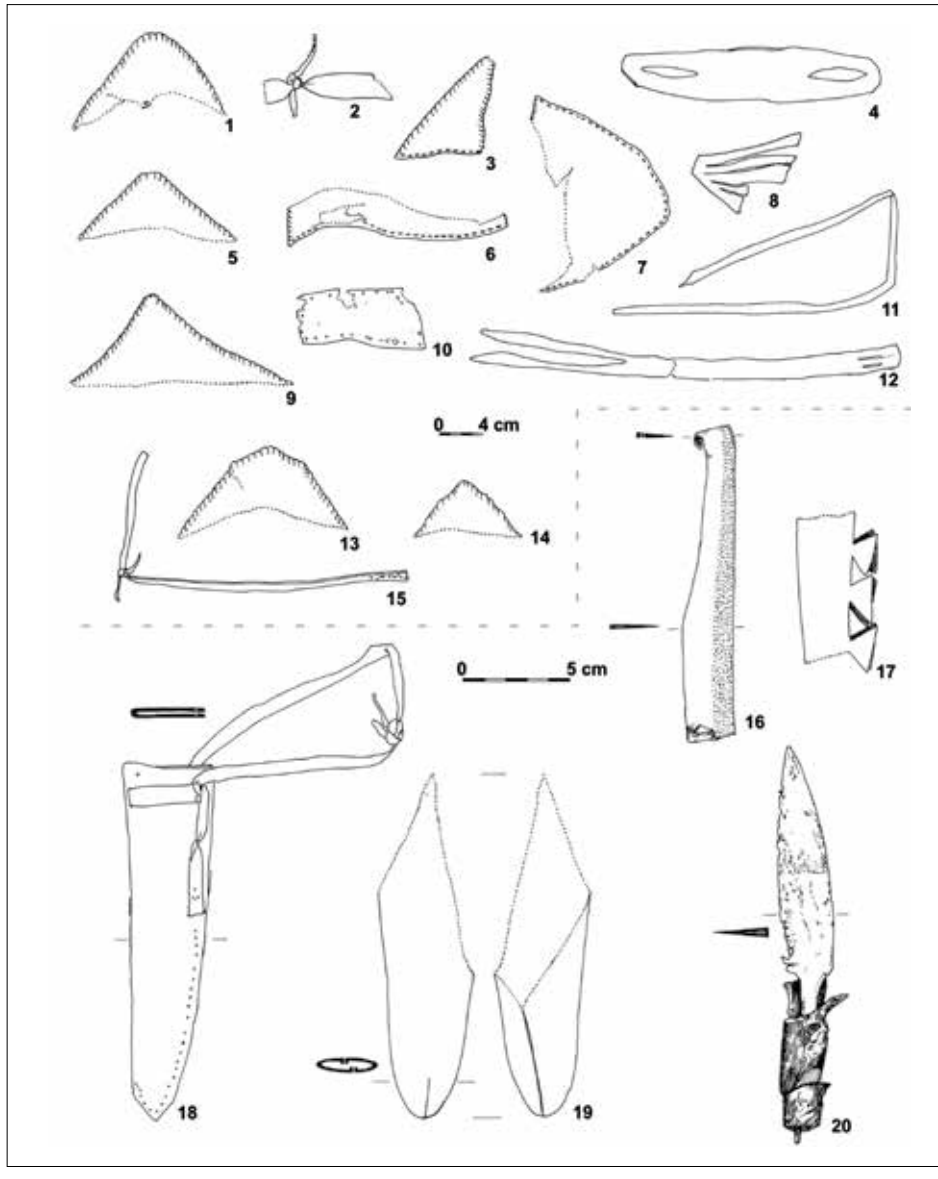

Fig. 36. Kołobrzeg, Nr 7 Gierczak Street. A selection of finds from a shoemaker's workshop. 1–11, 13–15, 17 – leather scraps, 12 – leather belt, 16, 20 – iron knives, 18–19 – leather knife sheaths (after Archeologia Kołobrzegu 2, tab. 46; 58; 60)

of dehairing procedures, indicates that the craftsmen operating here processed the raw material on their own behalf. Unfortunately, no remains of tannery equipment were recorded in the section of the plot excavated. It is possible that they were destroyed later, or were located in a part of the yard outside the site of the archaeological investigation. A knife with a steel working part is also associated with the raw material (Fig. 36:16). Its specially formed blade was perfect for cleaning, fleshing and splitting the skin without the risk of accidentally piercing it (Polak 1997a, 175).

About 50,000 leather artefacts were recovered from the investigated area, including over 47,000 leather offcuts or their fragments (Fig. 37). The size of this assemblage of finds is evidence of the workshop's large production capabilities. This group included offcuts of both hard sole leathers for shoes and relatively soft leathers used for making not only shoe uppers but also leather accessories. The proportions between the materials of both types (there were twenty times fewer offcuts of sole leather than the remains of the leather for uppers and other leather goods), suggests that in this workshop, in addition to footwear, other leather items were also produced on a large scale. This activity was complemented by repairs and alterations of used products, mainly footwear, and only to a small extent other items. This is evidenced by secondary cuttings and fragments (over 300 pieces) of shoes, as well as knife sheaths and cases, on which traces of cutting off of better preserved parts of the leather were found. This workshop also dealt with production of items using furs, although to a very limited extent (Wywrot-Wyszkowska 2008, 105).

The other Kołobrzeg shoemaker's workshop that has been studied in detail had activities of a slightly different nature. This was also located on today's Gierczak Street, but at plot Nr 37 and it functioned from the second half of the 14th century. Nearly 11,800 leather offcuts were recorded within its area. This assemblage is characterized by a relatively high frequency of pieces of sole leather, which are only five times less common than those cut from the soft leather of uppers. This structure of the scraps suggests that they were created primarily during shoe production. Other items were produced only to a small extent, which is confirmed by the meagre number of pieces of thin and delicate leather for accessories and clothing. A very important place in the workshop's activities was occupied by shoe repairs and alterations. Among the waste, an exceptionally high percentage (almost 40%) of secondary offcuts was recorded, being a by-product primarily of the alteration of shoe uppers. This waste was accompanied by numerous finds (1,244 items) of shoe fragments with cutting marks. (Wywrot-Wyszkowska 2008, 106). As in the case of the workshop discussed above, the manufacture of items using pelts with fur played a marginal role (Wywrot-Wyszkowska 2008, 105–108).

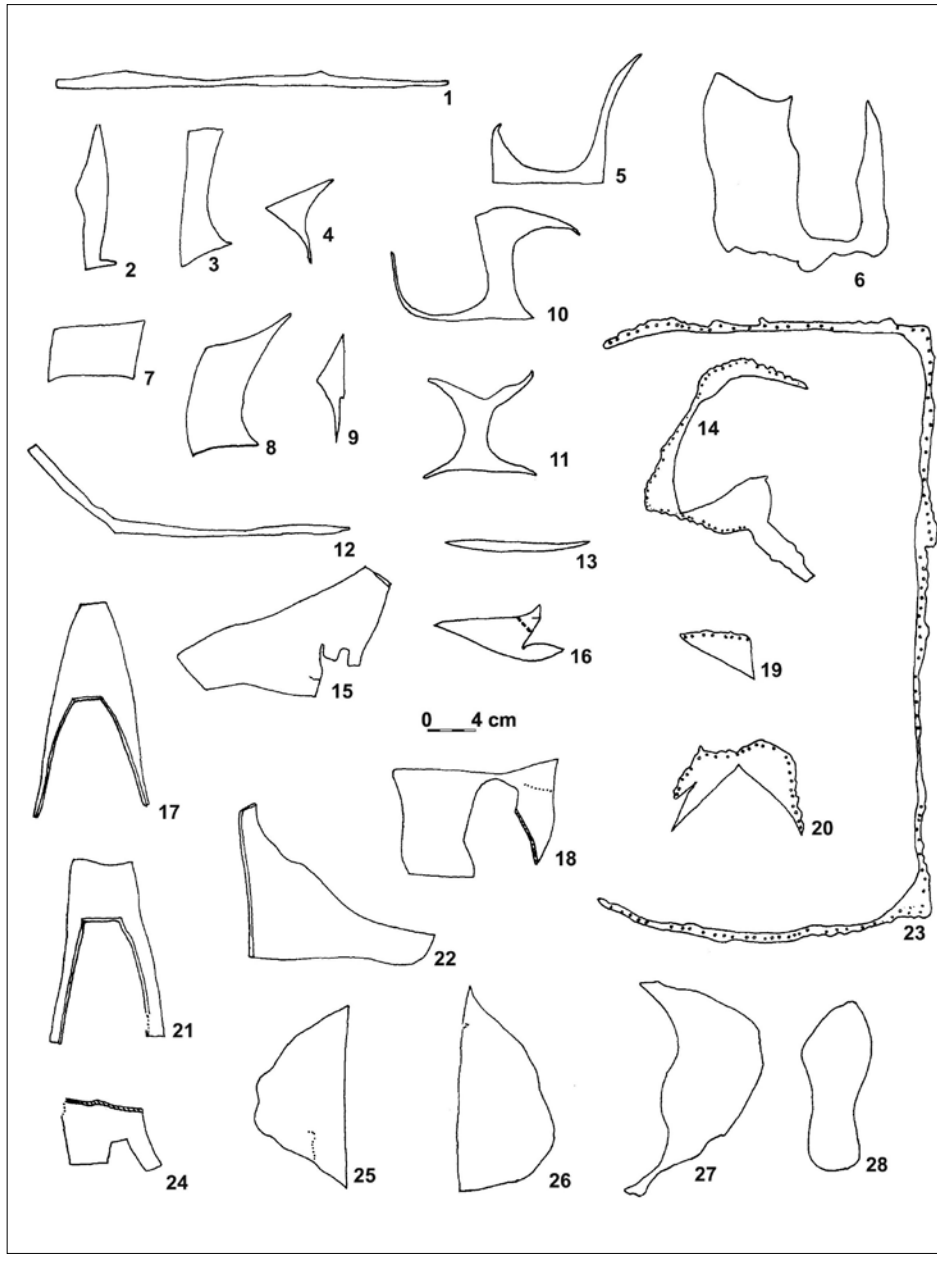

Fig. 37. Kołobrzeg, Nr 7 Gierczak Street. A selection of leather waste from a shoemaker's workshop (after Wywrot-Wyszkowska 2008, tab. XLIV)

Certain differences shown on the basis of the macroscopic assessment of the structure of the waste, relating to the scope of activities conducted in these two workshops, are confirmed by the results of raw material analyses. Although the list of animal species whose skins were used in both workshops is the same, they differ in the frequency of use of particular types of raw material.[57] In the workshop on the Gierczak 7 property, cattle skins constituted approximately one third, and on the Gierczak 37 plot, cattle skins constituted more than half of the remains included in the analysis. Moreover, at the Gierczak 7 property the skins of goats, sheep, horses and animals from the deer family were used much more often than at Gierczak 37. This material was generally used more often for the production of accessories (bags, purses, cases, gloves – see Radek 1997, 209 ff., tab. VIII-4).

In the waste from the workshop on the Gierczak 7 site the occurrence of sheep, horse and deer skins is in some cases twice as high as in the material from the workshop on the property at 37 Gierczak Street. The relatively high percentage of these different types of leather in the former indicates that production was not only of footwear, but also of accessories and clothing items. Cowhide leather was the basic raw material used in shoemaking; that is probably why this material dominates the waste found in the workshop on the Gierczak 37 site, which specialized in shoe production (Wywrot-Wyszkowska 2008, 110 ff.). The older workshop (operating in the 13th and the first half of the 14th century) on the Gierczak 7 site was characterized by a more diversified activity. In the case of the later workshop (dating from the second half of the 14th century) on the Gierczak 37 site, a clear narrowing of the work performed is visible; it concentrated mainly on activities related to the production of, repairs to and alterations of footwear. These differences may be a manifestation of specialization progressing over time and the resulting professionalization of shoemaking in late medieval Kołobrzeg (Wywrot-Wyszkowska 2008, 133).

The results of the analysis of production waste obtained in Puck confirm the existence of shoemaking workshops already in the initial phase of the city's development. In the market square, in layers from the third quarter of the 14th century, a significant concentration of leather offcuts was recorded. It is not known, however, whether they were related to the workshop operating there, or whether they could have ended up on the market square as part of material dumped there to

57 The analysis of the raw material of the offcuts from the workshop on the Gierczak 7 property showed the proportions were as follows: cattle skins (34.7%), goat skins (22.1%), sheep skins (11.2%), goat/sheep skins (0.8%), horse skins (7.5%), deer (8.1%), beavers (0.2%) and various carnivores (4.2%). However, in the sample of waste from the workshop on the plot Gierczak 37, the proportions were: cattle skins (54.7%), goat skins (18.9%), sheep skins (4.1%), goat/sheep skins (4%), horse skins (4.7%), deer (4%), beavers (0.7%) and carnivores (3.4%).

improve or level its surface (Starski 2015, 186; Blusiewicz 2017a, 351). However, no such doubts are raised by the groups of production waste discovered in the back of the plots at Nr 4, 10 Lutego Street and Nr 14 Plac Wolności, dated respectively to the fourth quarter of the 14th century and the second half of the 15th century (Blusiewicz 2017a, 351 ff.). In these workshops, in addition to shoes, leather goods were produced. They also repaired shoes and probably other items on a small scale. The presence in the excavated material obtained on the 10 Lutego site of fragments of patten tops showing traces of cutting may indicate that the shoemaker working here was also involved in repairs or even production of wooden and leather protective footwear (Blusiewicz 2013, 412; 2017a, 352). In this workshop, tools for leather processing – a needle and four iron awls – were also found (Blusiewicz 2017a, 351). Puck shoemakers tanned the leather themselves. In the workshop at Plac Wolności 14, three oak vats were discovered containing remains of lime and numerous tufts of hair. These features and the waste accompanying them were associated with the stage of the process consisting of removing the hair from the skins and preparing them for tanning (Blusiewicz 2017a, 352).

The various groups of offcuts from the Puck workshops are characterized by a variation in the proportion of pieces cut from sole leather, ranging from 4.6% to 12.3%. The lowest percentage of such waste was found in the oldest group, from the third quarter of the 14th century, obtained in excavations in the market square, and the highest percentage of such waste was found among the remains from the Plac Wolności 14 site, which is the latest workshop, dating from the second half of the 15th century (Blusiewicz 2017a, 344 f., tab XII.12). The percentage of sole leather scraps may, to some extent, determine the scale of shoe production carried out in individual workshops. Over time, it clearly gained importance, while the production of other leather items was gradually marginalized. This phenomenon is reflected in the structure of the raw material used, especially in relation to cattle leather, which was the basic material used to make footwear. While in the oldest workshop this constituted approximately 68% of the raw material used, in the latest workshop the percentage reached almost 93% (Blusiewicz 2017a, 344 ff., tab. XII.11). These observations seem to confirm a process over time of directing and narrowing the activities of these craftsmen to the production and repair of shoes. As has been noted above, this process was also observed in the case of Kołobrzeg.

The presented results of analyses of assemblages of finds, mainly leather offcuts, identified with shoemaker's workshops indicate that a relatively wide range of activities were carried out there. It seems that, in the case of the evidence from Kołobrzeg and Puck, in the initial period of the development of municipal towns, shoemakers produced a wide range of leather items in addition to footwear. Over

time, however, their activities were limited primarily to the production and repair of shoes. In Kołobrzeg, this process became visible only after almost a hundred years of operation of the chartered town, around the mid-14th century. However, in Puck, founded much later (in the mid-14th century), it progressed much faster, as clear signs of the professionalization of the shoe industry are noticeable already after several decades of the city's development, in the last quarter of the 14th century. Due to the lack of appropriate analytical studies, it is currently difficult to assess the degree of professionalization of shoemaking production in the other Baltic cities. However, it should be assumed that this process was similar, although in larger centres – such as for example Lübeck, Rostock, Stralsund, Greifswald or Gdańsk, where there was a great deal of occupational diversity – it could have been initiated much earlier, most probably as early as the 13th century.

Shoemakers had the right to tan leather, primarily for their own use. However, not all craftsmen took advantage of this privilege, mainly due to financial and space limitations (Bulach 2013, 145, 239 ff.). This is also reflected in the archaeological evidence, as only in some workshops were traces of leather tanning recorded. Probably some of the masters, especially the poorer ones, obtained their raw materials from tanners.

Documents from the 14th and 15th centuries mention the use by shoemakers of tanneries that were the common property of the entire guild. Such facilities existed, among other places, in Lübeck, Wismar, Greifswald (Bulach 2013, 276 ff.), Kołobrzeg (Riemann 1924, 99), Gdańsk (Bogucka 1962, 128) and Riga (Stieda, Mettig 1896, 11 ff.). One of the Lübeck tanneries was identified by excavation. During research at Weberstraße, in addition to numerous remains of skins, the elements of a tannery were discovered in the form of boxes sealed with a clay coat up to their full height. These features may be identified with the tannery located near Wakenitz, which was bought by the shoemaker's guild in 1440 (Mührenberg 2002a, 90; 2006, 259; see also Bulach 2013, 276).

Almost all of the workshops presented above were identified based on finding concentrations of dumped waste offcuts which makes it much more difficult to learn about issues related to the actual premises used by shoemakers for their workshops. The size and equipment of their workshops depended primarily on the type of business they conducted. Craftsmen who tanned leather themselves had to have sufficiently large facilities to enable the installation of the necessary stationary equipment: vats, boxes or tanning pits. The discoveries of workshops from Lübeck (on the Hundestraße 95 property), Kołobrzeg (on the Gierczak 7 site) and Puck (on the Plac Wolności 14 plot) indicate that this part of the activity took place in the courtyards in the rear of the plots. However, the rooms where the products were

made were probably located within the residential part of the property. In the case of shoemakers who purchased leather from a producer or used common tanneries to make their own, rooms that could accommodate a work table and the necessary tools and materials were quite sufficient (see Turnau 1975b, 55 ff.). The location, size and equipment of such workshops probably depended on the financial condition of individual masters.

In addition to the leather shoes discussed above, the assortment of footwear available for use by the inhabitants of late medieval cities also included pattens.[58] These were protective overshoes with a wooden sole and a leather upper that could be slipped over other footwear to protect it when going out. The chronology of some finds in Szczecin (Cnotliwy 1994, 204) and Elbląg (Domagalska 2007, 455) indicates that wooden and leather pattens appeared in the region discussed here as early as the 13th century, although they became popular only in the 14th century and were still in use in the 16th century (see Wywrot-Wyszkowska 2002, 103; Ceynowa 2005a, 320). The particular popularity of this type of footwear at the end of the Middle Ages is evidenced by exceptionally numerous finds in Gdańsk, obtained from deposits dating to the 15th and 16th centuries (see Ceynowa 2003; 2005a; 2005b; 2009a, tab. 1, chart 1). In addition to wooden and leather clogs, other types of protective footwear were also produced. In the 15th century, the production of leather pattens became popular, and at the turn of the 15th and 16th centuries, so-called mule shoes appeared (Ceynowa 2009a, 97, 99).[59] So far, most of these items have been recorded from Gdańsk (Ceynowa 2007; 2009a).

Initially the manufacture of these overshoes was done by shoemakers, which is confirmed in archaeological and written sources. As mentioned above, in one of the shoemaking workshops in Puck (on the property of Nr 4, 10 Lutego Street) traces were recorded indicating the production and repair of such footwear (Blusiewicz

58 Such footwear is known from finds at: Lübeck (Groenman-van Waateringe, Krauwer 1987, 79); Wismar (Buchholz 1994, 67, Fig. 14; Bleile 2005, 149); Rostock (Bleile 2005, 150, Fig. 5; Mulsow 2005c, 430, Fig. 6); Stralsund (Möller 2004, 125, Fig. 4a); Szczecin (Cnotliwy 1994); Stargard (Stań 2017, 200, Fig. 3); Pyrzyce (Gutkowska-Rychlewska 1967); Kołobrzeg (Wywrot-Wyszkowska 2002; 2016a); Puck (Blusiewicz 2013, 410–411, Fig. 9; 2017a, 339 f., Fig. XII.20); Gdańsk (Ceynowa 2003; 2005a; 2005b; 2009a; 2020a; Blusiewicz 2022a); Elbląg (Domagalska 2007) and Tartu (Vissak 1994, 76, Taf. XXXI:4–5).

59 Leather pattens were characterized by a specific sole design. It consisted of two layers of leather, between which an insert made of cork or cork and wood was placed. Such a sole was lower in the front part and higher in the rear part (see Ceynowa 2009a, Fig. 8). Mule shoes were shaped like modern slippers. They had a covered front part that was rounded, and the rear part remained open. As in the case of leather pattens, their soles were raised at the heel (see Ceynowa 2007, Figs. 2.c; 9).

2017a, 352). The statute of Lübeck includes provisions allowing the production of pattens by shoemakers, although only under certain conditions (Bulach 2013, 146). With time, the manufacture of these overshoes developed as a separate craft. The emergence of this specialization can be traced through documents, such as those mentioning patten-makers in Riga in the 14th century (Stieda, Mettig 1896, 38). However, it was not until the 15th century, and usually in larger centres, that there were guilds of patten-makers, such as in Lübeck, Wismar (Bulach 2013, 148 ff.), Rostock (Dragendorff 1896, 90) and Gdańsk (Hirsch 1858, 298). These craftsmen are also attested in sixteenth-century documents from Kołobrzeg (Riemann 1924, 377 ff.) and Elbląg (Domagalska 2007, 455, there further literature).

The exceptionally large number of examples of protective footwear from the 15th and 16th centuries excavated in Gdańsk proves not only the extraordinary popularity of such shoes in that city, but also their mass production there. The significant size of this industry is also supported by guild documents. In the statute of the local shoemakers from 1439, the weekly norm for a good journeyman was to carve 100 wooden soles (Hirsch 1858, 317). It is possible that at the end of the Middle Ages, in other large Baltic cities, the production of pattens and various other types of overshoes was at a similar level, although in the light of archaeological sources, Gdańsk seems to be the leading centre of their production.

Another professional group associated with footwear were shoe-patchers. Patchers were mainly involved in shoe repairs and the production of footwear from used leather (Bogucka 1962, 127; Bulach 2013, 150). Written sources from the 14th–15th centuries confirm the presence of such craftsmen in Lübeck, Wismar, Stralsund (Bulach 2013, 150 f., 255), Rostock (Dragendorff 1896, 90), Greifswald (Kattinger 2000a, 84) and Gdańsk (Hirsch 1858, 327; Bogucka 1962, 127). Remains of the specialized and large-scale activities related to shoe repairs and alterations have so far only been recorded within shoemaking workshops (see above). In none of the cities discussed was it possible to discover production sites that could be clearly associated exclusively with the sewing workshops of these craftsmen. Nevertheless, the results of analyses of excavated material allow us to obtain some idea of the scope of their activity. Studies of finds from the second half of the 14th and 15th centuries, obtained in Kołobrzeg from the quarter at the corner of Narutowicza and Rzeczna Streets, turned out to be particularly interesting (Wywrot-Wyszkowska 2015; 2016a). The recovered artefacts, including exceptionally numerous pieces of used leather, were lying in layers of mulch brought to that plot to raise the usable level of the ground and dry the muddy land. These offcuts, together with the accompanying leather items, most likely came from the workshop (or workshops) of shoe-patchers (Wywrot-Wyszkowska 2016a, 121–123).

The nature of the activities involved in the repair of shoes and the production of footwear from used leather by these craftsmen (Bogucka 1962, 127; Bulach 2013, 150) had a decisive impact on the type of raw material they used. They obtained the leather almost exclusively from used shoes (Reith 2003, 49 ff.). Various shoe elements were reutilised – for example, patches, soles, heels, fastenings, straps and linings were made from pieces of leather cut from the soles or uppers (Wywrot-Wyszkowska 2016a, 108). Some of the soles of used shoes could be used for repairing or replacing the soles of other shoes. Shoe alterations performed by patchers consisted mainly of adapting the shapes and dimensions of used shoes that were probably partially worn out and no longer being worn, to the new needs of their users or new owners (Wywrot-Wyszkowska 2015, 31; Jędrzejczak-Szkutnik, Rembisz-Lubijewska 2018, 85).

Among the above-mentioned finds from Kołobrzeg, a relatively large series of shoes was identified, probably the product of patchers. These include items with tops composed of a larger number of components than was usually practiced, and in some cases they were even pieced together. The way they are cut indicates not so much economic management of leather material, but rather attempts to cope with the shortage of appropriate raw material (Wywrot-Wyszkowska 2016a, 97). Next, we should mention products in which the upper elements were cut from different types of leather in terms of species, assortment and quality of the material (Radek 2016, 133). This assemblage also included the presence of shoes made of sheepskins, generally rarely used by Kołobrzeg shoemakers due to their poor quality (see Wywrot-Wyszkowska 2009a, 148 ff.).

The use of different types of leather and the lack of consistency in the selection of raw materials when cutting the components of the uppers clearly differed from the standards applicable in the footwear industry in Kołobrzeg. Such actions were not allowed in the case of shoemakers, especially those associated with a guild, obliged to comply with specific quality standards. Unlike patchers, shoemakers had much better access, as provided for in guild regulations, to the appropriate raw material. Patch makers, however, usually had great difficulties in obtaining new skins, so they had to use recycled or inferior material (Wywrot-Wyszkowska 2015, 33; 2016a, 124). It is interesting to note in this context the provisions in fifteenth-century Rostock documents that allow patch workers to use – but only for shoe repairs – only the less valuable parts of cowhides, that is, those cut from the front or neck. Similar recommendations are also included in the Lübeck guild acts (see Bulach 2013, 151 ff., there further literature).

In late medieval towns, in addition to the above-mentioned craftsmen, many other specialists were involved in the production of items from grain leather,

including leather workers, glove makers, saddlers and harness makers. Traces of their activities are most often recorded in the form of finished products, including sword scabbards (and the leather collars at their mouths), sheaths of daggers and puginals, knife sheaths, pouches, bags, needle cases and other cases, gloves, belts, elements of harness and riding equipment.[60] These products are characterized by standardized design, decoration and high quality of workmanship, which was achieved through careful selection of raw materials,[61] and the use of standardized cutting and assembly techniques. The close examination of the material shows that these items were created as a result of mass production carried out by specialized craftsmen.

Only in Kołobrzeg have production sites related to such activities been identified. The oldest workshop, operating in the fourth quarter of the 13th century and probably at the beginning of the 14th century, was located in a building with wattle walls, located at the back of the property at Nr 5A Armii Krajowej Street. In this workshop knife sheaths with metal fittings were produced. This is evidenced not only by the leather waste, which included almost exclusively scraps (over 800 pieces) of soft and delicate goat, sheep, calf and deer leather, but also (Polak 1999a, 221

60 Such objects have been found in: Schleswig (Schnack 1998; van de Walle-van der Woude 2001); Lübeck (Groenman-van Waateringe, Guiran 1978; Groenmann-van Waateringe, Krauwer 1987; Vons-Comis 1982; van den Berg, Groenman-van Waateringe 1992; Volken 2002); Stralsund (Möller 2004); Greifswald (Schäfer C. i H. 1997; 1998); Pyrzyce (Cnotliwy, Nawrolski 1996; Kowalska 1996); Szczecin (Kowalska 2013); Stargard (Wywrot-Wyszkowska 2009b; Stań 2012; 2013; 2017); Kołobrzeg (Wywrot-Wyszkowska 2008, 2016a); Puck (Blusiewicz 2017a); Gdańsk (Ceynowa 2005b; 2008; 2009b;2020b; 2020c; 2020d; 2020e;Wywrot-Wyszkowska 2010; Blusiewicz 2022a); Elbląg (Marcinkowski 2009; Nawrolska 2009); Riga (Bebre 1998; 2002; 2009) and Tallinn (material known to me from personal examination). Quite frequent finds also include loose examples of the iron fittings for sheaths and belt buckles and various applications used to decorate them (see for example Kowalska 2013; Janowski 2016a). The excavated material also include stirrups, which were integral elements of saddles, and other metal parts of horse harnesses and riding equipment (see for example Schäfer, Brandt 1996; Polak 1996a; 1997a; 1998a; Janowski 2016a). In turn, wooden saddle elements have been discovered in Schleswig (Mayer-Küster 2006) and Greifswald (Bleile 2005, 147 f. Fig. 3).

61 The results of research on raw materials of the finds from Kołobrzeg show that craftsmen of that time producing leather goods used two main types of leather. The first one is hard leather obtained from the skin of cattle, horses and calves, from which sword sheaths, cases, belts and other saddlery products were made, and sometimes also knife sheaths. The second one is soft skins, of goats, sheep, animals from the deer family, and appropriately treated cattle and calf skins, used for the production of knife sheaths, purses, clothing items and cases (Radek 1997, 209 ff., tab. VIII-4). Analogous results relating to raw material preferences in the production of particular categories of leather goods were also observed in the case of artefacts discovered in Schleswig (Schnack 1998, 36, Fig. 17).

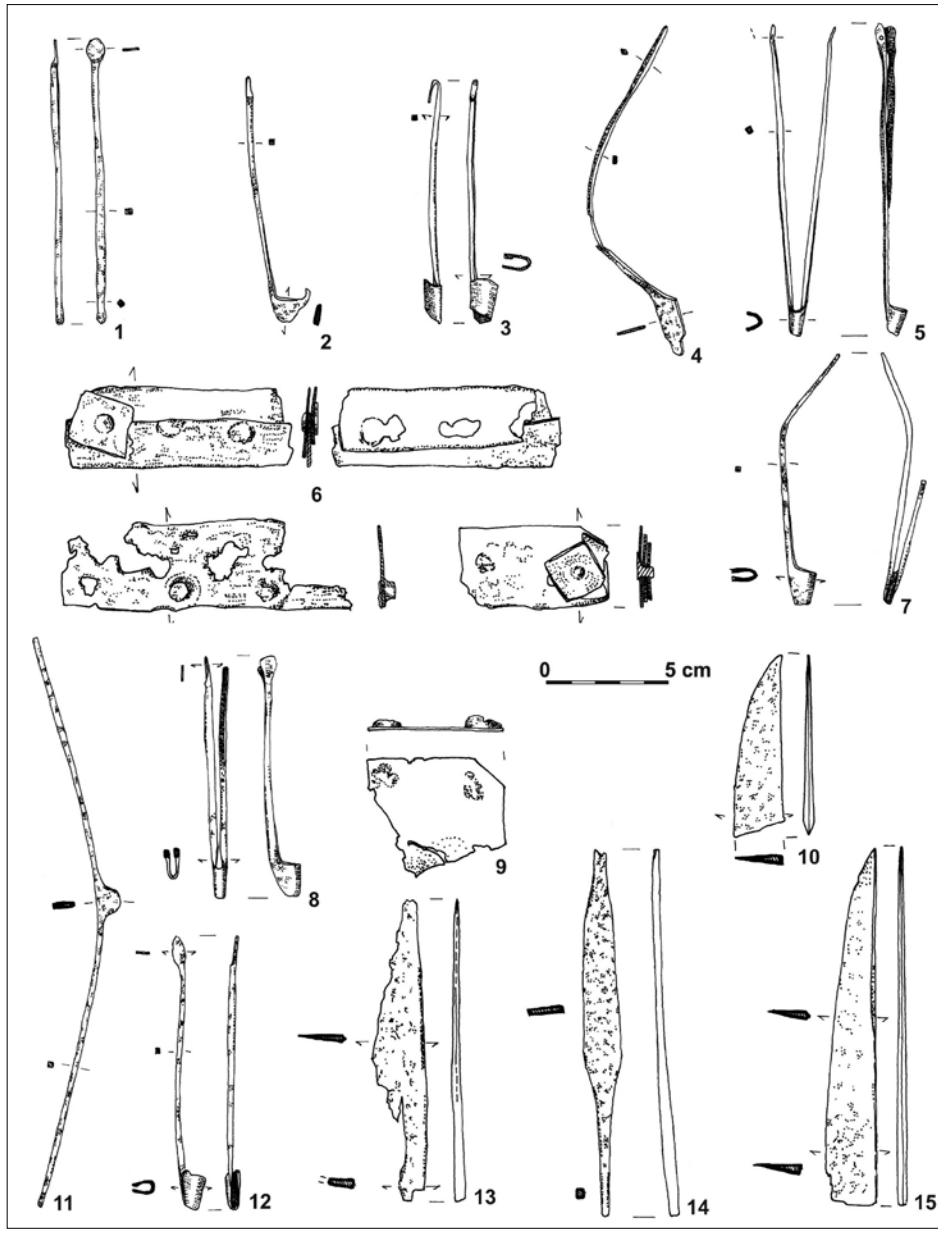

Fig. 38. Kołobrzeg, Nr 5A Armii Krajowej Street. A selection of finds from the leather-worker's atelier. 1, 4, 11 – semi-finished metal sheath fittings; 2–3.5, 7–8, 12 – metal sheath fittings; 6.9 – pieces of iron sheets; 10, 13, 15 – iron knife fragments, 14 – iron bar (after Wywrot-Wyszkowska 2017, Fig. 13)

ff.) by the finding of about fifty different items illustrating almost all stages of production of the iron fittings of sheaths (Fig. 38:1–5, 7–8, 11–12). Additionally, fragments of several knives with similar shapes and dimensions were found (Fig. 38:10, 13, 15) as well as 27 sheaths, including specimens with preserved rivets and traces of fittings (Fig. 39), as well as pieces of copper wire and rolls of copper and bronze sheet metal (Wywrot-Wyszkowska 2008, 114). In the workshop in question, waste generated during the production of solid bone and antler handles and the bone or antler plates to be attached to a flat tang (Fig. 40:2) was also recorded (Rębkowski 1999b, 227). These finds clearly indicate that knife sets were made here. These activities consisted of fitting handles on knives and equipping them with locally made leather sheaths with metal fittings (Wywrot-Wyszkowska 2008, 114). What is particularly interesting is that this was not the only activity of the craftsman working here. Finds of pieces of iron sheets, including pieces connected with rivets (see Fig. 38:6, 9) and loose loops, evidence the production or repairs of iron cauldrons (Polak 1999, 223). This activity was complemented by the production of single-layer combs with horn sheaths, as evidenced by the presence of sheep, goat and cattle horn-cores with traces of processing (Fig. 40:1, 3–4) among the production waste (see Rębkowski 1999b, 272 ff.).

A similar workshop was located on the property at Nr 36 Narutowicza Street. It was located in the cellar of the frame-built house on the street frontage, and its activity took place in the first half of the 14th century (Wywrot-Wyszkowska 2008, 114 ff.). A relatively large assemblage (over 900 items) of offcuts from soft hides was obtained from the layers lying inside the cellar. In its fill, there was a significant concentration of finished products – knife sheaths, cases, as well as bag elements and relatively large, decorated pieces of leather (pieces of clothing?) that showed traces of alterations and secondary extraction of raw materials (Fig. 41). These finds were accompanied (Rębkowski 1997, 239 ff.) by production waste and semi-finished products created during the production of knife handles of bone and antler, as well as the handles themselves (Fig. 42). The nature of the finds indicates that cutlery sets and leather goods were made in this workshop, including bags, pouches and cases. The workshop was probably also involved in the alteration and/or repair of leather items – bags and clothing items (Wywrot-Wyszkowska 2008, 115).

A leather workshop where similar activities were carried out was identified at Nr 9 Ratuszowa Street (Wywrot-Wyszkowska 2008, 115 ff.). In the yard of the property, in a layer dating to the late 14th century, a concentration of leather offcuts (almost 500 items) was recorded. The main component of this assembly were scraps cut from soft and delicate leather used for the production of a variety of leather goods. Only a small percentage of them (less than 8%) were the remains of

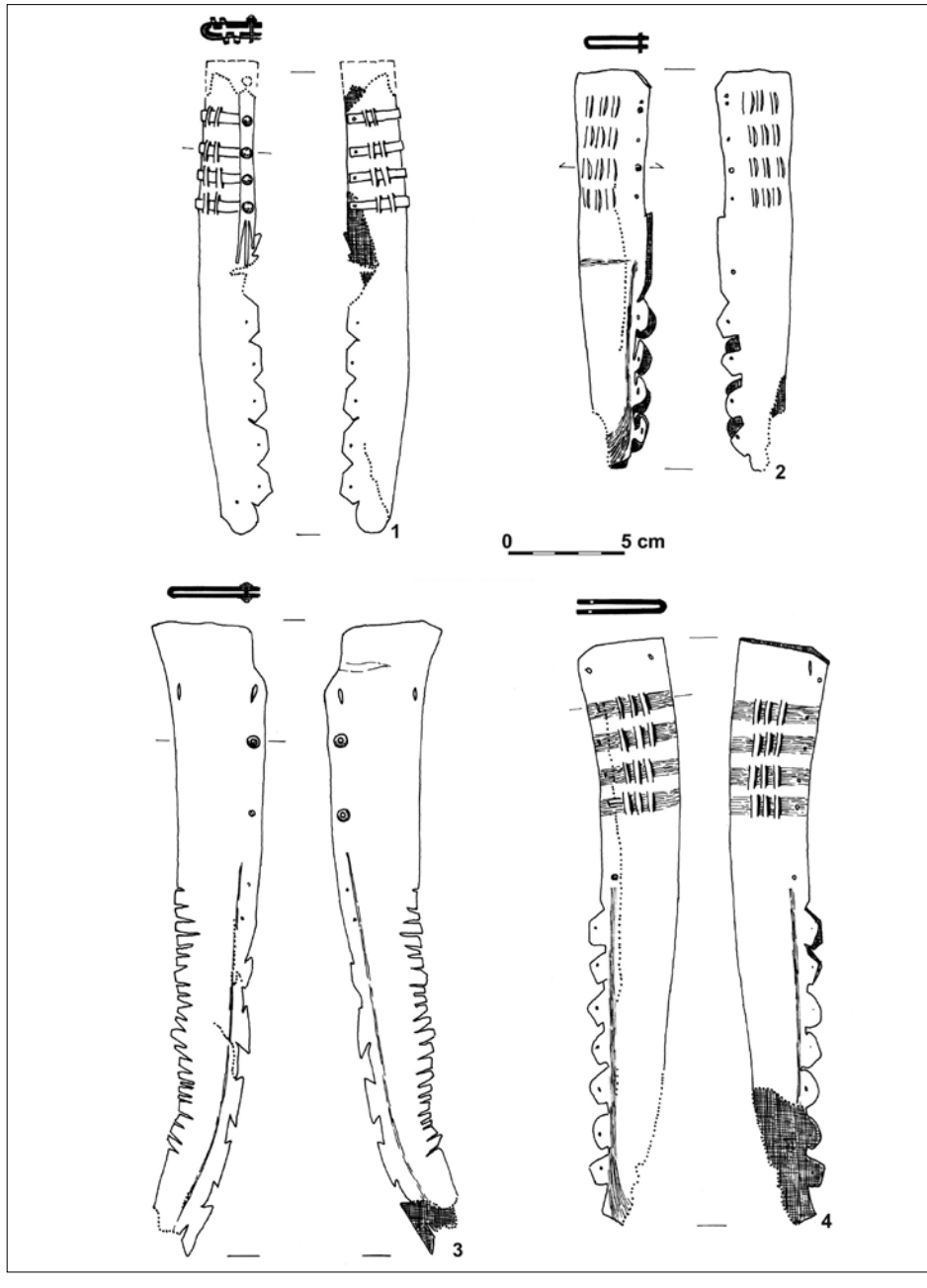

Fig. 39. Kołobrzeg, Nr 5A Armii Krajowej Street. A selection of knife sheaths from a leather-worker's atelier (after Archeologia Kołobrzegu 4, tab. 19; 32)

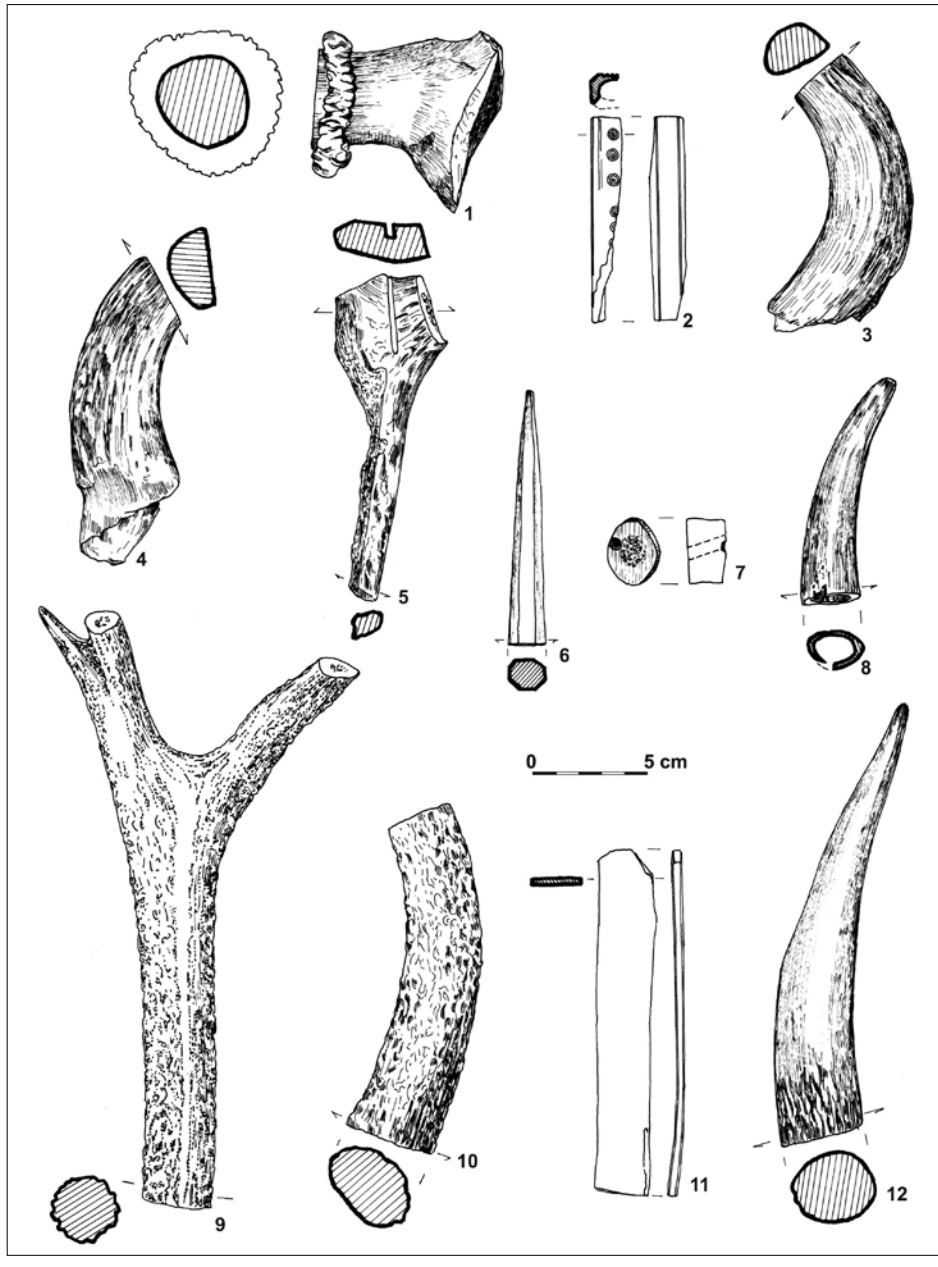

Fig. 40. Kołobrzeg, Nr 5A Armii Krajowej Street. A selection of finds from the leather-worker's atelier. 1, 3–12 – waste from the production of objects made of bone, antler and horn, 2 – fragment of a bone knife handle (after Wywrot-Wyszkowska 2017, Fig. 12)

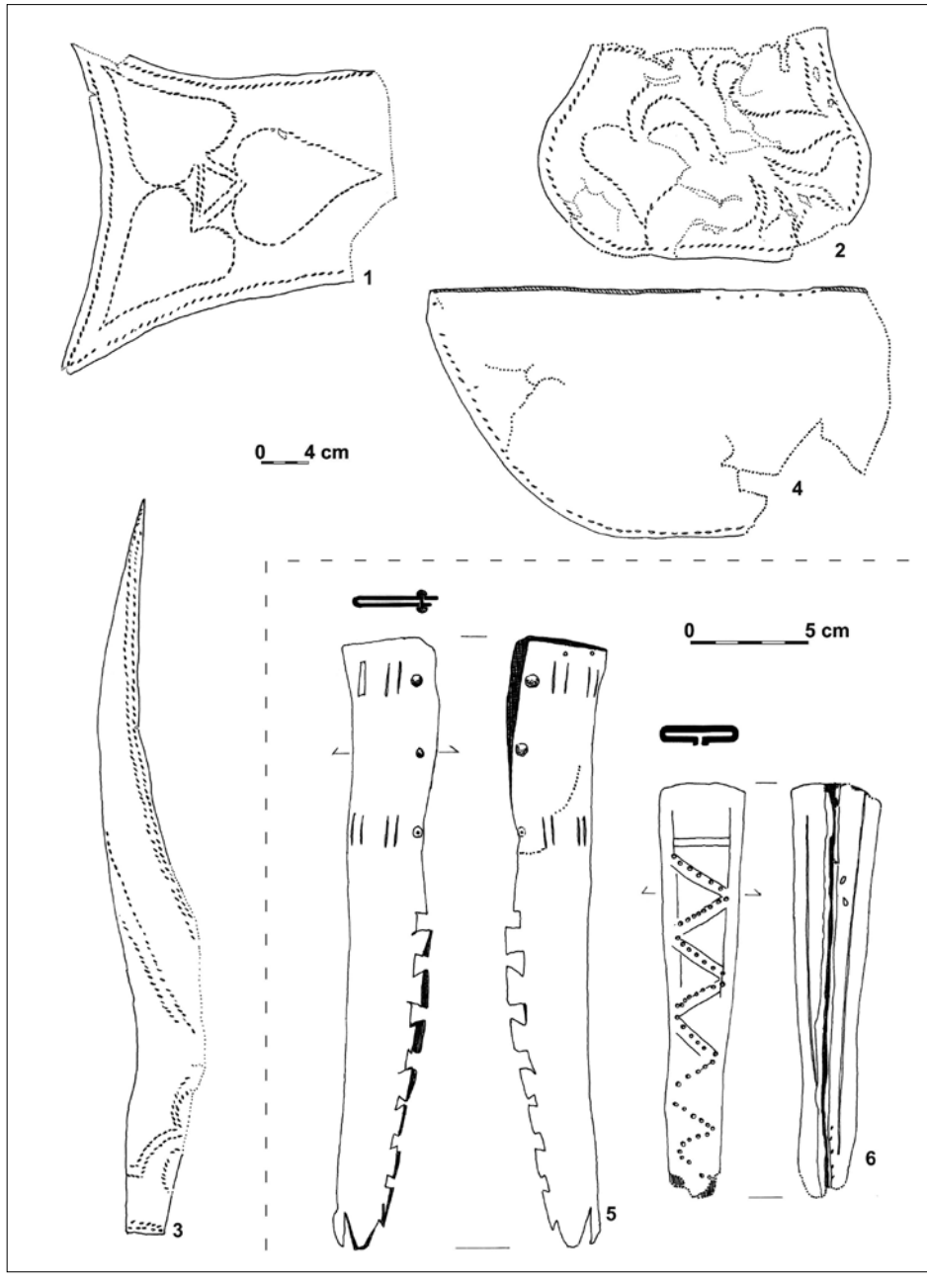

Fig. 41. Kołobrzeg, Nr 36 Narutowicza Street. Selection of leather finds from the leather-worker's atelier (after Archeologia Kołobrzegu 2, tab. 9; 10)

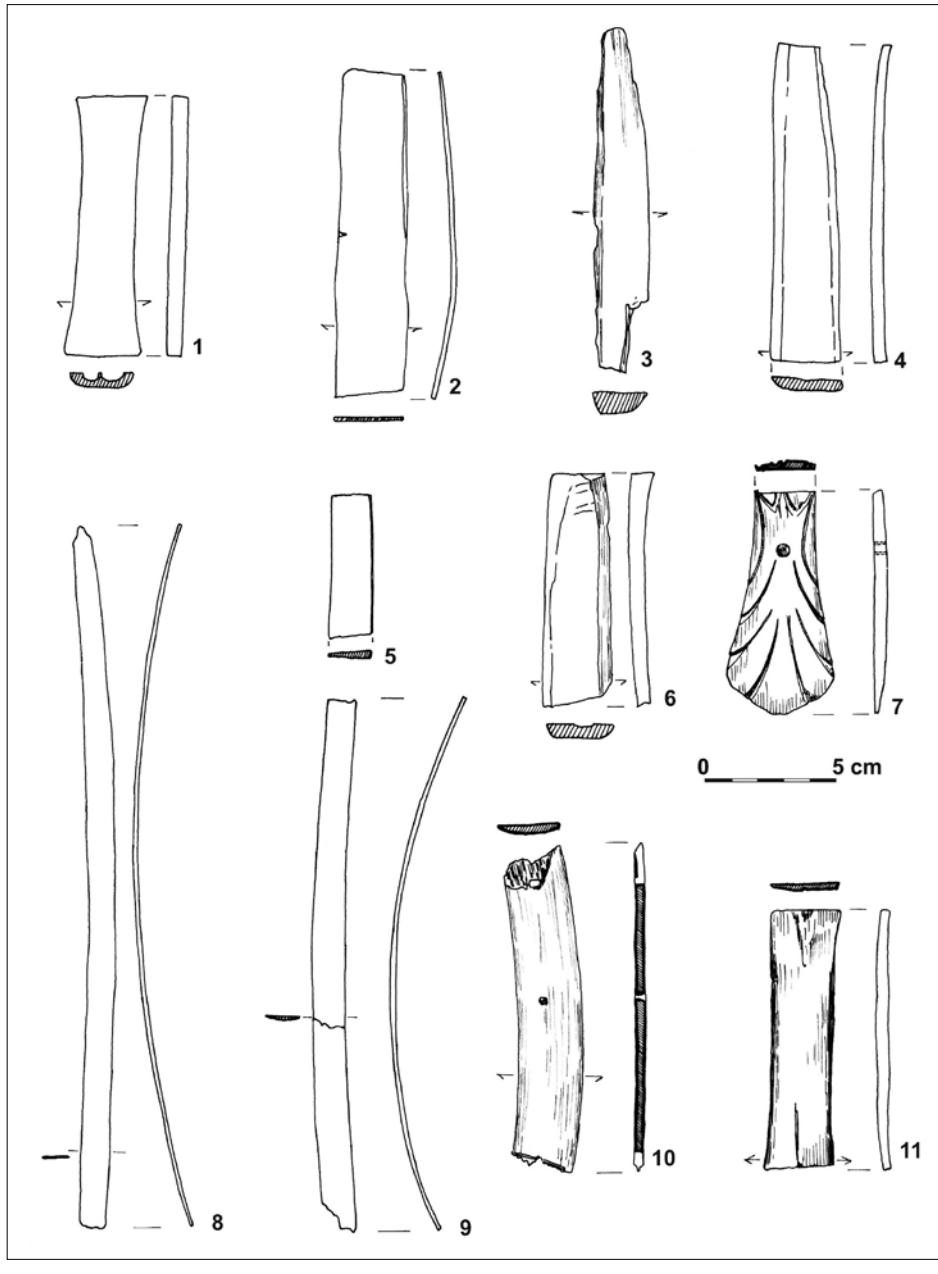

Fig. 42. Kołobrzeg, Nr 36 Narutowicza Street. A selection of antler and bone finds from the leather-worker's atelier. 1–6, 8–11 – semi-finished products and production waste, 7 – fragment of a bone plate from a knife handle (after Archeologia Kołobrzegu 2, tab. 11; 13)

hard leathers. From the same layer, several antler and bone items were recovered, including production waste and finished products, including knife handles. The small amount of waste may indicate quite limited craft production carried out on the plot in question. It is also possible that the excavated finds constitute only part of the waste related to this workshop, because the archaeological excavation did not cover the entire width of the plot. Its eastern part, currently located under the modern pavement, has not been examined.

The above findings support the existence of workshops specializing in the production of knife sheaths in Kołobrzeg since the end of the 13th century. It is worth adding that the metal fittings of the sheaths were also made in-house, although the semi-raw material for their production was most likely purchased from blacksmiths, and the leather workers only dealt with their final processing. The workshop at Nr 5 Armii Krajowej Street produced sheaths with metal fittings, while the workshop at Nr 36 Narutowicza Street produced products without such reinforcements. The production of sheaths was accompanied by activities related to finishing knives, i.e., equipping them with handles of bone or antler. These elements were also manufactured in-house. Probably the activity related to finishing knives and producing sheaths did not guarantee adequate income, hence additional activities were carried out alongside it. The production of a diverse range of leather products or products made of other raw materials (iron, antler, bone and horn) and the provision of services related to their repair could therefore have been a way to acquire a wider group of customers and increase earnings.

A different scope of activity, limited solely to the production of leather products, was found in a thirteenth-century workshop discovered on the property at No. 6 Armii Krajowej Street (Wywrot-Wyszkowska 2008, 111 ff.). Nearly 2,800 cuttings were recorded in the yard of the plot, including pieces of hard leather (obtained from cattle) and soft leather (goat, sheep, calf and deer leather). Nearly 10% of the remains for which we have an expert identification of the raw material are cuttings of fur skins (carnivorous animals and sheep and deer skins with hairs). The quite diverse structure of the raw material must have translated into the production of a diverse set of products. These could be cases, pouches, gloves, leather elements of clothing, knife sheaths and sword sheaths. Mainly grain leather was used for their production, and only to a small extent was fur leather employed.[62]

62 The use of fur raw material in the production of leather goods is evidenced by the presence among Kołobrzeg knife sheaths of an example made of deerskin with the hair still present (Wywrot-Wyszkowska 2008, 112).

However, other types of observations are interesting. In the excavated material from the workshop at Nr 6 Armii Krajowej Street, in addition to cuttings, there are fragments of shoes with traces of cutting off of better-preserved parts of the leather. Their presence may indicate that both repairs and alterations of shoes took place here, as well as secondary acquisition of raw materials. The first possibility would indicate that, as a sideline to the main activity of footwear production, shoe repairs and alterations were also carried out here, although it is not known whether such activity was not reserved exclusively for shoemakers or patchers. The second possibility would suggest that a certain percentage of the raw material used was leather obtained from used shoes. In my opinion, the latter seems more probable, which is also supported by the belts, cases and a pouch found in Kołobrzeg, made of leather cut from shoe uppers (see Wywrot-Wyszkowska 2015, 31, Fig. 3.a, e–f, h). In turn, in Riga, cases for storing toilet combs were discovered that had been made of leather cut from shoe uppers (Bebre 2002, 370, Fig. 1). It is therefore highly probable that not only patchers and shoemakers, but also other leather workers obtained raw materials from old shoes.

3. 7. Bone, antler and horn working

Objects made of bone, antler and horn, as well as waste generated during their production, constitute a significant component of the assemblages of artefacts discovered in excavations in the late medieval coastal towns. A wide range of products were made from these raw materials. These included primarily combs, knife handles, rosary beads, buttons, belt buckles, needles, pins, cubic dice, gaming pieces, styli, as well as simple musical instruments and toys.[63] The most common raw materials used in crafts at that time were cattle bones, especially metapodia. They were used to produce combs with long teeth (so-called weaving combs) and double-sided, three-layer combs. They were also used in the production of knife handles and six-sided dice. Rosary beads and buttons were made from the jaws, ribs

63 See information on finds of bone, antler and horn from: Schleswig (Ulbricht 1984); Lübeck (Falk 1983; Falk, Gläser 1988; Gläser 1989c; 1992a; 1992b; Lüdecke, Drenkhahn 2002); Wismar (Ottenbreit 1994), Rostock (Mulsow 2000a); Stralsund (Samariter 2010); Greifswald (Schäfer H. 1996; Schäfer C. 1997a; Enzenberger 1997; 2007; Samariter 2004); Pasewalk (Ansorge 1997); Neubrandenburg (Schmidt 1999); Kołobrzeg (Rębkowski 1996a; 1997; 1998; 1999b; Wywrot-Wyszkowska 2016b); Stargard (Janowski 2016c; 2017b); Puck (Miścicki 2017b); Gdańsk (Hilczerówna 1961; Kasprzak 2007b; 2010a; 2010b); Elbląg (Marcinkowski 2003b; 2004a; 2004b); Riga (Tilko 2000; 2003; Strēle, Tilko 2001); Tallinn (Luik, Maldre 2003) and Tartu (Vissak et al. 2015).

and shoulder blades. Deer antlers were used to produce double-sided single-layer combs and double-sided three-layer combs, knife handles, belt buckles, styli, cubic dice and playing pieces. Finally, horn sheaths were used to make double-sided, single-layer combs. Pig bones were used only to a small extent (see for example Ulbricht 1984, 24–26; Luik, Maldre 2003, table 2). The production of items made of bone, antler and horn in all the towns discussed here was very similar. The same production techniques, design and, with some exceptions, the same raw materials were used everywhere. The high quality of workmanship of the discovered products, especially combs, proves not only the use of appropriate tools but also compliance with specific technological standards (Müller 2006c, 276).

As in the case of shoemaking and production of other leather goods, the sites of the workshops where bone, antler and horn were worked are most often identified on the basis of the concentration of production waste. To some extent, this results from the very nature of this field of crafts, for which stationary equipment and extensive premises were not needed (see Mührenberg 2000, 229 f). A comb maker or other specialist had to have a set of appropriate hand tools, such as saws, knives, drills, drawknives, hatchets, chisels, rasps, various shapes and sizes of files, a compass for making the decoration and a grindstone for shaping and smoothing (Ulbricht 1984, 26 ff.). In some of the workshops, lathes were also probably present (Hilczerówna 1961, 85 f.; Ulbricht 1984, 30). These craftsmen could therefore conduct their activities in small rooms or in open spaces, or even in living rooms.

However, clusters of production waste do not always indicate the location of workshops. This was the case with such a group of material from Schleswig.[64] In the so-called Schild quarter was excavated a large pit, filled with the sawn-off ends of the metacarpal and metatarsal bones of cattle, among which only a few pieces of horse metapodial bones were recorded. There were also other types of waste in its fill – leather offcuts, pieces of wood and small branches. This pit was clearly separated from the buildings nearby and was probably a kind of rubbish dump used by the local population (Ulbricht 1984, 65, see also Müller 2006c, 278). The bone waste lying there could have been created by processes such as the production of long-tooth combs, and possibly also double-sided three-layer combs. It is therefore probable that there was a comb maker's workshop nearby.

64 As a result of archaeological research conducted in Schleswig at Lange Straße, Plessenstraße and in the Schild quarter, an impressive assemblage of objects made of bone, antler and horn was obtained, numbering over 68,000 items, of which nearly 64,000 are production waste and semi-raw materials. In the present work, only the material from the Schild quarter, where deposits from the 13th–14th centuries have been preserved, is taken into account (see Ulbricht 1984, 10–12, tab.1).

Comb workshops have been identified in other cities. In Rostock, in the yard of a plot of land at Fischbank, a pit was discovered in which several hundred cattle horn-cores with traces of processing and pieces of removed horn sheaths, including already straightened plates, were recorded. Another group of finds included the ends of cattle metapodia sawed off from the shafts, as well as semi-raw materials, semi-finished products and other waste, illustrating all stages of the production of long-toothed combs (Mulsow 2000a, 199, 211; 2006, 286 f. Fig. 3). The finds from this site indicate that a workshop specializing in the production of combs operated on the property in question in the mid-13th century (Mulsow 2000a, 199). There were probably other comb workshops in Rostock, as evidenced by the finds of production waste related to such activities. On the plot at Nr 7 Am Bliesathsberg Street, a significant concentration of horn-cores and pieces of antlers with traces of processing, including semi-finished plates for the handles of knives, was recorded (see Schindler 2007, Figs. 7–8). These items were found in layers brought onto the property to raise the level of the ground. Perhaps they came from a workshop nearby (Schindler 2007).

The remains of a workshop from the second half of the 15th to the early 16th centuries, producing horn and bone combs with long teeth, were discovered in Kołobrzeg on the plot of Nr 18 Narutowicza Street (Wywrot-Wyszkowska 2016b, 191). The small number (46 items) of the finds – mainly production waste, but also semi-raw materials, semi-finished products and scrap products – suggests a rather limited production. This assemblage also included a stone whetstone (Fig. 43). The Greifswald workshop may have had a slightly different activity profile, where traces of the production only of bone combs with long teeth were found. It operated in the second half of the 13th century, on the property at today's Johann-Sebastian-Bach-Straße 23. In the yard of the plot, a pit was discovered from which over 50 fragments of cattle metacarpals and metatarsals with traces of processing were excavated. They included sawn-off bone epiphyses, bone plates and small pieces of bone with traces of sawing. In addition to the waste, combs were found, some of which were damaged (Samariter 2004, 69–72, Figs. 4; 5).

Excavations in Lübeck on the property Hundestraße 13–15 have provided interesting data for understanding the type of working space used by comb makers. In the second half of the 13th century, the front part of the plot was occupied by a spacious, aisled hall building (Mührenberg 1989, 241 f. Fig. 5). In one of the rooms in the rear part of the central range there was a clay hearth, around which there was waste generated during the production of horn and bone combs, suggesting the existence of a craft workshop there (Stephan 1978, 78; Mührenberg 1989, 242). Similar

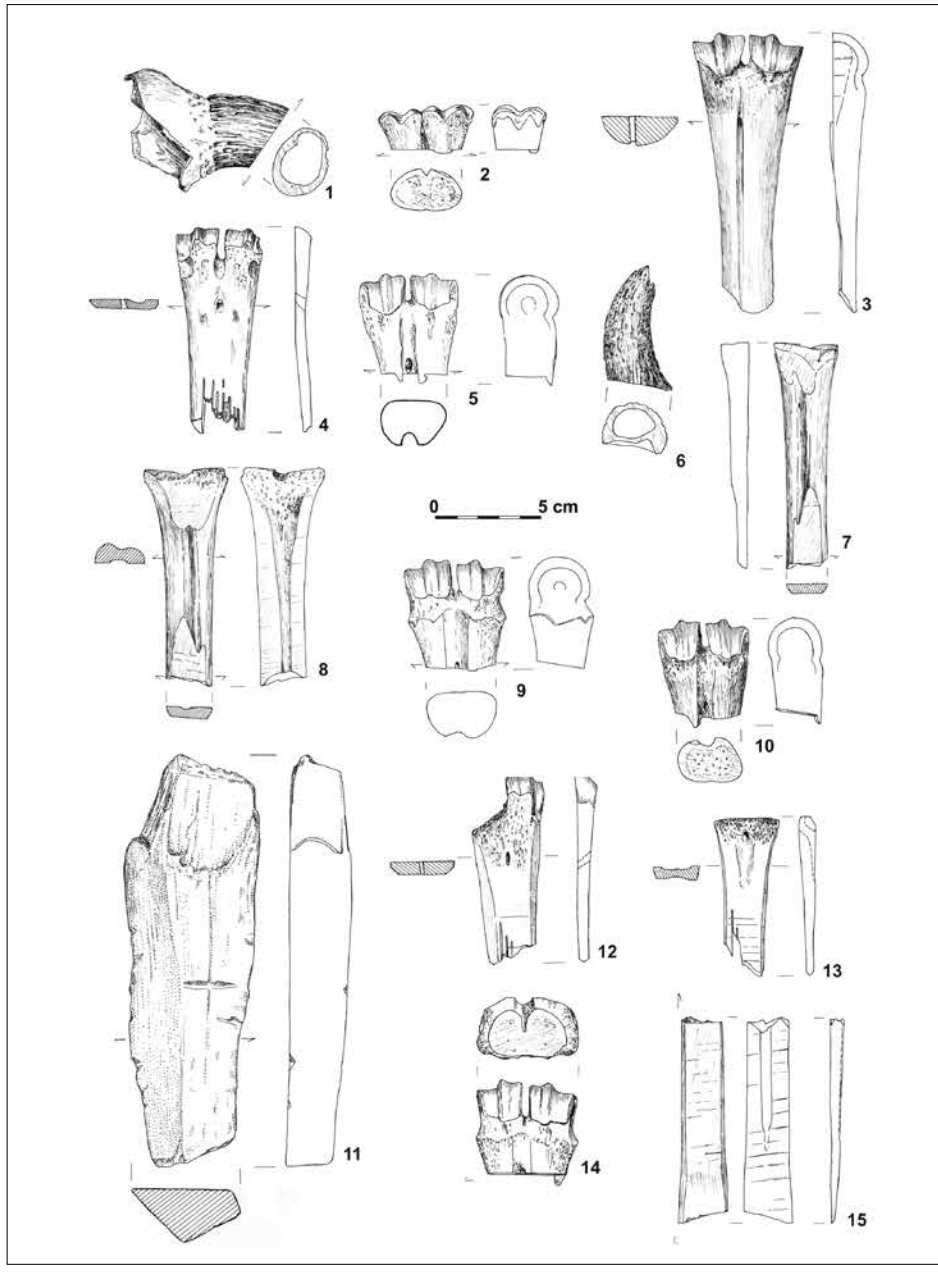

Fig. 43. Kołobrzeg, Nr 36 Narutowicza Street. A selection of finds from the comb workshop. 1–3, 5–10, 14–15 – production waste, 4, 12–13 – combs with long teeth, 11 – whetstone (after Archeologia Kołobrzegu 6, tab. 121; 122)

waste was also found in the yard of the plot (Mührenberg 2002a, 91).[65] This workshop produced mainly bone combs with long teeth, and to a lesser extent antler combs (Mührenberg 2002a, 92; 2006, 258).

Another Lübeck workshop was discovered on the premises of the Benedictine monastery of St John. It produced horn combs and bone combs with long teeth and two-sided, three-layered bone combs (Gläser 1989c, 53–55; see also Mührenberg 2002a, 92, Fig. 8). It can therefore be assumed that a craftsman working for the needs of the religious congregation worked here (Gläser 1989c, 68).

A quite diverse range of activities was represented by the waste from another Lübeck workshop, discovered on a plot at Nr 80 Hüxstraße. It operated in the second half of the 13th and early 14th centuries, in a small front building, most likely built as a frame structure (Müller Uwe 1992b, 170). It contained waste resulting from the production of double-sided single-layer bone combs, double-sided three-layer bone combs and long-toothed bone combs, as well as rosary beads and cubic dice (Müller Uwe 1992b, 183 ff., Fig. 8.13–25; Mührenberg 2002a, 92). This workshop also produced amber rosary beads, evidenced by the presence in the excavated material of lumps of raw material, semi-finished products and finished beads, which reflect all stages of the production process of these items (Müller Uwe 1992b, 184, Fig. 8.26–66).

Bone and amber rosary beads were made in the fourteenth-century Strasund workshop discovered at Semlower Tor, which also produced personal ornaments from non-ferrous metals (Samariter, 2010, 60 ff., Figs. 11–12; see above). Rosaries made of bone beads were made in Rostock, as evidenced by the few finds of characteristic waste in the form of bone plates with the cut-out negatives of small disks. These objects, dating back to the second half of the 14th and 15th centuries, were discovered in several latrines located in various parts of the city (Lehmkuhl 1993, 298; 2005, 275; Mulsow 2000a, 210–211; 2006, 286). Similar waste has also been identified in excavated material from Greifswald (Schäfer C. 2005, 35, Fig. 17.g–h), Anklam (Lehmkuhl 1993, 288 n., Figs. 8:c–d; 9:a–b) and Gdańsk (Kasprzak 2007b, 21, Fig. 5:1376; Jaskólski 2008; Kozłowski et al. 2020, 574 ff., tab. XV).

At the end of the Middle Ages, the production of bone buttons gained importance. It is believed that at the end of the 15th or the beginning of the 16th century, a workshop conducting such activities existed in Elbląg, on the property at

65 Unfortunately, the discussed material has not been fully analysed, and the available literature contains only general information about the type of waste, without specifying the exact number of finds, only stating that there were several hundred of them (see Stephan 1978; Mührenberg 1999; 2000; 2002a; 2006).

Nr 3 Świętego Ducha Street (Marcinkowski 2004b, 440, Fig. 3). Waste from button-making has been recorded among the finds from Gdańsk (Paner 2006, figs. 5.6–8). Unfortunately, there is no exact information regarding their chronology, although it is highly probable that the production of such items was carried out in Gdańsk already in the Middle Ages. Waste and finished products confirming the production of buttons were also discovered in Tartu (Vissak et al. 2015, 163, Fig. 11).

In Tallinn, in two neighbouring plots at Roosikrantsi 9 and 11, an assemblage was found of 116 bone and antler items, including production waste, dating back to the 13th–17th centuries. Nearly half of the finds are fragments of ribs, shoulder blades and long bones of cattle with cut-out discs that are the production waste of the manufacture of bone buttons. Some of the finished products were also found (Luik, Maldre 2003, 21 ff., figs. 18–20). Button production was probably carried out here only from the 15th century (Luik, Maldre 2003, 37). Apart from these finds, on the properties in question, an antler hammer, stone whetstones, and small crucibles with enamel remnants on the inner walls were recorded.[66] While the hammer and whetstones can probably be related to the above-mentioned bone waste, the crucibles could have been related to the production of glass beads (see also below).

A separate issue is the question of some differences in the raw materials used, which have already been indicated. In Kołobrzeg (Wywrot-Wyszkowska 2016b, 185 f., further literature there), Gdańsk (Hilczerówna 1961, 50 ff.; Kasprzak 2007b, 17 f.) and Elbląg (Marcinkowski 2004a, 499 f.; 2004b, 439), in the 13th and 14th centuries, deer antlers were still being commonly used to produce double-sided, three-layered combs, which clearly distinguishes them from other Baltic centres. This raw material was also most often used to produce knife handles, cubic dice, playing pieces and belt buckles (Rębkowski 1999b, 227; Marcinkowski 2004b, 439, 443). These observations indicate that craftsmen from Kołobrzeg, Gdańsk and Elbląg had relatively easy access to antlers, probably due to specific environmental conditions or economic connections (Wywrot-Wyszkowska 2016b, 186; see also below).

The production of objects made of bone, antler and horn in the Baltic cities had a rather special character. What comes to the fore is the observation that only a few workshops dealt exclusively with making items from these raw materials, and the production of a diversified assortment of products was a common phenomenon. The most uniform production was found only in comb workshops. Attention is also drawn to the very large quantitative diversity of the assemblages of waste products collected within them or in their immediate vicinity. Their size

66 These tools are known to me through personal examinaton. Of these, only the hammer has been published (Luik, Maldre 2003, 11, Fig. 8).

may, to some extent, reflect the volume of production. It must, however, be taken into account that in workshops where the assemblages of waste material were not very large, in addition to bone and horn products, wooden combs may also have been produced. Such a suggestion is supported by the fact that the preserved double-sided, single-layer wooden combs found in excavations in the Baltic coastal towns discussed here do not differ either in shape or in the way they are made from their counterparts made of bone, antler or horn.[67] Regardless of the raw material used, the manufacturing process of such combs, especially in its later stages, came down to the same procedures – that is, forming an appropriate plate, then cutting out the teeth, smoothing and in some cases decorating the product. The lack of traces confirming the production of wooden combs in the workshops discussed above may be the result of insufficient preservation of waste generated during their production or their incorrect assessment during field research (particularly inconspicuous waste, such as shavings and small pieces of wood, could often remain unnoticed and therefore undocumented and unexplored). This is probably why in the case of these objects, the material available from excavations consists solely of finished products. Finding other traces of the production of wooden combs is practically impossible.

Another issue of interest related to the manufacture of items from bone, antler and horn is the degree of specialization and the resulting professionalization of the craftsmen using these materials. In the light of the observations made, the production of combs was the most professional. On the other hand, knife handles and gaming equipment (such as dice and gaming pieces) could have been made in conjunction with the production of objects made from other raw materials or as a sideline to that other work. This is visible in the case of the remains from the Kołobrzeg leather goods workshops, uncovered on the plots at Nr 5A Armii Krajowej Street and Nr 36 Narutowicza Street. The craftsmen working there were mainly engaged in the production of leather sheaths and finishing knives, hence they produced their own bone knife handles (see above). In turn, gaming accessories, apart from being made by bone-workers, seem to have also been manufactured by other specialists (including, as mentioned above, bronze-founders, as had been the case in the workshop in Rostock at Wollenweberstraße 33/Sackpfeife).

67 See finds of wooden combs, for example, from: Wismar (Ottenbreit 1994, 95, Fig. 6:q, u; Schacht 2002, 512, Fig. 124:3–4); Stralsund (Ansorge et al. 2009, 468, Fig. 190:5); Kołobrzeg (Polak 1996b, 333, tab. 96:7; Bobik 2016, 155, tab. 57:14; 69:19); Gdańsk (Kościński 2003, 379, Fig. 11:e; Kasprzak 2010a, 150, Figs. 11: 1610; 1611) and Riga (Tilko 2000, 101 f.).

Such activity, carried out as a sideline to the main production activity, was only an additional job for someone in the atelier.

It is very difficult to assess the degree of professionalization of activities related to the production of rosaries on the basis of the analysis of the excavated material. According to the written records, in many cities there were specialized craftsmen involved in their production (see for example Hirsch 1858; Stieda 1887; Stieda, Mettig 1896). Available archaeological sources show that these items were also made in workshops producing a diverse range of products from bone, antler and horn, including combs and cubic dice, as was found in the case of the Lübeck workshop at Huxstraße 80. Rosaries of bone beads could also have been one of many types of products made in other workshops. An example of this is the atelier producing personal ornaments from non-ferrous metals operating near Semlower Tor in Stralsund and the workshop located in one of the cloth cutting booths on the market square in Greifswald. The discoveries at Tallinn indicate that a similar situation applied to the production of buttons and this activity had been carried out in conjunction with the manufacture of other products, not only of bone, but also of glass.

The above observations confirm the earlier conclusions of A. Falk (1983) regarding the nature of bone, antler and horn working in Lübeck. During his analysis of a relatively small assemblage of bone products, this researcher attempted to indicate the specialization of the craftsmen involved in their production. Analyzing the statutes of the local guilds of comb makers, rosary makers and crossbow-makers, he noticed the lack of any mention of bone raw material in these documents. Only the statutes of rosary and crossbow-makers mentioned materials imported to Lübeck, such as amber and antlers. These observations led A. Falk to conclude that the production of bone products, due to the large supply and low price of the raw material, was not subject to any restrictions, and such an activity could therefore be carried out in many different workshops (Falk 1983, 119 ff.).

3. 8. Amber-working

Despite the situation of the urban centres that we are interested in on the southern coast of the Baltic Sea, rich in amber deposits, remains of the artisanal processing of this raw material have been identified in only a few of them. So far, the largest collections of amber artefacts have been discovered in Gdańsk, although only early medieval finds have been studied in detail (Wapińska 1967; 1993). These studies confirm the intensive development of production of amber artefacts already in the pre-location period. In the Gdańsk stronghold, the remains of several workshops

specializing in the production of decorations, mainly beads and rings, were identified (Wapińska 1967, 87; Lepówna 1992).

In the light of records written in the 14th and first half of the 15th centuries, the development of the amber industry in Gdańsk slowed down due to difficulties in access to the raw material (see, for example, Bogucka 1962, 197). After occupying the city in 1308, the Teutonic Order monopolized the acquisition and trade of amber, most of which was exported (Hirsch 1858, 121). Despite these difficulties, amber craftsmen operated in the city, mentions of which can be found in documents from the mid-14th century (Hirsch 1858, 323). Nevertheless, amber objects are relatively rare in the excavated material dating from the 14th to the first half of the 15th centuries.[68] Some semi-finished amber items, a few finished products, and lumps of raw material were found in investigations in plots on Długi Targ and Powroźnicza (Blusiewicz 2022b, 513 ff., Fig. XVI.1, tab. XVI.1) and Mariacka Streets (Korszański 2018, 535 ff., Fig. 6). Also at Mariacka Street, in one of the butcher's stalls, 498 lumps of unprocessed amber were discovered. It is difficult to clearly determine the nature of this find, as no traces of amber processing were found within the stall (Korszański 2018, 536–537). It can be hypothetically assumed that it was a raw material intended for sale.

In the second half of the 15th century, after the fall of the Teutonic Order, control over the amber deposits located in the areas belonging to Gdańsk was taken over by the city council (Bogucka, 1962, 197), which facilitated access to the raw material for local craftsmen and thus favoured the development of amber production. In 1477, the amber-worker's guild was established (Hirsch 1858, 323), and in the first half of the 16th century there were already 46 representatives of this profession operating in the city (Bogucka 1962, 143, further literature there). During excavations in Stare Przedmieście, near the shipyards, amber objects were discovered, including finished products – mainly beads (288 items), semi-finished beads (229 items), production waste (2,888 items) and lumps of raw material (246 items). These artefacts were located in a small space, in layers saturated with amber shavings dating to the second half of the 15th to the 16th centuries (Ruta 2020, 563–567). All these finds should be associated with the production of beads used to make rosaries and personal ornaments. In turn, the saturation of the layers with amber dust indicates that the beads were made on a lathe. It is rather unlikely that there was an amber workshop (or workshops) in the immediate vicinity of the shipyard.

68 It should be added here that over 3,000 amber objects were discovered in various parts of the late medieval urban complex (Ruta 2020, 563). However, research on these artefacts is hampered by the lack of exact chronology. Much of it was obtained from deposits dating within a broad framework covering the medieval and modern periods.

The items discovered here were most likely brought along with the soil from other parts of the city (Ruta 2020, 572).

Remains of artisanal amber processing, primarily related to the production of rosaries, were also recorded in Lübeck. On two neighbouring plots located at Hundestraße 11 and 13–15, clusters of lumps of raw material, waste in the form of amber shavings, semi-finished products, defective items and finished beads were recorded (Stephan 1978, 78, Mührenberg 2002a, 90 f.; 2006, 258 f.)[69] The method of processing the beads and the presence of amber dust indicate that they were made using a lathe (Mührenberg 2006, 258 ff., 263, Figs. 12–13). The workshop on the property Hundestraße 13–15 most likely operated in the early 15th century, and the one at Hundestraße 11 was in use around 1400 (Stephan 1978, 78). Beads made of rock crystal were also found in the latter workshop (Stephan 1978, 78). Both archaeological and written sources testify to the quite dynamic activity of rosary makers in Lübeck. These craftsmen obtained a statute in 1350, and around 1397 their guild had 39 members, including 16 masters (Stieda 1887, 98, 100 ff.). Rosary makers from Lübeck used various raw materials, including wood, minerals, bone and antler. However, amber was of particular importance, and rosaries made of this material were exported (Stieda 1887, 101).

Another city where traces of the activity of craftsmen producing amber items were recorded is Riga. During the excavations, a relatively large collection (1,368 items) of artefacts made of this material was obtained, dating to the 12th–13th centuries. They include natural amber nuggets, various beads, tiny crosses, pendants and other ornaments, as well as semi-finished products, unfinished products and production waste (Strēle 2005, 128–132).

These finds were concentrated in excavations located at: Albert Square (891 items), Peldu Street (355 items) and another 122 items came from a site at the corner of Peldu and Ūdensvada streets (Strēle 2005, 126, Fig. 1). Perhaps there were workshops here in which amber products were produced. The nature of the finds indicates that in Riga, in addition to ornaments, rosaries were made (see Caune, Ose 2006, 467). This is also supported by fourteenth-century documents, which mention a maker of rosaries (Stieda, Mettig, 1896, 38).

A relatively small assemblage of amber artefacts (c. 80 pieces) was obtained from the recent excavations in Kołobrzeg. More than half of them are natural lumps of raw material, and a few products are represented by beads and pendants (Rębkowski

69 As in the case of the bone artefacts collected on the plots at Hundestraße 9–17, the amber finds have not yet been the subject of detailed studies. It is not even known what their number was (see Stephan 1978; Mührenberg 2000, 2002a; 2006).

1996a; 1997; 1998; 1999b; Wywrot-Wyszkowska 2016b). The small number of these finds proves that the production of amber objects in late medieval Kołobrzeg was very limited. It could have been carried out in conjunction with the production of products from other raw materials, as was the case in the Lübeck workshop at Hüxstraße 80 or in the Strasund workshop located near Semlower Tor (see above).

3. 9. Textile production

Unlike many other crafts, the remains of textile production are relatively rare archaeological finds. The excavated material most often records finished products, that is, fragments of fabrics, and much less frequently the tools used to produce them. Most of the tools discovered so far are related to the initial stages of textile production. They were used for spinning (spindles and spindle whorls), winding (thread winder) and spinning (spinning wheels). Such objects are known from Lübeck (Drenkhahn 2017a), Rostock (Schäfer C. and H. 1996), Neubrandenburg (Schmidt 1989), Kołobrzeg (Maik 2000a), Puck (Starski 2016), Gdańsk (Grupa 2012), Elbląg (Maik 1997a) and Tartu (Rammo 2009). However, elements of looms are much less frequently recorded (see Maik 1997a; 2000a; 2000b; Grupa 2012). A unique find was a charred loom with the remains of linen cloth that was part of the workshop equipment excavated in Peitava Street in Riga. This device has been preserved almost entirely and is dated to the first half of the 13th century (Caune Ose 2006, 465, further literature there). It is a horizontal treadle loom on which plain weave fabrics were made using two or four heddles (see Maik 2000b, 257, there further literature). Previous research has shown that in the Middle Ages, several types of horizontal treadle looms were used, differing in width (narrow or wide) or in the number of heddles (two, three or four) (Maik 2000b, 258 ff.). All these devices could be used to make both woollen broadcloth and linen fabrics (Maik 1997a, 50; 2000b, 259; see also Grupa 2012, 94).

Woollen products dominate among the textiles discovered. They have been identified in excavated material from Lübeck (Tidow 1978; 1980a; 1980b; 1984; 1986; 1992; 2006), Stralsund (Brüggemann 2008), Kołobrzeg (Maik 1996; 1997b; 1998; 1999; 2000a; 2016), Puck (Żołędziowska 2017), Gdańsk (Jabłońska 2009a; 2009b; Grupa 2012) and Elbląg (Maik 1997a). Textiles made of linen are much rarer – they are known from Lübeck (Tidow 1980a, 137; 1980b, 163 f.; 1984, 34 f.; 1992, 246 f.),[70]

70 It should be emphasized here that the majority of linen fabric finds from Lübeck date to the modern period.

Kołobrzeg (Maik 2016, 166 f.) and Gdańsk (Jabłońska 2009b, 210). Almost as uncommon are so-called half-woollen (mixed) fabrics – textiles with woollen threads and threads of plant fibres. These have been recorded from Elbląg (Maik 1997a, 17) and Lübeck (Tidow 1978, 139, tab. 1; 1980a, 187; 1992, 247). The small number of products made of plant fibres is due to the poor state of preservation of this type of material. It is therefore difficult to estimate the production volume of such fabrics based on archaeological sources. However, it had to be large enough to cover the demand for linen, which was used to produce clothing and many other products (such as towels, bedding and tablecloths) related to household equipment (see Tidow 1978, 154).

The available excavated material allows for more detailed research only on woollen cloth-making. As previous observations have shown, a diverse set of woollen fabrics were produced in the Baltic towns, differing in the type of yarn, thickness, weaving method and finishing. In most towns for which we have studies of larger fabric assemblages, the most common weaving method was plain weave (1/1). Fabrics made in this way dominate among finds from Lübeck (Tidow 1992, tab. 8, older literature there), Elbląg (Maik 1997a), Gdańsk (Jabłońska 2009b; Grupa 2012) and Puck (Żołędziowska 2017). In turn, in Kołobrzeg (Maik 2000a; 2016) and Schleswig (Maik 2005), twill weave (2/1) products predominate.

Some of the fabrics were subjected to finishing procedures – fulling, carding, shearing and dyeing – which increased their quality. In the case of the excavated material, the most common finishing procedure detectable is fulling, thanks to which soft and durable fabrics were obtained (Grupa 2012, 103). The percentage of such products, depending on the centre, ranges from about 40% in Gdańsk and Elbląg to over 60% in Kołobrzeg (see Maik 1997a, 33; 2000a, 239). A fragment of a wooden frame of a comb used for carding cloth was found in Rostock. Originally, the frame contained teasel heads, which were used to scour the fabric stretched on a special frame (Schäfer C. and H. 1996, 128 f., Fig. 2).

The vast majority of discovered textiles are remnants of clothing. Sometimes thick fabrics that may be the remains of, among other things, bedspreads, blankets, etc. are found (see for example, Tidow 1980a; 1980b; 1984; 1992; Grupa 2012). Fragments of textile sacks have been identified in Elbląg (Maik 1997a, 13), Gdańsk (Grupa 2012, 136 ff.), Kołobrzeg (Maik 1996, 300; 1999, 262; 2016, 175) and Lübeck (Tidow 1984, 36). It is significant that finds of such products are most often recorded in port centres (Maik 2016, 175; Grupa 2012, 136). A particularly high concentration of sack cloth was recorded in Gdańsk on Granary Island and in the area of the district of Lastadia (Grupa 2012, 136 ff., table 11). It can therefore be assumed

that technical woollen fabrics were also produced in port centres for the needs of trade and transport.[71]

Quite special finds related to textile production are various types of textile strips – ibbons, tapes, belts and selvedges. Such products, although not very numerous, have been discovered in Lübeck (Tidow 1980a; 1980b; 1984; 1992), Kołobrzeg (Maik 2016), Gdańsk (Grupa 2012), Riga (Zariņa 2001) and Tartu (Rammo 2009). Passementerie of this type was made on tablet looms (see Tidow 1984, 35; Zariņa 2001; Rammo 2009). They were simple devices consisting of several four-sided tablets (usually made of wood or antler, bone or hard leather), with rounded corners in which there were holes for threading the warp threads. The weft thread was threaded with a needle or forceps (Grupa 2012, 150, Fig. 49). In late medieval towns, various tapes were made, mainly by women, and mainly for their own use. Only in the modern period were specialized craftsmen engaged in the production of passementerie (Grupa 2012, 147 ff.).

The results of research on the raw material carried out for finds from Kołobrzeg (Maik 2000a, 235), Gdańsk (Jabłońska 2009a 274; Grupa 2012, 190 ff.) and Elbląg (Maik 1997a, 29) has shown that the wool used was from local breeding. During the Middle Ages, in what is now north-eastern Poland, Polish Heath Sheep and Masurian sheep were bred (Maik 1997a, 29). The wool of the more primitive Heath Sheep was of inferior quality compared to that of the Masurian sheep.

3. 10. Construction crafts

With the appearance and spread of brick construction in the Baltic coastal towns, new craft specializations emerged related to production of bricks, lime burning and stonemasonry. These activities were subordinated to the needs of various investments, both public, religious and private. Most often, during excavations, the final products are discovered in the form of remains of the masonry walls of various buildings and structures, or loose finds of bricks, roof tiles, stone blocks and products referred to as architectural details, ceramic tiles, mouldings, decorative stone elements, etc.

The places of production of building materials were usually located outside the city defences. This concerns above all the brickworks, in which brick-makers and other craftsmen were employed. These were most often near clay outcrops

71 It should be assumed that bags for storing and transporting goods were also made of plant fabrics (linen or hemp), and their production may also have been artisanal in character.

(see e.g. Wiesiołowski 1997, 265 ff.; Ansorge 2005e, 308). The proper functioning of such plants also required the provision of a sufficiently large yard where a brick kiln and other devices enabling the production cycle could be installed and operated. Various buildings were also necessary to store materials, equipment, etc. (see Bogucka 1962, 65).

Archaeological research conducted within urban areas relatively rarely produces discoveries of devices related to brick production. The remains of a medieval brickworks have been identified outside Greifswald (Brandt, Lutze 2000). A brick kiln was discovered situated three kilometres from the city to the west, on the southern bank of the Ryck River. Its interior had dimensions of 5 × 5.2 m. Two openings/entrances have been preserved in the northern wall, approximately 0.70 m and 0.65 m wide. The furnace was probably equipped with another entrance, which was located to the east of the above-mentioned holes, but this part of the structure had been destroyed (Fig. 44). The period of operation of the device is dated between the second half of the 13th century and the first half of the 15th century. Both bricks and lime were fired in the kiln in question.[72] There is a mention of this brickyard in written sources from 1492. It included information about the city's takeover of the plant, which was previously owned by the Dominican monastery (Ansorge 2000, 135, further literature there).

In turn, in Tartu, traces of brick production were recorded in the Riga Suburb, where several pits related to the extraction of clay and its further processing were uncovered. Near these facilities, on a plot at Nr 1 Kistas Street, a brick kiln was uncovered. It was 6.2 m long and its width is estimated at about 4 m (Mäesalu 2006, 476). This structure had two fuel chambers, 0.5 and 1 m wide, which narrowed towards the firing chamber. A little further to the east, another similarly constructed furnace was discovered, measuring 6 × 5 m. There were broken bricks lying in the space between the two kilns. Both structures are dated to the end of the 13th to the beginning of the 14th centuries (Mäesalu 2006, 476 ff.).

Lime was burned not only in brickyards, but also directly next to the buildings being constructed, an example of which are the lime kilns discovered in Rostock. One of them was located right next to the church of St Nicholas. The walls of the kiln were made of bricks laid in clay. This structure was slightly sunk into the ground,

72 In the Middle Ages, it was relatively common for brickyards to simultaneously produce bricks and burn lime, and even slake it. An example of the above may be the Gdańsk brickyards mentioned in written records (see Bogucka 1962, 65 ff.).

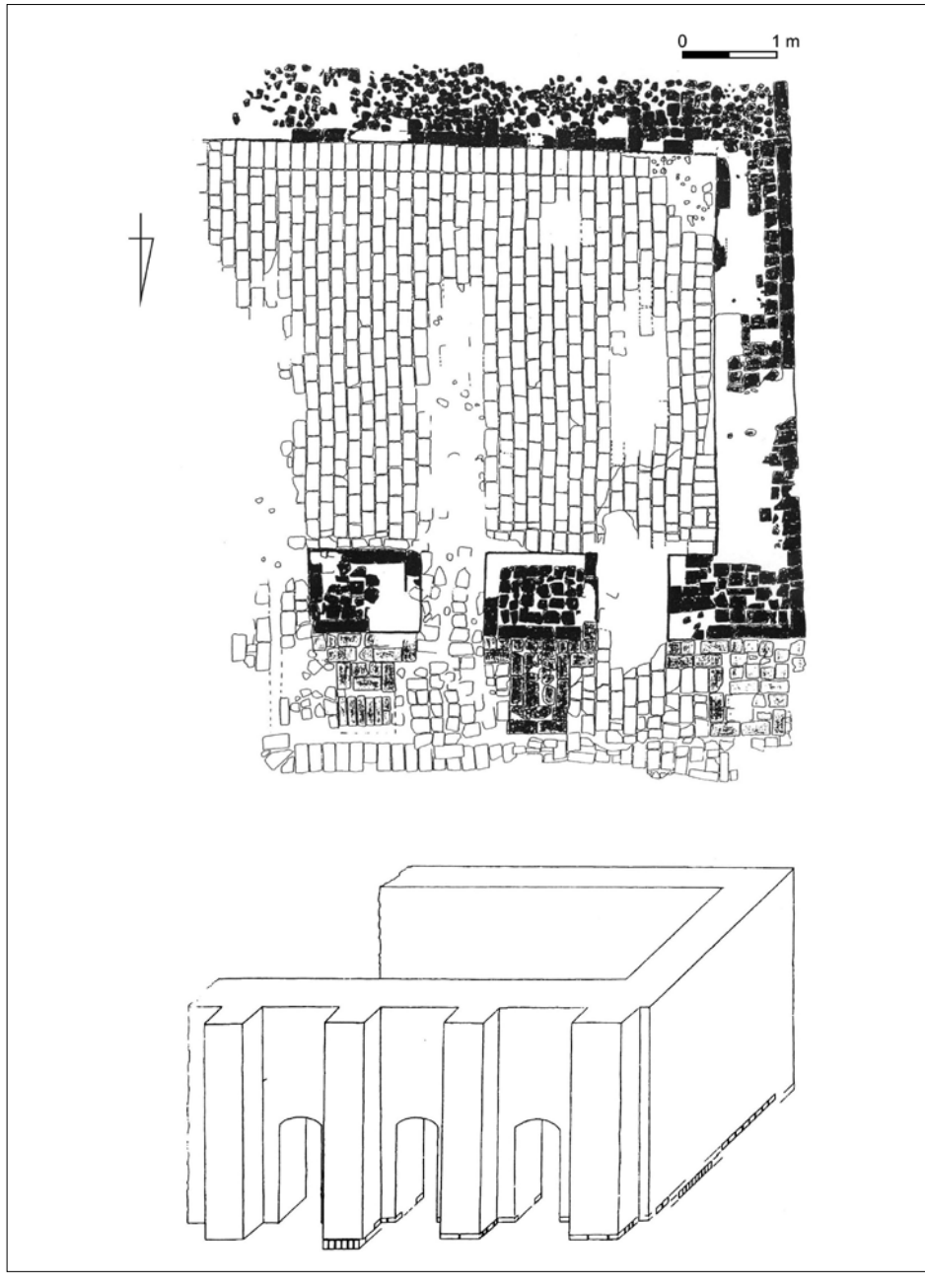

Fig. 44. Greifswald, Wackerow. Plan and reconstruction of a brick/lime kiln (younger phase) (after Brandt, Lutze 2000, Figs. 2; 4)

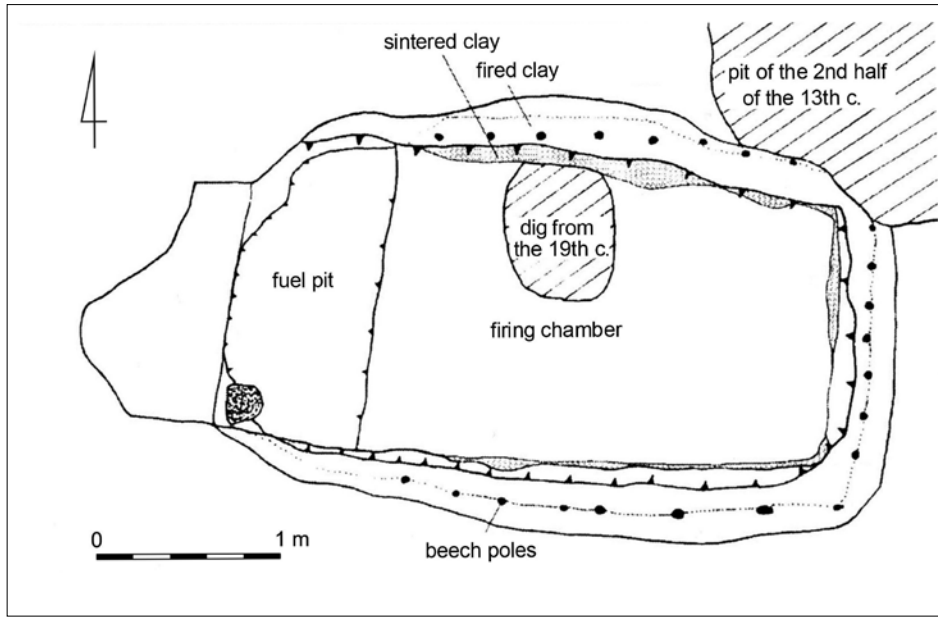

Fig. 45. Greifswald, Rakower Straße 5. Lime kiln (after Ansorge 2000, Fig. 6)

and inside there was a brick floor. The furnace had a trapezoidal outline and the interior was 4.1 × 4.25–4.50 m (Mulsow 2002, 126, Fig. 5). This kiln may have been used in the period from the end of the 13th century to the first half of the 14th century, in connection with the expansion of the church (Mulsow 2002, 128). A second lime kiln, dating to the first half of the 13th century, was discovered during research in the Franciscan monastery. It was built of bricks, and its interior was approximately 3 × 3 m. There were two openings/entrances into the kiln (Mulsow 2006, 298). This structure was erected for the construction of the monastic church dedicated to St Catherine. A similar purpose was served by a lime kiln discovered in Pasewalk on Marktstraße, in the southwest corner of the quarter containing the church of St Nicholas (Hoffmann U. 1999, 44).

The lime kilns described above were related to the construction of large buildings. Discoveries from Greifswald indicate that they were also built for smaller investments. On the plot at Rakower Straße 5, a lime kiln was discovered that was related to the construction of a tenement house (Ansorge 2000). It was oriented on an east-west axis, and its dome was made of beech poles covered with clay (Fig. 45). In the western part of the kiln there was a fuel chamber, which was located approximately 40 cm below the firing chamber. At the

time of discovery, there were remains of the last charge inside the furnace. According to J. Ansorge (2000, 138), the raw material for lime production was imported from Gotland.

A lime kiln was also excavated on a site at Podwale Grodzkie in Gdańsk; unfortunately, however, apart from a laconic mention of its discovery, we do not have any information about its construction, dimensions or period of use (Kasprzak 2003b, 95).

3. 11. Fishing

The location of the towns under discussion here on rivers – sometimes near large bodies of water – created favourable conditions for the development of fishing, which played an important role in supplying their inhabitants with food products. The great importance of fishing in the economy of municipal centres is indicated by the privileges issued by local rulers, most often together with the town's charter allowing fishing in the adjacent waters (see for example Lesiński 1960, 21; Długołęcki 1993, 199 f.; Kattinger 2000b, 44 f.; Kardasz 2017, 82). Also, the very large number of days in the medieval calendar when citizens should be fasting contributed to a constant demand for fish, which thus created an opportunity for a large group of residents to earn money. In many towns there were separate market squares or commercial facilities where fish were sold (see for example Hirsch 1858, 210; Stieda, Mettig, 1896, 22; Riemann 1924, 52; Piskorski 1987, 196; Czaja 1992b, 361).

In the archaeological sources, the activity of fishermen is evidenced by various tools and equipment used for fishing. These are usually floats (made of bark or wood) and net weights (of clay and lead). Next, we should mention finds of the implements used for making nets and items related to boat equipment. Sometimes there are fishing tools, for example various types of fishing spears, usually with multiple prongs, or wooden net hoops. Relatively common finds also include small metal fishing hooks.[73] Noteworthy is a very large assemblage of such items found

73 Finds of items related to fishing come, among other places, from: Riga (Caune, Ose 2006); Elbląg (Marcinkowski 2006b; 2006c); Gdańsk (Kasprzak 2010a; 2010b; Trawicka 2010); Puck (Starski 2017a; Miścicki 2017a); Kołobrzeg (Polak 1996b; 1998a; 1998b; 1999b; Bobik 2016; Janowski 2016a); Szczecin (Rulewicz 1999); Pasewalk (Ansorge 1997); Greifswald (Kaute, Ansorge 2006; Enzenberger 2007; Schäfer C. 2016); Stralsund (Kulessa 2003); Lübeck (Ellmers 1992; Gläser 1992a; 1992b) and Schleswig (Saggau 2000; 2006). In Neubrandenburg, a fairly large set of clay net weights was recovered, but these finds were discovered within the pottery workshops

in Kołobrzeg, in the building block at the intersection of today's Narutowicza and Rzeczna streets, located next to the medieval fish market. Their analysis allowed us to assume that Kołobrzeg fishermen may have used longlines for fishing. These tools were very suitable for catching cod (Janowski 2016a, 60 f).[74] In Elbląg (Marcinkowski 2006b, 240), Kołobrzeg (Wywrot-Wyszkowska 1998, 231, tab. 45:17; 62:6; 65:12; 2016a, 94, tab. 66:18; 86:9), Szczecin (Rulewicz 1999, 267, Fig. 12:1; Kowalska 2013, 37, Fig. 13:1–2, tab. XII) and Greifswald (Enzenberger 2007, Fig. 52:2) fragments were found of special leather boots that had iron spikes in the soles allowing the wearer to walk on ice while fishing in frozen bodies of water (see Rulewicz 1994, 220 f).

Objects related to fishing were usually found in different parts of the towns, although their clear concentration is noticeable in specific parts of the urban complex, most often located near watercourses. In Riga, these are the quarters near the Dvina and Riga rivers (Caune, Ose 2006, 467 ff.), and in Kołobrzeg, in the north-eastern part of the city adjacent to the moat (Polak 1996b) and the area on the Parsęta (see Polak 1998a; 1998b; Janowski 2016a; Bobik 2016). In Greifswald they were found in the quarter between Rotgerberstraße and Weißgerberstraße located by the moat (Enzenberger 2007), as well as a block located a little further north on the current Friedrich-Loeffler-Straße, located near the Ryck River (Schäfer C. 2016). However, in Stralsund (Kulessa 2003) and Lübeck (Ellmers 1992), significant accumulations of fishing tools and equipment were recorded near the quays of the ports.

Fishermen's residences have been identified in some urban centres. In Kołobrzeg, they were located in a quarter located on the flood terrace of the Parsęta river, on the lower section of today's Gierczak Street. This was adjacent to the so-called Mill Canal, which is a tributary of the Parsęta. During the excavations carried out there, a significant collection of various types of items related to fishing was obtained. The preserved remains of the buildings indicate that the fishermen lived in frame-construction buildings, the lower beams of which were supported by piles driven into the swampy ground. Although archaeological excavations covered only the front parts of the plots, it can be assumed that at the back there were open jetties where various professional and household activities were performed (Polak, Rębkowski 1998, 178 ff.). Until the mid-15th century the current Gierczak Street was called

where they were made (see Schmidt 1989; 1990). A similar situation is seen in Elbląg, where the largest collection of clay weights was found in a pottery workshop (Marcinkowski 2003a).

74 It is worth adding that the remains of this species dominate the ichthyological material discovered in the city (see Zabilska-Kunek, Makowiecki 2016, 241 f., older literature there).

Fischstraße, which is a further reason for postulating the location of fishermen's residences in this area (Riemann 1924, 52).

In Greifswald, the remains of a house used by a fisherman (or fishermen) were discovered on a plot of land at Rotgerberstraße 25, located on the edge of the city moat. In the rear part of the property there was a wooden building (dimensions 3 × 6 m), of which one of the longer walls was built directly on the reinforced edge of the moat. Inside and in the immediate surroundings, a numerous group of net floats, a fragment of the frame of a flat-bottomed boat, and the remains of fish were found (Enzenberger 2007, 42, Fig. 48:7–15). A small jetty, 6 m long and 1.6 m wide, extended from the building into the moat (Enzenberger 2007, 41–42, Figs. 33–34). This building complex was used from the second half of the 13th century to the beginning of the 14th century.

In Elbląg, at the back of the plot at Nr 23 Bednarska Street, relics of a two-room building erected around the middle of the13th century were discovered. Within it and in its immediate vicinity, a significant collection of items related to fishing were recorded, together with a number of metal elements of boatbuilding equipment (Marcinkowski 2006b, 239–242, Figs. 5:11–12; 6:3; 7:6–11; 8–10). An exceptionally large collection of fish remains was also recovered from the plot in question, with sturgeon remains dominating (Marcinkowski 2006b, 243). In the opinion of M. Marcinkowski (2006b, 245 f.), the fisherman living here could have specialized in catching this species of fish.

The Elbląg discovery is probably an isolated case of narrow specialization among fishermen. It is more likely that they caught different species of fish, as evidenced by the results of ichthyological research. In Kołobrzeg, bone fragments of cod, herring, flounder, roach, zander, pike, bream, perch, roach, cyprinids, as well as sturgeon and salmonids have been identified (Makowieccy 1996; Makowiecki 1999; Zabilska-Kunek, Makowiecki 2016). However, in Elbląg, the remains of sturgeon, bream, pike, tench, perch, roach, cod, carp, crucian carp, ide, eel, asp, flounder and cyprinids were found (see Marcinkowski 2006c, 237, further literature there). The assemblage of ichthyological finds obtained in the area of the medieval port of Gdańsk was dominated by cod and herring, while flounder, roach, asp, ide, catfish, pike and sturgeon were less numerous (Kościński 2003, 380, further literature there). All of these lists include marine, freshwater and diadromous (dual-environment) fish. Fishermen therefore caught various species of fish, although some of them, such as cod in Kołobrzeg, could be subject to more intensive fishing, which was probably due to the accessibility of its fishing grounds (see Zabilska-Kunek, Makowiecki 2016, 246 f). Perhaps there was a similar situation in Gdańsk, where a high proportion of remains of this species was also found (see Kościński 2003, 380). The relatively numerous finds related to boatbuilding recorded within

buildings identified with fishermen's residences indicate that they repaired and probably built their own boats (see below).

3. 12. Boatbuilding

Boatbuilding was of particular importance for the economy of port towns – in excavations within them, artefacts related to this field of crafts can be regarded as typical finds.[75] These are usually metal elements of boatbuilding equipment (nails, rivets, clamps), as well as wooden parts of hulls (hull planks, frames) from used ships, most often reused as a material for creating a hard surface in yards and even inside buildings. The above-mentioned objects (especially recycled wooden parts of boats), are usually found in various parts of towns, sometimes at a considerable distance from the ports. They are a by-product of activities related to the repair and dismantling of ships and boats. The better-preserved parts removed from them in the process would have been used for construction or renovation of other vessels (Ellmers 1992, 9 f.). There were probably special places in each port town where ship repairs were carried out – several have been identified by excavations.

In thirteenth-century Rostock, such a place was located on the northern section of today's Grubenstraße. In a trench in the area originally located on the western side of the watercourse separating the Old and Middle Towns, at the level of its confluence with the Warnow, the remains of a small quay were found. Near it, remains of a ramp running perpendicular to the stream and inclined towards it were recorded. This ramp was quite a massive structure built of three parallel rows of beams, covered here and there with short, transverse beams (Mulsow 2000, 200 f; 2006, 290, Fig. 6). On both sides there was an area with a hard surface with the remains of a brick hearth and loose ship elements – decking boards and frames (Mulsow 2009, Fig. 7). In addition, a large number of nails, rivets and boat clasps were found, as well as woodworking tools, including spoon bits and knives (Mulsow 2000, 213). The above discoveries prove that small vessels were repaired and/or dismantled in this area (Mulsow 2006, 290).

75 See the information on shipbuilding from: Elbląg (Litwin 2004, 406, Figs. 5–6; Ossowski 2009a, 89 f., Figs. 8–9; 2009b); Gdańsk (Krąpiec, Ossowski 2003, 277–281; Ossowski, Kościński 2003; Trawicka 2004; 2020; Osowski 2009a, 79 f. Figs. 3–7; Kasprzak et al. 2020); Kołobrzeg (Polak 1996a, 232; 1996b, 334; 1998a, 215 f,; 1998c; Janowski 2016a, 61); Greifswald (Bleile 1997, 138–145, 147 f., Figs. 5–11); Stralsund (Kulessa 2000, 176 f.; 2003, 197–207); Rostock (Bleile 1997, 133–138, 147, Figs. 2–3; Mulsow 2000, 201, 213; 2006, 290); Lübeck (Ellmers 1985; 1992; Hoffmann et al. 2002, 537 f. Fig. 8) and Schleswig (Saggau 2000, 45, Fig. 31:1–5).

Traces of similar activity were also recorded in Stralsund, in the Port Suburb. In the quarter located between Wasserstraße, Langenstraße, Am Langen Wall and Bei der Heilgeistkirche, numerous finds of ship elements (planks, frames and portions of rigging) were recorded, most of them reused as building materials (Kulessa 2000, 176 f.; 2003, 193–207, Taf. 5–15; 23). Additionally, a fragment of an unfinished ship element was discovered, along with nails, rivets, clasps, wooden dowels, as well as caulking made of hair, moss and some made of textile materials (Kulessa 2000, 178; 2003, 207–216, Taf. 16–23). The rivets include pieces with one end cut off, which may be the result of the separation of the planks during the disassembly of the hull of a boat (Kulessa 2000, 178, Fig. 2:1–3). In the western part of the investigated quarter, clumps of moss and layers saturated with tar and with a high content of hair were recorded. This material evidences the production of seals that were used for ship repairs (Kulessa 2003, 208). This is supplemented by finds of the wooden tools – a hammer and a wedge – used in sealing the gaps between the planking of hulls (Kulessa 2003, 222–223, Fig. 202; Taf. 34:228, 230). These artefacts related to the repair and dismantling of ships were recorded in layers and features created in the 13th–15th centuries (Kulessa 2003, 249). This activity was continued in the following centuries, which is confirmed in iconographic sources. On the plan of Stralsund by Johannes Staude from the first half of the 17th century, a dumping ground for ships pulled ashore and partially dismantled was clearly marked in the Port Suburb (Kulessa 2000, 179; 2003, 250, Fig. 15, further literature there).

In Lübeck, on plots located near the Trave River at An der Untertrave 97, Große Petersgrube 21 and 27, An der Untertrave/Kaimauer, and Alfstraße 36–38, elements of sheathing and rigging were discovered, as well as nails and clamps for the planking (Ellmers 1985, 156–157, Fig. 70:3–4; 1992, 7–14, Figs. 1:B, C; 2:1–3; see also Gläser 1992b, 197, 199f., Figs. 15:5–7, 9–13; 16:1–3; 20). This material dates to the initial period of the city's functioning. On the properties at Alfstraße 36–38 a spoon bit and three knives for woodworking were also found (Ellmers 1992, 11, Fig. 2:5, 8). According to D. Ellmers (1992, 9, 15), these artefacts are the remains of repairs or demolitions of ships carried out in the port or in its immediate vicinity.

Mentions of permanent places intended for shipbuilding appear only in fourteenth-century documents, for example in Elbląg in 1343 (Litwin 2004, 404 f., there further literature), Gdańsk in 1363 (Hirsch 1858, 212) and Stralsund in 1392 (Kulessa 2003, 247 f., there further literature). The results of excavations in Gdańsk, in Stare Przedmieście (Kocińska 2004a; 2004b), are of particular importance for these considerations. In the quarter located between the Motława River and today's Lastadia Street, traces related to the construction and repair of boats have been recorded. During the research, exceptionally numerous groups of items related to

boatbuilding equipment were obtained (Trawicka 2004; 2020, 147 ff.). These include the clamps used on hulls, fragments of chains, nails, rivets and washers (roves). The finds included some unused roves, several of which were in the form of semi-finished products in the form of iron strips, cut into segments, the length of which corresponds to the length of a single rove. Each segment had a hole pierced in the middle for inserting the end of the nail (Trawicka 2020, 152, Fig. 3). Another group of finds consists of tools, including axes, saws, drills, chisels, gouges, knives and rasps (Ignasiak 2020, 167–173). In addition, a wooden caulking tool (used to stuff moss sealing the spaces between the hull's planking) and brushes were found (Kasprzak et al. 2020, 189 f., Fig. 1), as well as textile bale seals and fragments of ropes (Grupa et al. 2020, 158 ff.). The vast majority of these artefacts were excavated from layers consisting of shavings and sawdust. The large thickness of these layers indicates the intensity and scale of the wood processing going on here.

The above finds should be identified with the region known as Łasztownia, mentioned in 1363 (Hirsch 1858, 212; see also Maciakowska 2020). It occupied the area stretching along the western bank of the Motława River, between the Targ Maślany and Toruńska Street. Seagoing vessels were built there as were boats intended for coastal and inland navigation (Ossowski, Krąpiec 2001, 98; Ossowski, Kościński 2003, 157, further literature there). In the area of Lastadia, shipbuilding was carried out from the Middle Ages to the second half of the 19th century (Ossowski 2020, 115).

Unfortunately, the excavations failed to uncover any fixed equipment or structures used to build ships that could be associated with the initial period of the shipyard's activity. The oldest layers examined in the course of the archaeological excavations date back to the second half of the 15th to the first half of the 16th centuries (Kościński 2020, 39).[76] As the results of research on the written sources indicate, in the oldest period of operation of the shipyard at Łasztownia in Gdańsk, the individual places for ship building were only rented. The slipways and other devices were made each time for the implementation of a specific project, from the shipowner's own materials, and after its completion they were dismantled (Maciakowska 2020, 68–69). During the excavations, the remains of two wooden slipways used

76 Excavations were carried out in this area in two stages. In the first phase, the site was sampled using several small (2.5 x 2.5 m) trial excavations. In the second stage, the exploration of the layers was carried out over the entire area intended for redevelopment, but only down to the level that was to be disturbed by the building activity and not reaching the natural deposits under the stratified archaeological layers. For more information on the conditions of the excavations, see: Kocińska 2020.

for building and launching ships were discovered, built in the 16th and the first half of the 18th century (Ossowski 2020, 116–125, Figs. 3; 12).

In the late Middle Ages, ships used in the North and Baltic Seas included the cog, hulk and caravel (Förster 2005, 159). In the Baltic region, the most common type of seagoing ship until the 15th century was the cog – a tall, single-masted ship with a flat bottom, equipped with a hinged rudder, the capacity of which was approximately 32–150 'loads' (Litwin 2004, 403 f.; Förster 2005, 159, 162; Ossowski 2009a, 93). It is probable that cogs were built in all important port cities where there was a great demand for seagoing ships. Their construction in the Elbląg centre is indicated by a document from 1374, defining the local shipyard as the *Coggenlastadie* (quoted in Litwin 2004, 405, further literature there). However, a wreck of a cog dating from around 1280 has been found near Rostock. It was made of oak wood harvested near Rostock (Förster 2005, 161) – perhaps it was built in the town.

As already mentioned, in addition to seagoing ships, smaller vessels were also built in the shipyards of the coastal Baltic towns of that time. It is believed that the river boat discovered in the area of the medieval port of Gdańsk, under the Green Gate (dating from the period after 1332), was built in the local shipyard (Ossowski, Kościński 2003, 171). However, Elbląg is indicated as the most likely place of the construction of an analogous boat (dated to the period after 1291) discovered at Kobyla Kępa in the Vistula Fens region (Ossowski, Krąpiec 2001, 99). The construction of boats used for river transport, which was associated with the intensive development of inland cargo shipping, must have been an important part of the activities of shipyards (see Ossowski 2009a, 97).

The development of shipbuilding was largely dependent on access to appropriate wood (Ossowski, Krąpiec 2001, 99). Access to extensive raw material resources therefore played a crucial role. This was a factor that most probably determined the successful development of shipbuilding in those towns around which there were large forest complexes, such as Elbląg and Gdańsk. Moreover, these centres were connected with areas located inland, from where wood was floated down the rivers (Tandecki 1993, 171; Osowski, Krąpiec 2001, 99). In particular, Gdańsk was an outstanding shipbuilding centre from the second half of the 14th century (Bogucka 1962, 43 f.; Ossowski et al. 2005, 348).

Fishermen were also involved in boatbuilding (Ossowski 2009, 94; 2014, 111). This is evidenced by the fact already mentioned that in those parts of the urban centres where fishermen's residences have been identified, metal elements and parts of boats and of boatbuilding equipment were found. Of particular interest are the finds from the site of the stronghold at Gdańsk where numerous items were recorded that were not only related to fishing but which were also found with others

confirming participation in boatbuilding activities. Among them, special tools used in boat construction deserve attention. These are clamps used to temporarily immobilize the planks of the hull while they were being fixed to the boat's structure using wooden pins or iron rivets at the stage of forming the hull using the shell method (Ossowski 2014, 111 f., Fig. 6). These clamps date to the phase of the town predating its chartering, but it should be assumed that similar tools were also used in the later Middle Ages.[77]

The production of small boats for use in local waters was also being undertaken. Such projects did not require expensive equipment or specialist knowledge and could be implemented to fulfil one's own needs, even by not very wealthy people (Ossowski et al. 2005, 350). Sometimes they consisted of the construction of very simple water vehicles, such as the fourteenth-century flat-bottomed dugout canoe with the sides heightened with planks discovered in Kołobrzeg, most likely used to transport goods between the port and the city (Polak 1998c).

3. 13. Ropemaking

Ropemaking was a craft closely related to shipbuilding and servicing shipping (see Stieda, Mettig 1896, 15; Bogucka 1962, 57), as evidenced by, among other things, exceptionally numerous finds of ropes and cords recorded within the Gdańsk shipyard (see above). These craftsmen produced thick threads, cords, nets, ropes and ship ropes for rigging, etc. (see Bogucka 1962, 57). Cordage products were discovered, among other places, in Schleswig (Körber-Grohne 1989), Lübeck (Tidow 1978, 141, Taf. 52; 1984, 43, Taf. 3:1; 1992, 239), Kołobrzeg (Maik 1996, 304 f., Fig. X-24; 1997b, 223; 1998, 272 f., Figs. XI-4 – XI-5; 1999, 265, Fig. IX-7; 2016, 168, 172 f., Figs. IX-15 – IX-17, IX-19), Gdańsk (Kasprzak 2003a; Grupa 2012, 184–188, tab 12, Figs. 77–78; Grupa et al. 2020, 161–164, Figs. 6–7) and Elbląg (see Maik 1997b, 273). The main products were usually strings and ropes of wool or hair, less often made of plant fibres (usually hemp),[78] and also lines made of bast or thin twigs. These last two types of products dominate among the finds from Schleswig (Körber-Grohne 1989,

77 This is evidenced by the finds of such tools from Denmark (see Ossowski 2014, 111, further literature there).

78 The relatively small number of ropes or cords made of plant fibres recorded in the excavated material is due to the fact that products (not only rope, but also fabrics) made of such raw material are very rarely preserved in cultural layers due to the soil conditions in them (see comments by Körber-Grohne 1989, 120–122).

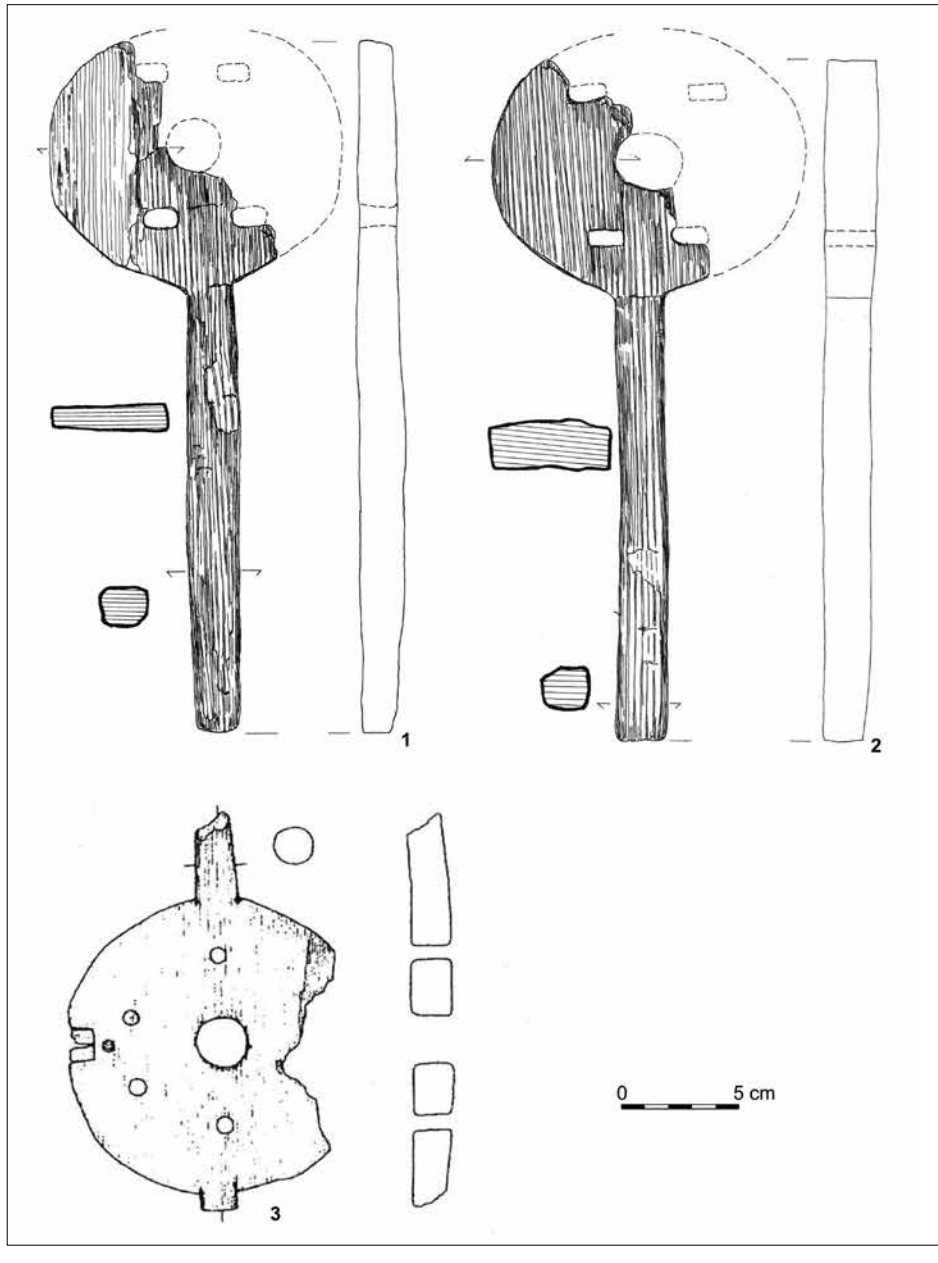

Fig. 46. Tools for twisting ropes. 1–2 – Kołobrzeg (after Archeologia Kołobrzegu 2, tab. 2; 5), 3 – Gdańsk (after Kasprzak 2010a, Fig. 10)

tab. 2). For their production, raw materials obtained from oak, elm, willow, hazel, birch and coniferous trees were used (Körber-Grohne 1989, 107, 124 ff.).

Tools used for twisting ropes were recorded in the excavated material from Kołobrzeg (Polak 1997b, 232, tab. 2:5; 3:2) and Gdańsk (Kasprzak 2010a, 157, Fig. 10:1594; Krzywdziński 2013, 109, Fig. 117). These are guides used to align the threads in yarn bundles (Krzywdziński 2013, 109, further literature there). They take the form of wooden discs with holes for threading yarn through. There are handles on both sides of the disc to facilitate moving the guide while making ropes (Fig. 46).

The vast majority of discovered rope products are twisted and not braided (see Körber-Grohne 1989, 108 ff.; Maik 1998, 273). Individual types of ropes and cords, depending on their thickness and purpose, were made of several or even a dozen thinner strings, often twisted many times, which increased their strength (Maik 1998, 273). Their high quality proves that they were made on rope walks (Körber-Grohne 1989, 108 ff.; Maik 1998, 273). Cords and ropes obtained during excavations are characterized by a large variety of products and raw materials (including hemp, wool, hair, bast). The ropemakers made products that were used in shipbuilding, transport and many other areas of everyday life (Grupa 2012, 188).

In order to carry out their task, ropemakers had to have a sufficiently large area to work, as the length of the ropewalks for twisting the ropes was usually several dozen metres (Körber-Grohne 1989, 112). In towns, they were usually located away from dense buildings or were in the suburbs. According to the written sources, Tallinn ropemakers set up their premises on the north-western side of the city, along the walls (Johansen, von zur Mühlen 1973, 77, 190). In turn, in Elbląg, the activity of ropemakers was concentrated on the eastern side of the Łasztownia region, on the St George's Causeway (Czaja, Nawrolski 1993, 93, Fig. 15). However, in Gdańsk, rope production took place in the suburb located on the right bank of the Motława River, in the quarter along Długie Ogrody Street. This area was settled by rope makers at the end of the 14th century (Maciakowska 2013, 10 ff.). There were plots here that were exceptionally long, which allowed the ropes to be twisted freely. On the city plan from around 1600, the so-called Stockholm Plan, rope walks were marked in this area (see Krzywdziński 2013, 107, Fig. 106).

In the course of excavation work carried out on the plots at Nr 111–115 Długie Ogrody Street, remains were uncovered of features related to ropemaking, created between the mid-14th and mid-18th centuries (Krzywdziński 2013). Particularly noteworthy is the canal located on the border of plots 111–112 and 113. This feature was over 97 m long and up to 1 m wide. It was used for a long time, and its banks were reinforced with boards set vertically edge to edge and fixed with vertical posts (Krzywdziński 2013, 37, figs. 13, 15). It could have been used not only to drain the

muddy ground, but also to soak hemp stalks at the initial stage of their processing, preceding the process of obtaining fibres from them (Krzywdziński 2013, 102 ff.). In the rear parts of plots 111–112 and 113, the remains of several large wooden buildings were discovered (Krzywdziński 2013, 35 ff., figs. 12, 15, 42). These structures were considered to have been rope sheds, used as production and storage rooms (Krzywdziński 2013, 110).

Ropemaking workshops were also located in other port centres (Maik 1998, 273). Difficulties in identifying places of rope production may result from the already mentioned fact that they were often located on the outskirts of towns or on their suburbs, and archaeological research in most centres is limited to areas located within the medieval city defences. Moreover, when setting up rope walks, portable devices were most often used, which were most likely removed and stored in closed rooms each time the work was completed.

3. 14. Food crafts

The production of food and drink by craftsmen, especially baking, butchery and brewing, played an important role in the daily lives of the citizens of the Baltic coastal towns. Despite this, due to the perishable nature of the products, archaeological sources do not provide much information, and allow for more detailed considerations only in relation to baking and brewing. Traces of such activities, primarily in the form of production equipment, have been discovered in only a few towns – Lübeck, Wismar, Rostock, Stralsund, Greifswald, Kołobrzeg, Puck and Gdańsk.

The basis of the diet of the medieval population were cereal products, among which bread was particularly important (Grabowski 2005, 285). It is therefore not surprising that in late medieval urban centres, baking was one of the most important crafts, and craftsmen producing bread formed one of the most numerous guilds (Gläser 1989a, 318). The activity of bakers is very well documented in Lübeck, where several workshops have been identified. The remains of one workshop was discovered on the property at Engelswisch 65, which had originally been part of the corner plot Engelsgrube 54 (Gläser 1989a, 310). At its rear, in the first third of the 14th century, a brick building (dimensions 14 × 8.5 m) was built, and along with it or only slightly later, a bread oven was constructed inside. This oven was of a circular plan and had a brick dome. There were special holes in the walls of the furnace closed with clay plugs, which were used to regulate the temperature inside (Fig. 47). The area of the floor of the oven was approximately 9.3 m² (Gläser 1989a, 312 ff.). Calculations show that approximately 100 one-kilogram loaves of

bread could have been baked in this oven each time (Gläser 1989, 319),[79] giving a measure of the bakery's large production capabilities. Its location close to the port would also indicate that part of the bread produced was intended to supply ships (Gläser 1989a, 320). This workshop operated until the mid-19th century – over the course of its life, seven successive ovens were in use, each built above the previous one (Gläser 1989a, 312–314, 320, Figs. 4–6). In addition to the oven discussed above, two further ovens of identical shape, structure and similar size should be associated with the Middle Ages. Their modern replacements were distinguished by a four-sided plan and much larger floor area, up to 18 m². It is estimated that the useful life of each oven was approximately 90 years (Gläser 1989a, 313, 320). Six knives with wide blades were found within the described workshop; their shape would suggest that they were tools used in the production of baked goods, such as ship's biscuits (see Gläser 1989a, 314).

Another bakery was located on a corner plot at Mühlenstraße 65, located in the south-eastern part of the city. In a room attached to the front house on the yard side, the remains of seven ovens built one above the other were recorded, the latest of which was used until the end of the 1940s (Müller Uwe 1992a). The oldest device was probably built at the end of the 13th or the beginning of the 14th century. It was a dome-shaped oven (3.6 m in diameter) with walls 1.5 bricks thick (Müller Uwe 1992a, 125, 128, Fig. 1:7). Each subsequent rebuild had the same construction, differing only from the previous one in that the floor of the oven was slightly larger.[80] The increasing capacity of ovens over time may indicate the successful development of the bakery.

The oven discovered during the excavations at Große Altefähre 14 should also be associated with a bakery, although the lack of a complete study of the results of the research conducted there hinder reaching a more detailed understanding of this site. The information provided only shows that the oven was built of bricks, and the area of its floor was approximately 9 m² (Mührenberg 2002a, 85, especially fn. 1; see also Grabowski 2007, 132, Fig. 6). This property, like the plots at Engelswisch 65/Engelsgrube 54 (Gläser 1989a, 310) and Mühlenstraße 65 (Müller Uwe 1992a, 128), was owned by a baker in the second half of the 14th century (Mührenberg 2002a, 85; see also Hammel 1981, 60).

79 These calculations were based on information contained in the eighteenth-century *Oeconomische Encyclopädie* (Krünitz 1782, 346 ff.). The authors of studies on other ovens discovered in Lübeck and Wismar also refer to this publication (see below).

80 In the second oven it was 10.2 m², in the third 11.3 m², in the fourth 12 m². In the case of one of the modern devices, the baking chamber area reached 14.9 m² (Müller Uwe 1992a, 125 ff. Figs. 2:1–2; 3:1–2).

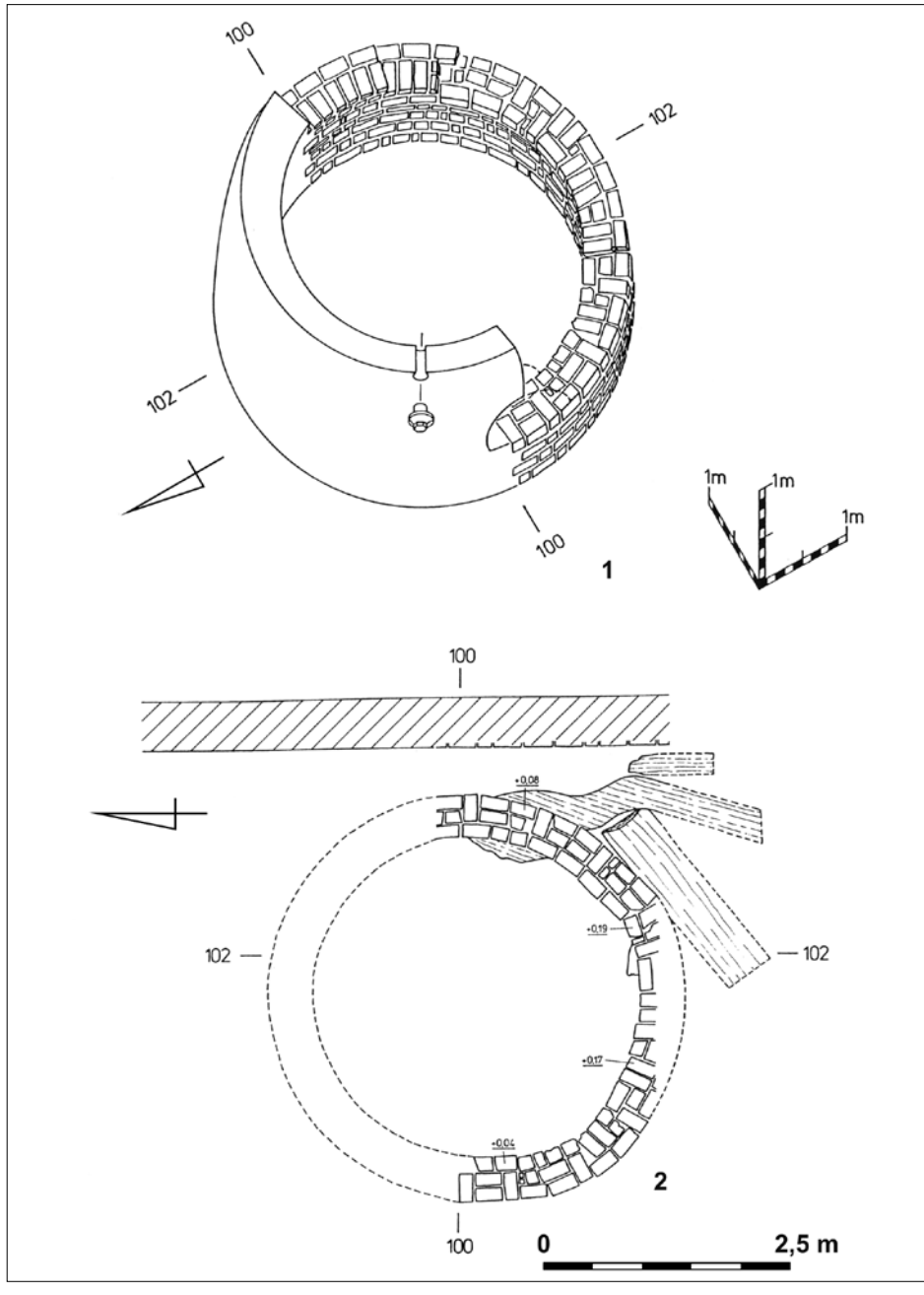

Fig. 47. Lübeck, Engelswisch 65 (Engelsgrube 54). Bread oven of the 14th century. 1 – reconstruction, 2 – plan (after Gläser 1989a, Figs. 4; 10)

Unlike the situation in Lübeck, baking is only evidenced in other towns by individual discoveries of the remains of bread ovens. In Stralsund, such a device was found on the property at Fährstraße 9 (Brüggemann 2015). However, its location is surprising – it was built in the south-eastern corner of the yard and attached to the walls between the plots. The oven was built of bricks and its floor was made of clay. On the side of the outbuilding, in front of the oven, there was a hardened surface (Fig. 48). Due to the very limited information about the results of the investigations conducted on this property, it is not known whether the oven had been located in a closed room or in an open space. It was only noted that the furnace was built in the 15th century and was still in use in the following century. It was part of the equipment of a bakery that had been mentioned in fifteenth-century city documents (Brüggemann 2015, 427).

We have much more data regarding the remains of the bakery found in Rostock, on a property at Mühlenstraße 2. Like the Lübeck bakery, it was located on a corner plot, just behind the front house (Konze 2005, 712; Mulsow 2006, 299 ff.). The oven was built on a quadrilateral foundation (4.5 × 4 m) made of brick rubble and small field stones. The oval dome of the furnace had been destroyed, but the position of the lower parts of the walls were marked by field stones and fragments of bricks still *in situ*. The interior of the oven was lined with small stones on which a clay floor was placed, with an area of approximately 11.3 m². It had been renovated many times, as evidenced by the four layers of sintered clay that mark its subsequent levels of use. The oven door was located in its north-western wall, on the side of the front building (Konze 2005, 712, Fig. 99; Grabowski 2005, 287, Figs. 4–5; Mulsow 2006, 299 f., Figs. 16–17). The oven had been built in a frame-built structure, the panels of the walls of which were, at least on the ground floor, filled with bricks. The poor state of preservation makes it impossible to determine the building's dimensions, but on the basis of the remains of the western and northern walls, it can be assumed that it was at least 9 m long and more than 4 m wide (Konze 2005, 712; Grabowski 2005, 288). The bakery building and the oven inside were built in the second half of the 13th century. They were demolished in the first half of the next century. The destruction of later layers makes it impossible to clarify whether the bakery had subsequently been reconstructed or not. However, the content of the later layers recorded in this place, with many brick fragments and lumps of baked clay, probably indicate the existence of further ovens, although their number and duration of use are difficult to determine on the basis of this evidence (see Grabowski 2005, 288). This workshop therefore probably operated continuously for a very long time. Suffice to mention that a bakery located on this property is mentioned around 1600 (Konze 2005, 712; Grabowski 2005, 288, further literature there).

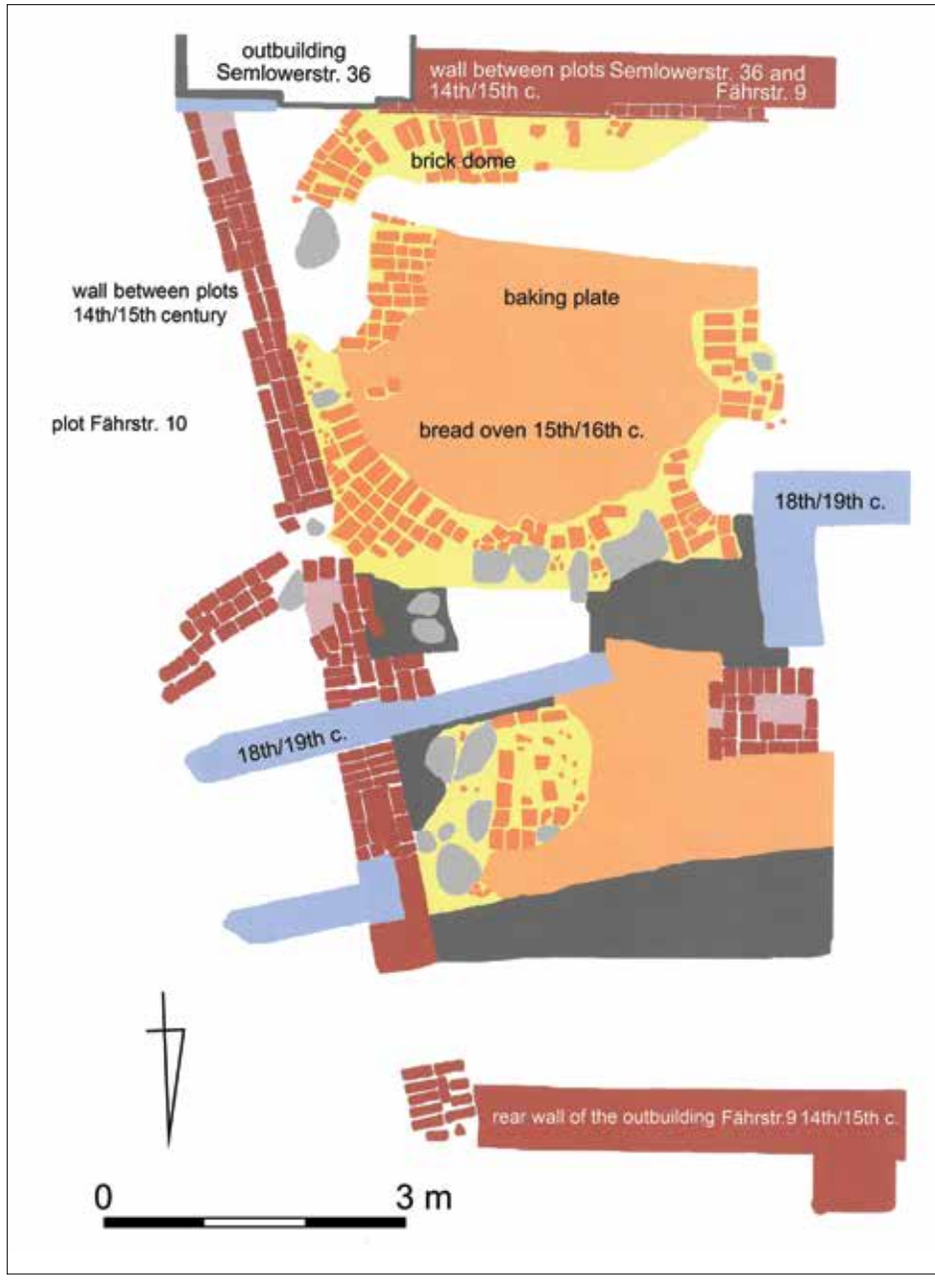

Fig. 48. Stralsund, Fährestraße 9. Bread oven of the 15th century (after Brüggemann 2015, Fig. 222)

In Greifswald, the remains of a bakery were discovered on the plot of land at Knopfstraße 13 (Schindler, Kaute 2009). In the central part of the property there was a single-chamber bread oven, measuring 3.4 × 3.9 m. It was built on a solid, four-sided platform made of beams. Initially, it had a clay dome set on vertical posts, which was later replaced with a brick one. The floor area of the oven is estimated to have been 7.5–8 m². Its size was therefore slightly smaller than the ovens from the above-mentioned bakeries in Lübeck and Rostock. Due to the significant damage to the oven and the deposits around it, it is not known whether it had stood in the open or whether it had been situated inside a building. The oven was built at the beginning of the 14th century. The end of its use was related to the construction of a late medieval outbuilding.

In Kołobrzeg, the remains of a bakery were discovered on the plot at Nr 19 Mariacka Street (Wywrot-Wyszkowska 2017, 162 f., Fig. 18). This plot was just over 100 m away from the bread stalls located near the collegiate church, along the upper section of modern Narutowicza Street (Riemann 1924, 52). The bakery was located in the yard of the plot, originally facing today's Wąska Street.[81] It was equipped with a free-standing brick oven (Fig. 49). Despite the fragmentary state of preservation of the oven, the area of its baking plate can be estimated at 10–12 m². The presence of as many as nine layers of sintered clay inside the oven, marking the subsequent levels of use of the baking plate, indicates its long-term use. A wooden building was an integral part of the bakery. This structure was only partially uncovered, although it can be assumed that it was 4.5 m wide and much more than 4 m long. What is worth emphasizing is the careful way in which it was made. It was equipped with a drainage system and a wooden floor, elements that protected against excessive moisture, which was particularly important in the production of bread.

A fifteenth-century bread oven discovered in Puck, at Nr 4 on 10 Lutego Street, is interpreted as a device related to craft activities (Starski 2017b, 401, Fig. XV.20). Within the excavation, only a fragment was found of the furnace wall, with a door leading to its interior. This state of affairs made it impossible to know its dimensions. The furnace was located in the central part of the plot, where a shoemaker's workshop operated in the last quarter of the 14th century (see above). Its later chronology suggests that it was built after the leather workshop ceased operations, which may have been related to a change of owner of the property.

The above data shows that bakeries were most often located in the courtyards of the plots just behind the front buildings, and sometimes in their ground floors.

81 The parcellation of the building block in which the workshop in question was located has undergone several significant transformations in the modern period (see Wywrot-Wyszkowska 2017, 162, especially footnote 55).

Fig. 49. Kołobrzeg, Nr 19 Mariacka Street. Features discovered within the bakery. Remains of a bread oven (in front), remains of a wooden building (in the back) (after Wywrot-Wyszkowska 2017, Fig. 18)

Apart from the Kołobrzeg bakery and perhaps also the Stralsund bakery, bread ovens were located in closed spaces. Most likely, other activities related to bread making were also carried out there, and there were separate storage areas. The construction of these bakery buildings attracts attention – most often they were of brick, or frame-built buildings with brick wall filling. The use of refractory materials in their construction was presumably intended to minimize the danger of fires spreading (Gläser 1989a, 319). The ovens themselves were usually built of bricks laid in clay. Only in the case of the device on the property Knopfstraße 13 in Greifswald was a clay dome used in the initial period of its use. The ovens used in bakeries had a single chamber. Baking was a two-stage process: first, wood was burnt to heat up the structure, and then after heating the oven to the appropriate temperature, it was necessary to clean its interior of hot coals and then put in the bread to be baked (Gläser 1989a, 318; Grabowski 2005, 286). Each baking oven was used for a relatively long period, reaching several dozen years. During this time, there were repeated repairs, sometimes involving replacing the baking plate or building another level of it.

Ovens belonging to the workshops of bakeries are distinguished by their large internal capacity, with floors ranging in area from 8 to 12 m^2. Much smaller bread

ovens were also registered in the towns discussed here. One such example was an oven discovered in Wismar, on the Mecklenburger Straße 22 property located near the market square (Grabowski 1996). This oven was located in the ground floor of a tenement house and had been built at the same time as the front house, in the first half of the 14th century. It was a single-chamber domed oven with an opening measuring approximately 60 × 60 cm (Grabowski 1996, 119–121, Figs. 3; 4). The area of the floor was approximately 3.3 m² and it can be calculated (see above) that it could have accommodated at least 64 kg of bread (Grabowski 1996, 125; 2005, 287). According to M. Grabowski (2005, 287), the small capacity of the oven and the lack of intensive traces of use tend to exclude the possibility that it was associated with a bakery, and the device could therefore have been part of the equipment of a burgher's house. Bread ovens discovered in Lübeck, on the properties of Große Petersgrube 9 (Mührenberg 2006, 255), Mengstraße 62 (Meyer, Neugebauer 1982, 195) and Fischstraße 8 and 14 (Radis 2015, 107) are interpreted similarly.

This then raises the question whether all the smaller ovens found by excavation were really used exclusively for private purposes. As C. Theune (2008, 18) rightly noted, bakeries of that time could have had devices of various capacities. Their size depended primarily on the possibility of selling products, which was determined by the number of potential customers, demand, access to permanent sales places, or other circumstances, such as production outside the local market or to supply ships. The economic situation of individual bakers was also important. In the list of Lübeck bakeries prepared by R. Hammel (1981, 42, 60) for the year 1378, the very high percentage (approx. 45%) of workshops that were leased or located on rented plots is striking. In these cases, the craftsmen working there probably used buildings and equipment owned by wealthier townspeople. In the light of information derived from this list, among the bakeries not owned by the craftsmen working there were some of those in Mengstraße and Große Petersgrube (see Hammel 1981, 42, 60, esp. fn. 39). It is possible that the bread oven on the property at Mecklenburger Straße 22 in Wismar was also periodically rented by one of the less wealthy bakers.

A unique find is a two-chamber oven discovered in Lübeck within the Aegidenhof (Segeberger Konvent), which was the seat of one of the religious congregations (Suchowa 2000, 54). The oven had been built around 1400 and was located in the basement of the side wing of the building, with an entrance from the street. In the lower part of the oven there was a combustion chamber (dimensions 2.2 × 2.1 m) covered with a clay vault. Above it was the baking chamber. It had the form of a dome made of bricks, on an irregular circular plan; the openings to both chambers were located one below the other (Suchowa 2000, 54). The area of the floor of the baking chamber was approximately 9.1 m². The size of this oven was

therefore comparable to the size of the ovens found in bakeries (see Grabowski 2005, 288), although it probably functioned only to serve the needs of the inhabitants of the convent (Suchowa 2000, 54).

The oven of the Aegidenhof is the only currently known example of the use of two-chamber ovens in the Baltic coastal towns. Both in the Middle Ages and later, bakers in this region used single-chamber ovens (see Grabowski 2007, 135), which is confirmed by the remains of such facilities from the 14th–19th centuries, registered in the bakeries in Lübeck at Engelswisch 65 (Engelsgrube 54) and Mühlenstraße 65.

A characteristic feature of late medieval port towns was the high degree of development of beer brewing (Tandecki 1993, 171; 1997, 82; Kattinger 2000a, 82), although craftsmen conducting such activities were also located in centres located in their hinterland (see Kardasz 2017, 81 ff.). The significant size of brewing production resulted from the extraordinary popularity of beer, widely consumed by all social groups. It was also purchased to supply ship crews (Tandecki 1997, 82), and in some towns (for example Elbląg, Greifswald, Stralsund) it was an important export product (Tandecki 1993, 174; Kattinger 2000b, 35; Ansorge, Wiethold 2002, 164).

The results of research in Stralsund are extremely valuable for consideration of this field of craft. In the tenement house at Frankenstraße 57, a malt drying oven was discovered, dating to the 14th century. This was built into the back wall of the cellar. The kiln chamber was located in a triangular vaulted niche, closed from the inside of the building. In the rear wall of this niche a hole led to the firing chamber, located on the outer side of the wall. Its walls were built of bricks, and it had a concave clay floor covered with bricks (Fries 2003, 249 ff., Figs. 3–6). Inside the oven there were grains of cereals, along with a few peas and remains of wild plants. The cereals included mainly sprouted barley grains (Fries 2003, 251 n.).

The remains of a brewery workshop were also identified on the neighbouring plot, number 57a (Ansorge, Wiethold 2002). The production room was located in the cellar of the front building, the floor of which was paved with bricks. In the floor, along the western wall of the tenement house, a 5 cm deep gutter was built, one brick wide, with a slope towards the street. On the eastern side, it was connected by another, transversely oriented gutter, approximately 3 m away from the rear wall. Between them there was a hearth (about 2 m in diameter) made of pieces of bricks and field stones, over which there was a layer of burnt clay several centimetres thick (Fig. 50). This hearth may mark the location of the cauldron used to boil the wort (Ansorge, Wiethold 2002, 171 ff.).[82] This interpretation is strengthened

82 Kettles used for brewing wort usually had a large capacity, reaching several hundred litres. Due to their high volume, their bottoms had to be properly secured. They could be based

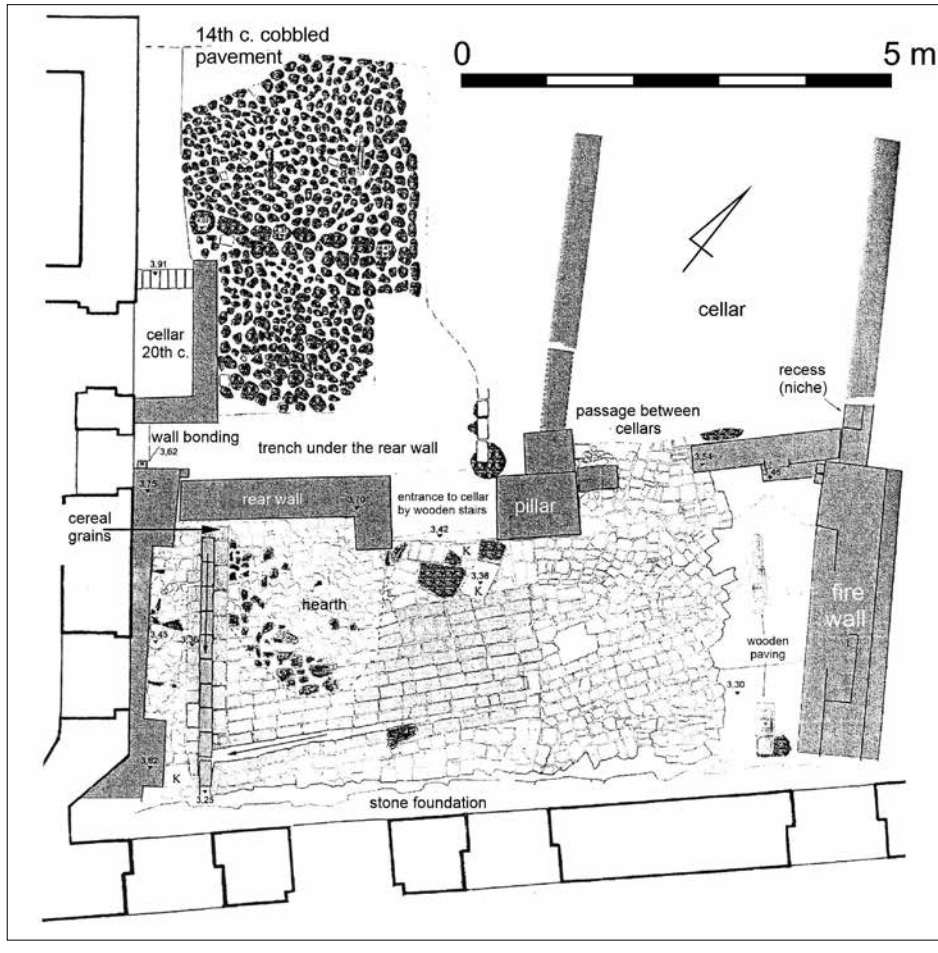

Fig. 50. Stralsund, Frankenstraße 57a. Remains of a brewery (after Ansorge, Wiethold 2002, Fig. 6)

on a special iron base, additionally supported with bricks or stones placed on clay (Dryja 2009, 196). Some information about the appearance of brewers' wort kettles is provided by the finds of such heating devices, dating back to the modern period, from Gdańsk, Kraków and Falkenhagen near Reinberg (Western Pomerania). These were built on a circular plan, the walls were most often made of bricks bonded with clay, and their hearths were lined with stones or bricks (see Niemirka 2009, 297, figs. 7–8; Dryja 2009, 201, Fig. 6; Clavén et al. 2012, 200, Fig. 5). A similar structure was probably located around the hearth in question (see Ansorge, Wiethold 2002, 171, Fig. 8, further literature there). It was most likely destroyed because the building at Frankenstraße 57a was bombarded during the Thirty Years' War, and then devastated and partially demolished (see Ansorge, Wiethold 2002, 173). The only trace of the kiln seems to be a burnt layer of clay.

by the discovery in the north-west corner of the basement, near the fireplace, of a cluster of burnt cereal grains and the remains of other plants, most of which were sprouted barley grains (Ansorge, Wiethold 2002, 177 ff., tab 1). They were characterized by high quality, i.e. they were fully developed and had a similar size (Ansorge, Wiethold 2002, 181). These observations indicate careful selection of the raw material intended for brewing beer.

The activity of the workshop discovered on the property at Frankenstraße 57a dates to the early modern period (16th–17th centuries). Brewing could have been carried out here much earlier, however, probably since the 14th century (Ansorge, Wiethold 2002, 170). This hypothesis would be supported by the presence of a water supply line, from which a dendrochronological date of 1369 was obtained. From then on, or only slightly later, the residents of the property had the use of their own connection to the water supply. The main recipients of water from municipal waterworks were usually craftsmen, especially brewers, for whom access to clean water was of particular importance (Ansorge, Wiethold 2002, 170).[83] The very good condition of the watermain and the lack of contamination inside it prove that this device was given special care, thanks to which it could be used for a long time, until the 17th century (Ansorge, Withold 2002, 170). The lack of traces of other medieval devices related to the operation of the brewery may be the result of damage caused by fires that hit the property in question. After a fire in the 15th century, the tenement house was rebuilt along with the cellar that housed the workshop (Ansorge, Wiethold 2002, 171). Already in the Middle Ages, residents of many houses located on the lower sections of Frankenstraße and nearby Langenstraße had the right to brew beer. It should therefore be assumed that the inhabitants of the plots at Frankenstraße 57 and 57a also benefited from this privilege (Ansorge, Wiethold 2002, 164, there further literature).

The evidence confirming brewing obtained in other Baltic towns is much more modest. One may mention here the discovery of a malt drying oven in Puck, in the yard of the property at Nr 13 Plac Wolności (Starski 2014, 155, Fig. 7B). Similar devices were excavated in Gdańsk (Polak 2007, 355; 2022). At the back of a corner plot at Nr 7 Powroźnicza Street, there were as many as three successive malt drying kilns built in the same place. They were in use in the period from the second half of the 14th century to the second half of the 15th century. They were built of bricks and had a T-shaped plan. The length of the stokehole

83 It is worth emphasizing here that the initiators of the construction of the first Lübeck waterworks were brewers (Grabowski 1994, 27 f.).

was 1.5 m and the length of the flues of the oven chamber is estimated to have been about 3.8 m (Polak 2022, 134, Fig. IV.16). In turn, on the property at Nr 3 Grząska Street, the malt drying furnace was located in the cellar of the front building. This device also had a T-shaped plan and dates to the fifteenth to sixteenth centuries. It was built using bricks laid in clay, and both chambers seem to have been covered with a barrel vault. The stokehole, in which traces of burning were recorded, was attached perpendicularly to the longer flue of the oven chamber (Fig. 51). It is assumed that there were chimneys at both ends of the flue (Kuczma, Dyrda 2009, 155). In such devices, the fire was lit in the stokehole, moving the embers deeper into the furnace, to the point of connection with the longer kiln chamber flue, which accumulated and distributed the heat given off in the vault (Dryja 2009, 195). It is not clear whether the kilns discussed here were part of the equipment of malting workshops or breweries.

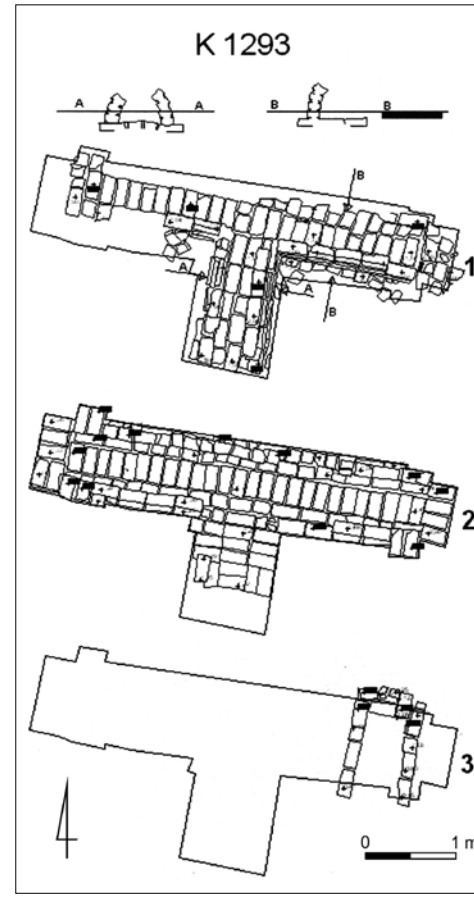

Fig. 51. Gdańsk, Nr 3 Grząska Street. Oven for drying malt. Cross-section and plans of three phases of use of the structure: 1 – phase III, 2 – phase II, 3 – phase I (after Kuczma, Dyrda 2009, Fig. 15)

Premises related to beer production were generally located in the front tenement houses or at the back of the plots, in the outbuildings built there (Dryja 2009, 194). This is where the excavated remains of malting and brewery ovens tend to be found. Based on the available finds, it is very difficult to reconstruct the layout of the individual rooms where the activity took place and their equipment. It can only be said that some breweries, especially in larger centres (for example at Frankenstraße 57a in Stralsund), had their own water supply.

3. 15. Other crafts

There are a number of craft activities and services indicated by the archaeological evidence that do not easily fall into the above categories. Some of them are marked by poor or ambiguous evidence, but two merit discussion here. Baths were an important element of the infrastructure of medieval urban centres. In these establishments people not only bathed, but also had their hair cut, shaved, minor surgical procedures were performed and various entertainments were performed. They were the workplace of bath attendants, barbers (and barber surgeons) and sometimes prostitutes (Enzenberger 2007, 92, further literature there). Public baths are not very common archaeological finds, and in the case of the Baltic towns discussed here, such a facility is known only from Greifswald (Enzenberger 1997, 2007). It was discovered in the central part of the property at Rotgerberstraße 25, located in the peripheral area of the city, right above the moat (see Fig. 30). The bathhouse was built around 1270 and was initially located in a wooden building, most likely constructed as a frame-built structure. It was not a very large facility (with an area of approx. 58 m²) but it was equipped with a hypocaust heating device. A gutter ran through the centre of the bathhouse and was used to drain used water and waste towards the moat (Enzenberger 2007, 42, 101, Fig. 34). Around 1300, a new building was erected in place of the older one. The new structure had brick walls, at least on the ground floor, and a much larger area (70 m²). However, the layout of its interior remained unchanged (Fig. 52). The heating device was still located in the north-west corner of the building. Also, as before, there was a gutter through which waste water was removed (Enzenberger 1997; 2007, 43, 72, 96). In the older period of the baths' existence, the water necessary for its operation was most likely obtained from the moat and from the gutter located at the southern border of the plot, running from Rotgerberstraße. Later, a sump located at the back of the neighbouring property, Rotgerbestraße 26, could have been used (Enzenberger 2007, 76, 101).

A significant concentration of items related to its activities was noted in the area of the baths and in the yard of the plot at Rotgerberstraße 25. These included toilet combs, scissors, gaming pieces, and fragments of the ceramic lids used to cover the openings of the heating channels. In a neighbouring plot, a reused stave bucket was found dug into the ground (Enzenberger 1997, 204 ff., Figs. 3; 4:1–2; 5–10, 13; 2007, 96). There is a documentary reference from 1304 to a bathhouse located on Rotgerberstraße, in the immediate vicinity of a tanner's workshop. Without doubt, this information refers to the structure in question (Enzenberger 2007, 97, see also

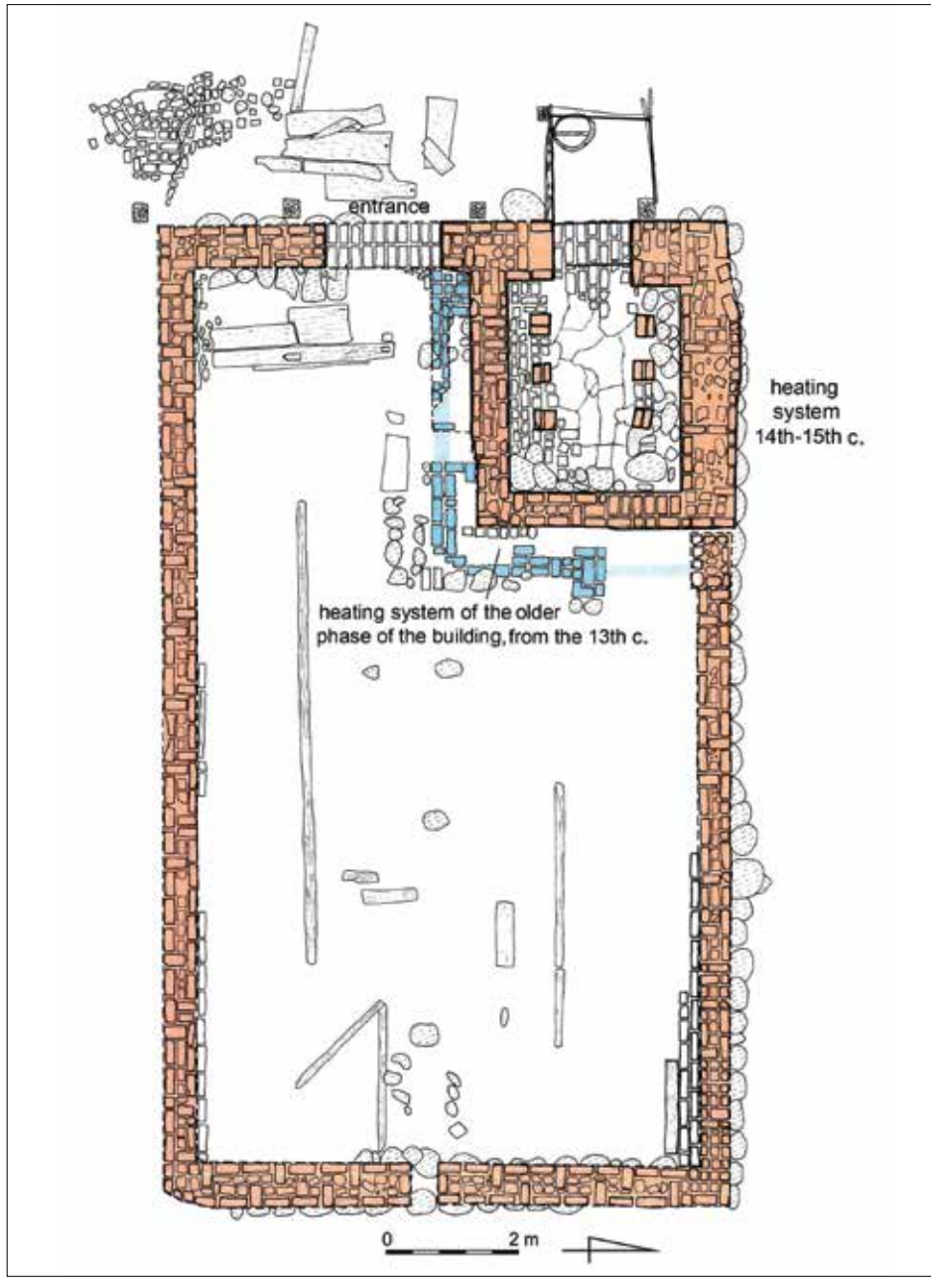

Fig. 52. Greifswald, Rotgerberstraße 25. Remains of the bathhouse building (after Enzenberger 2007, Fig. 45)

Igel 2010, 139 ff., Stadtplan 20). This bathhouse operated for a very long period, most likely until the 17th century (Enzenberger 2000, 112).

The discovery of evidence of glassworking from the 13th to 14th centuries in Riga is extremely interesting (Caune 2003; 2004). The workshop waste was found in several investigations concentrated in the north-eastern part of the city (Caune 2003, Fig. 8). In an excavation trench on Trokšņu Street, stretching along the city wall, a very large assemblage (1,521 items) of such material was recorded. It consisted mainly of beads including imperfect items, as well as cup-shaped crucibles (13 items) and fragments of clay pots (149 items) used for melting glass mass. These artefacts were accompanied by production waste in the form of lumps of glass and slag (150 items). The excavated material also noted the presence of two tiny clay crosses covered with glaze and fragments (474 pieces) of vessels glazed on the inside, as well as a fragment of a needle used to make holes in the beads (Caune 2003, 47 ff., Figs. 2; 4–6; 2004, 458 f.). These finds were located in an originally undeveloped area, in layers consisting of mulch, fragments of wood, sand and small stones brought from other areas of the city. The context of their discovery indicates that these are waste removed from a glass workshop. Its remains were uncovered on a nearby property at Nr 5 Aldaru Street, where there was a brick-built furnace with a clay floor where glass was melted. Only a small part of this structure was exposed, therefore it is impossible to determine its dimensions (Caune 2004, 468). A large accumulation (nearly 600 items) of glass beads, their semi-finished products and defective products (about 20 items) was recorded in the workshop. In addition, fragments of small crucibles and larger clay vessels whose inner walls were covered with glaze were recorded (Caune 2004, 458).Items found in work on Smilšu street, consisting of fragments of bowl-shaped crucibles and clay vessels covered with glassy material on the inside, probably came from this workshop (Caune 2004, 462 f.).

The results of the analysis of finds from the workshop at Nr 5 Aldaru Street and the related waste registered at Smilšu and Trokšņu Streets (Caune 2004, 458 ff.), indicate that Riga glassmakers were mainly engaged in the production of beads intended for making necklaces and costume decorations (Caune, Ose 2006, 465).[84]

84 According to the same author, these workshops had also been engaged in glazing clay crosses and vessels used in households. In my opinion, this last type of activity is unlikely. The clay vessels discovered here, covered with glaze on the inner walls, could have been used to melt glass mass. If such items were actually manufactured, they would have to be sold, at least on the local market. However (apart from finds within the above-mentioned workshop and dumps of waste), the presence of internally glazed vessels has not been recorded either in Riga or at other medieval Latvian sites (cf. Caune 2004, 459; Caune, Ose 2006, 462).

These products were widely distributed among the local population, as evidenced by their numerous finds in Riga and other towns in Latvia (see Caune 2004, 463, there further literature).

Glass beads were also made in Tallinn, which is confirmed by the presence in the excavated material of crucibles for melting glass mass, finished products and also production waste in the form of slag. Material of this nature was recorded during research conducted at Nrs 9 and 11 Roosikrantsi Street, Nr 10 Sauna Street, Nrs 4–6 Sulevimägi Street and in the market square.[85] The nature of the finds obtained at 4–6 Suulevimägi Street, among which – as in the Riga glass workshop – there are numerous fragments of clay vessels with glassy material on the inner surface, probably used to melt glass mass, allows us to assume that here or somewhere nearby there could have been a similar workshop. It is worth emphasizing that in plots Roosikrantsi 9 and 11, the remains of glass production were accompanied by traces of the production of bone and antler objects (see above; see also Luik, Maldre 2003).

85 The above-mentioned finds of beads, crucibles and production waste are known to me from personal examination. They are in the collections of the Institute of History of Tallinn University.

4. Changes in technologies and the range of craft production

The migration of people from northern and central Germany had a significant impact on the development of crafts in the municipal towns of the southern Baltic coast. The settlers who came to the newly established urban centres brought new production techniques, new consumption patterns and new forms of production organization previously unknown in the region (see, for example, Becker et al. 2004; Müller 2005a; 2006a; 2006b; Rębkowski 2006a; 2007a). These changes are visible in almost all areas of crafts, and they should be considered in three aspects: (i) through the prism of the raw materials and production techniques used, (ii) the assortment of manufactured products, (iii) the professionalization of production and the emergence of new professional specializations.

These transformations are particularly visible in relation to pottery. In most of the area considered in this book, until the 12th–13th centuries, vessels were fired in an oxidizing or, more often, uncontrolled atmosphere, in simple single-chamber kilns (Lüdtke 1985, 49, 118; Rębkowski 2007a, 104; Müller 2005a, 90). The vessels made at that time were dominated by multi-functional pots (jars), and bowls were only occasionally made (Rębkowski 2001, 32 n., 159; 2007a, 104; Drenkhahn 2015, 40 ff.). As early as the 12th century, greyware vessels fired in a reducing atmosphere appeared in the western part of the Baltic Sea. The technique of their production was developed in the areas west of the

Elbe, i.e., in Rhineland, Schleswig, Hesse and Lower Saxony (Rębkowski 2001, 160, 191, also further literature there). Initially, these were the so-called soft greyware vessels, which were not yet characterized by a relatively high hardness of the body. During the 12th century, we see the emergence of the so-called hard greyware ceramics, characterized not only by better firing, but also by a more careful composition of pottery fabrics (Rębkowski 2001, 160). Correctly carrying out the process of firing such vessels required the use of appropriate kilns. These were two-chamber devices in which the temperature and firing process could be controlled, which resulted in evenly fired products of the desired hardness (see Müller 2005a, 90; 2006a, 6).

In Schleswig, the presence of grey pottery was recorded in assemblages of vessels dating from the 11th to 12th centuries, including quite a large number (17%) of soft-fired wares. However, in the assemblages from the 13th–14th centuries, there were only hard-fired specimens, which comprised 86% of all finds of pottery (Lüdtke 1985, Fig. 10). In Lübeck, such vessels were widely produced already in the last quarter of the 12th century, as evidenced by their dominance in the pottery assemblages discovered in the city (Drenkhahn 2015, 130, table 3b). From the 13th century, with the progressing German colonization, the knowledge of the techniques of production of these grey ceramics spread eastwards. In the successively established towns located in Mecklenburg, Pomerania and Prussia, ceramics fired in a reducing atmosphere appeared in large numbers since the beginning of their existence (see, for example, Schmidt 1989; 1990; Schäfer H. 1997b; 1997c; Rębkowski 2001, 160–195; Marcinkowski 2003a; 2006a). The very large quantity of such material indicates that in each of these centres, local production of grey ceramics must have been initiated immediately after their foundation. These were high-quality products, which was ensured not only by careful preparation of the pottery fabric, but also by appropriate firing. It is significant that all thirteenth-century pottery kilns discovered so far in Lübeck, Neubrandenburg and Elbląg were two-chamber devices enabling control of the firing process.

Together with the appearance of a technologically new type of ceramics, the range of manufactured vessels changed dramatically. The multifunctional jar was replaced by a set of products with various forms and purposes. These were mainly jars, jugs, tripod vessels (pipkins), cups, mugs and special forms, such as troughs and basins or miniature vessels (Rebkowski 2001, 191). The high quality and functional diversity of grey vessels made them widely used in all Baltic towns until the 16th century (see, for example, Schmidt 1990; Rębkowski 1995; 2007a, 107; Schäfer H. 1997b; 1997c Trzeciecka, Trzeciecki 2002; Romanowicz, Zyśko 2012; Marcinkowski 2006a, 275, Drenkhahn 2015; Starski 2016).

Another type of pottery previously unknown on the southern Baltic coast was glazed redware vessels. This specific type of products probably began to be produced at the end of the 12th century in the towns of Flanders. In the 13th century, the knowledge of the techniques for producing such vessels reached Dutch cities and then the areas of southern Denmark, a process which was related not only to the transfer of production techniques, but probably to the migration of potters (Rębkowski 2006a, 66; 2007a, 106–107). In the light of recent studies on groups of finds from the second half of the 12th to the first half of the 13th centuries, supplemented by the results of specialized mineralogical research, it has been suggested that glazed redware vessels could have been produced in Lübeck already in the second half of the 12th century (Drenkhahn 2017c, 392). In the 13th century, among other types, jugs were produced decorated with characteristic anthropomorphic motifs (see Braun 2002; Drenkhahn 2015, 138). Most likely, from the turn of the 13th and 14th centuries, glazed redware vessels were made, although on a small scale, also in Neubrandenburg (Schmidt 1989; 1990, 37–38; Jantzen 1997, 183). Such vessels were also produced in the village of Parkentin near Rostock, belonging to the Doberan monastery (Schäfer 1997b, 302), and in Demmin (Schäfer H. 1999b, 229; Müller 2006a, 8). In the opinion of M. Rębkowski (2001, 189), glazed redware vessels made in centres located in today's Mecklenburg-Vorpommern could only be an imitation of Scandinavian and/or Dutch products. This is evidenced primarily by the nature of the ornament used on these vessels, which is relatively poor compared to that on imported products (see also Müller 2006a, 9f.).

One factor that was crucial for the development of blacksmithing in late medieval urban centres on the south Baltic coast was access to the iron obtained from high-grade ores processed in the metallurgical centres of the time (Mulsow 2005b, 301). The raw material obtained from them guaranteed the high quality of the manufactured items. Obtaining high-quality iron became possible thanks to improved smelting technologies. In Central Europe, from the 13th century, metallurgical furnaces were used that were much larger than those in the earlier period, and in them higher melting temperatures were achieved. The use of such devices significantly increased the profitability of iron production, even from ores with reduced iron content. Increased carburization of iron was also possible there (Röber 2006, 48). This raw material was brought to towns located on the southern coast of the Baltic Sea from metallurgical centres located in southern Germany and from Sweden (Lesiński 1960, 28; Bogucka 1962, 103; Mulsow 2005b, 301; Röber 2008, 99–100).

The involvement of the Baltic coastal towns in long-distance trade meant that, in addition to charcoal, coal imported from England was also used for iron processing. The use of such a material for fuel resulted in much higher temperatures

being reached. This was important in the production of items for special purposes. This is evidenced by the discovery of significant amounts of coal in the forges located in the Port Suburb in Stralsund, where anchors and small boatbuilding equipment were made (see Kulessa 2004).

Late medieval blacksmiths also used standardized manufacturing techniques. An example here is the technique of producing knives, probably the most common tools with universal use. In the 9th–12th centuries, they were generally made of 'soft' iron, carburized on both sides and then tempered. At that time, knives with steel overlays placed only on the blade were produced on a much smaller scale. Since the turn of the 12th and 13th centuries, there was a significant increase in the production of knives with blades made in the latter manner (Röber 2018, 118; Gan 2016, 86, there further literature). The use of steel overlays significantly simplified the manufacturing process, making it possible to mass produce standardized and relatively cheap products intended for sale to anonymous recipients (see Röber 2008, 118, and further literature there). The use of such procedures is confirmed by the results of metallurgical analyses of artefacts from Kołobrzeg (Gan 2016, 83–85) and Puck (Garbacz-Klempka et al. 2017, 241–244).

Based on the analysis of finds obtained in the blacksmithing workshops discovered so far, it is difficult to clearly determine the range of items made there. Nevertheless, it is probably safe to assume that here too, the process of separating various professional specializations must have begun already in the 13th century. Archaeological sources seem to confirm the activity of heavy blacksmiths (including horseshoe makers), small blacksmiths (including nailers and locksmiths), cutlers, and also anchor producers.

The emergence of specialist metalworkers such as pewterers and bronze-founders should also be associated with the development of location and the chartered towns. The founding of copper and its alloy, bronze, was of particular importance in the Baltic towns (Müller 2005a, 88 ff.; 2005b, 127). Bronze-founders specialized in the production of a particular form of cast bronze three-legged cauldron (the so-called grapen) that during the 13th and 14th centuries became one of the most characteristic vessels used both in households and craft workshops (Rütz 2005, 295). The production of bronze grapens was a complicated process, as it required appropriate furnaces in which the metal could be melted, and the vessels themselves were cast in clay moulds, each time prepared for a particular casting. The oldest bronze-founding workshop, dating back to the first half of the 13th century, was discovered in Lübeck (see Gläser 1989b; Drescher 2017). However, what is significant is the very rapid spread of this kind of metal casting along with the spread of colonization towards the east. Rostock may serve as an example here, where traces

of the craftsmanship of bronze cauldrons date back to the 1240s (Schäfer C. and H. 1994, 157; see also Mulsow 2000a; 2006). In the following century, bronze-founding developed dynamically in Greifswald (see, for example, Ansorge, Rütz 1999; Rütz 2002).

In the course of time, bronze-founding became an important craft for the economy of many towns, including: Lübeck, Wismar, Rostock, Stralsund, Greifswald and Stargard. This is evidenced by the remains of many workshops recorded during research. These remains mainly comprise extremely numerous finds of production waste in the form of fragments of broken foundry moulds. The huge amount of such waste indicates the significant scale of production. All these centres produced grapen vessels of unified design and dimensions (see Müller 2005a, 89 ff.). Standardized manufacturing techniques enabled mass production, aimed at sale to anonymous recipients.

Significant transformations also occurred in the case of woodworking crafts. Here, carpentry and house construction techniques come to the fore. Until the 13th century, on the entire southern coast of the Baltic Sea, from Lübeck to Riga, the corner-jointed horizontal log construction technique was a common way of building houses.[1] This technique usually involved the construction of single-space buildings with small areas, usually 15–25 m^2. Coniferous wood, mainly pine, was used for their construction (Rębkowski 2005, 53; 2007a, 105). During the period in question, in addition to these log buildings, wattle structures were also built. Along with the colonization campaign, significant changes took place in the construction techniques of buildings in urban centres (Rębkowski 2001, 154 ff.; 2007a, 105).

Post-built constructions appeared as early as the 13th century. These were structures whose structural base consisted of rows of posts driven or dug into the ground at intervals of usually 2–4 m (Rębkowski 2007a, 105, and literature there). Post buildings were erected in the urban centres discussed here until the end of the 13th century. They were quickly replaced by framed (skeleton) buildings. The basis of these structures was a wooden structural frame, consisting of a lower beam (sill-beam) and an upper one (wall plate), connected by vertical posts morticed into the sill-beam. Oak wood was most often used to construct building frames, and the wall surfaces between the structural elements could be filled in various ways (Rębkowski 2007a, 105). The use of the framed technique allowed for the creation of buildings of any size, and above all any height, thanks to which their floor surface could be multiplied even in a relatively limited space (see Rębkowski 2001, 155).

1 A very good overview of wooden construction in the Baltic Sea centres can be found in volume III of the Lübeck Colloquium (Lübecker Kolloquium 2001); see also Blusiewicz 2017b.

The next areas of crafts that saw significant changes in technology and the assortment of manufactured products were cooperage and turnery. In the 13th century, new patterns of vessels and new ways of producing them appeared in the Baltic towns. These are primarily stave-built vessels and bowls turned on one side (see Baran 2003, 208; Rębkowski 2007a, 105). Stave-built vessels appeared in the 11th century in Brandenburg. However, it was only in the following century that they were recorded in greater numbers in urban centres located in central and northern Germany. Knowledge of the production of stave-built vessels reached the towns located east of the Elbe together with the movement of German colonists (see Barnycz-Gupieniec 1961, 402; Baran 2003, 116, further literature there). However, the great popularity of bowls turned on one side could have been due to the simplification of their production techniques, which also resulted in the possibility of dividing work between the master and apprentices, increased efficiency and reduced production costs, which resulted in relatively cheap products (Baran 2003, 208).

Both types of vessels had standardized shapes and dimensions, and judging by the very high frequency of their finds in excavated assemblages, they were probably in continuous production on a mass scale. In the light of these comments, it should be stated that the changes in the production of wooden vessels recorded in the Baltic urban centres consisted of the simplification and unification of production methods, as a result of which continual production of relatively cheap products aimed at wide sales was possible (Polak 1996, 331 ff.; Baran 2003, 208; Rębkowski 2007a, 105). The scale of this production, and probably the organized trade of bowls turned on one side and stave-built vessels, are evidenced by the previously mentioned discoveries of warehouses of such vessels in Elbląg (Nawrolscy 1986, 632; Nawrolska 2009, 90) and Kołobrzeg (Polak 1997, 30; Rębkowski 2000, 46).

The period of the High and Late Middle Ages was marked by a flourishing of the cooper's craft and the related mass production of barrels – the basic packaging at that time. Their production was an important branch of craft not only in port towns, but also in the centres located in their hinterland.[2] The very high demand for such products must have stimulated their mass production (see Baran 2003, 208).

Changes in production techniques are also noticeable in relation to the wheelwright's craft. In the Middle Ages, two types of wheels were used, differing in the manner of making the rim, which could either be of bent wood, or constructed of

2 See, for example, studies for Lübeck (Warnecke 1937), Rostock (Dragendorff 1896; 1899), Greifswald (Krause, Kunze 1900; 1901; Kattinger 2000a), Szczecin (Blümcke 1884), Kołobrzeg (Riemann 1924; Tepp 1980), Stargard (Bohemer 1903), Gdańsk (Hirsch 1858; Bogucka 1962), Elbląg (Czaja 1992a) and Riga (Stieda, Mettig 1896).

several elements (felloes). Wheels with bent rims, used already in the early Middle Ages, were more durable, but at the same time more difficult, and more expensive, to produce (Robak 2009, 179). In the 13th and 14th centuries, wheels with composite rims came into use. Making such wheels was much simpler and faster. They were also much cheaper to produce, which contributed to their rapid dissemination (see Bobik 2016, 157; Starski 2017a, 154). This phenomenon is reflected in archaeological material, as evidenced by the fact that all wheels discovered so far in the sites discussed here have this structure.

Already in early urban centers, such as Old Lübeck, Haithabu (Hedeby), Schleswig, Wolin, Szczecin, Kołobrzeg and Gdańsk, leather processing was an important field of craft activity. At the end of the 12th century and in the 13th century, significant transformations also took place in this branch of crafts. They were related to changes in the structure of the raw materials used, as well as technological progress and the dissemination of new production techniques and a new set of products. A characteristic feature of early medieval leathermaking was the widespread use of the skins of small ruminants – sheep and goats – as evidenced by the discoveries from Haithabu (Groenman-van Waateringe 1984, 13, Fig. 2), Old Lübeck (Groenman-van Waateringe 1988, 142) and Kołobrzeg (Wywrot-Wyszkowska, Radek 2007, 216, Fig. 214). In some early medieval centres, such as Old Lübeck (Groenman-van Waateringe 1988, 142) and Kołobrzeg (Wywrot-Wyszkowska, Radek 2007, 216, Fig. 214), skins of animals from the deer family were also used on a large scale. In Schleswig, in the 11th–12th centuries, goat and sheep skins were widely used in the production of leather products, mainly footwear. Starting from the 13th century, there is a clear increase in the importance of cowhides (see Schnack 1992, 28; van de Walle-van der Woude, Groenman-van Waateringe 2001, 11). It is a similar situation in Lübeck, where in the initial period of the city's operation, goat and sheep skins dominated in the structure of the raw materials used (see Groenman-van Waateringe, Guiran 1978, 170, fig 73), while in the second half of the 13th century, cowhides were gaining in importance (see Groenman-van Waateringe, Krauwer 1987, 77; van den Berg, Groenman-van Waateringe 1992, 348, Fig. 3.1–3; Volken 2002, Fig. 11). This trend is particularly visible in towns located east of the Elbe. In Kołobrzeg, cowhides were widely used from the very beginning of its existence, but the proportion of them in the structure of the raw material used more than doubles, compared to the period before the chartering of the town (Wywrot-Wyszkowska 2008, 18–19). Also in Szczecin (Kowalska 2013) and Stargard (Wywrot-Wyszkowska 2009b; Stań 2012), cowhides were the dominant raw material species already in the second half of the 13th century.

The above examples very clearly illustrate the process of changes taking place in the leather craft over quite extensive areas of Central Europe at the turn of the early and late Middle Ages. These phenomena are generally associated with transformations in the structure of livestock breeding, in which cattle production played an increasingly important role (see Gręzak, Kurach 1996, 157 ff.; Müller 2006a, 14; Wywrot-Wyszkowska 2008, 19; Becker et al. 2004, 104). The easier access to such a raw material due to the increase in the numbers of these animals was not the only reason for the wider use of cowhides. Another reason was associated with the development of appropriate techniques for tanning and finishing cattle hides, thanks to which material with various physical properties could be obtained, which translated into a wider range of possibilities of using them for the production of various products (Radek 1998, 123; see also Becker et al. 2004, 104).

The 13th century brought significant changes in footwear design (see, for example, Schnack 1992; Müller 2006a, 14). In the early Middle Ages, mainly low or medium-high shoes were used. Already at the end of the 12th century, however, high shoes began to be produced, and a little later, footwear with high, full uppers were produced as well (see, for example, Schnack 1992). In the 13th century, new, previously unknown styles of low shoes came into use. Analyses of excavated material, mainly from Schleswig (Schnack 1992; van de Walle-van der Woude, Groenmann-van Waateringe 2001), Szczecin (Kowalska 1999; 2013), Stargard (Wywrot-Wyszkowska 2009b; Stań 2012) and Kołobrzeg (Wywrot-Wyszkowska 2008; 2009a), shows that the shoe manufacturing process was highly standardized.

Late medieval shoemakers used a unified system of cutting out the individual parts of shoes, which is evidenced by the repeated shapes of soles, vamps, complementary and strengthening elements of the upper, which had to be cut according to appropriate patterns. The use of templates contributed to better organization of work, enabled rational and even economical cutting of raw materials, and guaranteed the achievement of unified products. Noteworthy is the careful selection of the appropriate type and range of raw materials used to cut out individual footwear elements. A special expression of changes in late medieval shoe production was equipping footwear with various strengthening elements, which significantly influenced the quality and durability of the products. Moreover, the improvements introduced then are still practiced in footwear production today (see Wywrot-Wyszkowska 2008, 59 ff). The observations made clearly indicate that shoemaking in the municipal towns - from the very beginning of their operation – was focused primarily on sales. The marketization of production is probably one of the most visible changes that occurred in the shoemaking craft of that time.

Standardization of manufacturing techniques is also visible in the case of other leather products. The most representative example are the knife sheaths commonly worn by the inhabitants of late medieval towns. This applies in particular to those made of one folded piece of leather, the sides of which were fastened with rivets. Regardless of whether these products were discovered in Lübeck (van den Berg, Groenman-van Waateringe 1992), Schleswig (Schnack 1998), Greifswald (Schäfer C. and H. 1997), Kołobrzeg (Wywrot-Wyszkowska 2008), Stargard (Wywrot-Wyszkowska 2009b) or Riga (Bebere 1998), all of them are characterized by a similar assembly technique, ornamentation and the use of the same strengthening elements, i.e. simple metal fittings. These sheaths even have similar dimensions, which indicates that they were used to store knives of similar shapes and sizes, also manufactured according to unified standards.

One may observe the same phenomenon in the case of other products, such as belt bags, pouches or belts. We see examples of such items being made of similar types of leather, using the same technique and using similar decorative motifs, whether they came from excavations in Lübeck (Vons-Comis 1982; Volken 2002), Schleswig (Schnack 1998; van de Walle-van der Woude, Groenmann-van Waateringe 2001), Greifswald (Schäfer C. and H. 1998), Szczecin (Kowalska 2013), Stargard (Wywrot-Wyszkowska 2009b; Stań 2017), Kołobrzeg (Wywrot-Wyszkowska 2008), Elbląg (Nawrolscy 1989; Marcinkowski 2009) or Riga (Bebre 2005).

The emergence of new professional specializations among tanners and craftsmen involved in the manufacture of products from full-grain leather was not without significance for the development of leather production in late medieval towns. Archaeological evidence from Greifswald and Kołobrzeg confirm the existence in these centres, already in the 13th century, of workshops of red-skin and white-skin leathers and/or craftsmen specializing in fat dressing of leather (for these, see Schäfer C 1997b; Enzenberger 2000; 2007; Wywrot-Wyszkowska 2008). In addition to shoemaking workshops, the excavated material also identified workshops specializing in the production of various leather goods and probably leather clothing (see also Wywrot-Wyszkowska 2008, 102–117). Also noteworthy are the material traces of specialized activities related to the provision of services, i.e. repairs and alterations of leather products, mainly footwear (see Wywrot-Wyszkowska 2015).

The changes in craft production observed in the 13th century also concerned the processing of antlers, bones and horn. Their nature was very accurately defined years ago by K. Jaworski (1998a) in relation to the use of these materials in early medieval Wrocław. In his opinion, the models of early medieval and late medieval bone, antler and horn working differ in three fundamental aspects: (i) a clear

disproportion between the use of objects created in craft workshops and those made as part of home production; (ii) the raw materials used; and (iii) the assortment of manufactured products (Jaworski 1998a, 75). Analogous observations have also been supplied by the results of analyses of the archaeological material obtained in Baltic coastal towns.

Until the 13th century, over large areas of Central Europe, including the Baltic Sea coastal region, the dominant raw material was deer antlers, mainly those of red deer. They were obtained by collecting shed antlers or by hunting. This resulted in a certain dependence on a specific raw material base, which consisted of the forest complexes adjacent to the production centres. Demographic development and significant deforestation of areas around newly emerging urban centres must have resulted in a reduced supply of such raw material (Jaworski 1998a, 81). Therefore, deer antlers were gradually replaced by bones and cattle horns. This is a very noticeable phenomenon not only in the Baltic coastal towns (see Ulbricht 1984, tab.1; Rębkowski 1999b, 272–277; Mulsow 2000a, 211; 2000b, 257; 2006, 286–287; Strēle, Tilko 2001; Luik, Maldre 2003, tab. 2; Smariter 2004, 69–72). It also occurs in urban centres situated in the regions of Central Europe further inland (Jaworski 1998b, 106–107). To some extent, this process must have been related to the previously noted increase in cattle breeding (see Jaworski 1998b, 106; Rębkowski 2005, 55). The wide use of cattle bones in the production of various objects was also due to their physical properties and aesthetic values. Processing such raw material was not a complicated process and usually consisted of simple technical procedures. In particular, cattle metapodia were perfect for making flat, elongated plates or strips, which were then used for making various objects (see Ulbricht 1984, Fig. 2; Jaworski 1998a, 81).

In the municipal towns on the southern coast of the Baltic Sea, home production had almost completely disappeared. The presence of items such as the simple bone bobbins or clothes fasteners made from a transversely-pierced phalanx bone, or bone skates made from cattle or horse metatarsal bones is relatively rare in the historic material from these towns.[3] Bone bodkins, common in the early Middle Ages, were also falling into disuse (Jaworski 1998a, 77). The assortment of items produced in craft workshops underwent radical transformations. The production of certain groups of products was disappearing, for example single-sided three-layer combs and comb sheaths. However, the production of double-sided

3 Among the analysed cities, only Riga produced a larger number of finds of skates, dating back to the 13th–14th centuries (see Tilko 2005).

three-layer combs, usually made of bone raw material,[4] combs with long teeth (so-called weaving combs), rosary beads, six-sided dice and gaming pieces, handle plates for knives, as well as double-sided single-layer horn combs gained in importance (Jaworski 1998a, 84).

The study of textiles from excavations has also yielded many important observations relating to changes in textile production. In the Baltic Sea region in the 11th and 12th centuries, fabrics made in a 2/1 twill weave were very popular. Starting from the 13th century, this type of product was replaced by fabrics woven in a 1/1 plain weave. The appearance of this technique was caused by the simplification of weaving methods and the desire to increase production efficiency and reduce costs. However, the quality of these products was improved through better finishing, especially fulling (Tidow 1989, 341 ff.; Maik 2000a, 234). This phenomenon occurred earliest in Flanders, England and western Germany, and along with the foundation of chartered towns the practice spread eastwards (Maik 1997a, 26; 2000a, 234; Tidow 2006, 259 ff.). Such fabrics dominated the products in Lübeck since the turn of the 13th and 14th centuries (Tidow 1992, 239 f., tab. 4; 8). In the 14th century, they came into use in further Baltic coastal towns, including in Gdańsk (Jabłońska 2009a, 274, Fig. 27; 2009b, 202 f., Fig. 4; Grupa 2012, 33 ff., tab. 9) and Elbląg (Maik 1997a, 26, Fig. 6).

The analyses of textiles, and the remains of the very few devices and tools that have been found, have produced some important data on innovations taking place in the production process. It is highly probable that, in addition to spindles with spindle whorls, hand-propelled spinning wheels were used for spinning as early as the 13th century. These devices were used on a large scale in Western Europe in the 13th and 14th centuries, and may have reached the Baltic towns with German settlers (Tidow 1980b, 164; Maik 2000a, 236). Although there is no direct evidence of the use of a spinning wheel, its use is supported by the paucity of finds of spindle whorls recorded in excavations from late medieval towns – their numbers are much smaller than at early medieval sites (Maik 1997a, 41–42; 2000a, 236).[5] The introduction of the hand-driven spinning wheel significantly increased spinning efficiency. This was important in obtaining the appropriate amount of raw mate-

4 As already noted above, in some cities – Kołobrzeg (Wywrot-Wyszkowska 2016b, 185 ff.), Gdańsk (Hilczerówna 1961, 50 ff.) and Elbląg (Marcinkowski 2004a, 449 ff.; 2004b, 439) – deer antlers were still the basic raw material for making these items in the 13th–14th centuries.

5 As shown by the results of analyses of Gdańsk textiles, especially the yarn used to produce them, there is a significant increase in the percentage of threads twisted to the left (with an S-twist) compared to the early medieval period. These observations would support the use of spinning wheels in thread production (Grupa 2012, 82).

rial for weaving workshops and also contributed to reducing production costs. In the 14th century, wide looms became popular in Baltic towns, and they could be used to make products with a width of at least 2 cubits or more (Maik 1997a, 60). On such devices, operated by two people, fabrics were woven using two shuttles (Maik 1997a, 57; 2000a). They probably appeared in the coastal region south of the Baltic as early as the second half of the 13th century, which is supported by the presence of single-coloured fabrics made on such looms in the artefact assemblages from Gdańsk, Elbląg (Maik 1997a, 57 ff., there literature) and Kołobrzeg (Maik 2000a, 239).

Trade was one of the main factors determining the successful development of municipal towns on the Baltic Sea coast. In the Middle Ages, the fastest and safest means of transport used to move various goods was by the use of water vehicles. Having an appropriate fleet adapted to sea and inland navigation was an indispensable condition for conducting trade, and the need for the creation and maintenance of such fleets contributed to significant changes in the shipbuilding industry of that time. These changes manifested primarily in the desire to increase the capacity of ships used to transport goods. Already in the second half of the 12th century – as evidenced by the results of dendrochronological research on shipwrecks discovered in Denmark – the first cogs appear in the Baltic region (Ossowski 2009a, 95, further literature there). They originated from river ships, which were transformed over time into seagoing units with greater capacity (Ossowski 2009a, 96). The cog was first created in the southern part of the Jutland Peninsula, through the merging of influences of Frisian and Scandinavian shipbuilding and resultant technology transfer. (Ossowski 2009a, 96; 2013, 182; see also Förster 2005, 161). Cogs were distinguished by their specific hull structure. The side sheathing, made of wide planks, was fastened with overlapping nails bent inwards. The seams of the covering were sealed with moss held in with wooden strips nailed to the planks with iron clamps (see Litwin 2004, 404; Ossowski 2009a, 78). The first cogs had a small load capacity – it is estimated that in the 13th century this was approximately 10–50 tons, but in the next century it reached 120 tons (Litwin 2004, 403).

The shift of German colonization towards the east had an impact on the development of shipbuilding in the newly settled areas. Not only did new types of ships appear, but also new techniques for attaching the hull planks and sealing them (Ossowski, Krąpiec 2001, 92; Ossowski 2013, 182). A characteristic feature of Slavic shipbuilding on the southern coast of the Baltic Sea was connecting the planks with wooden pegs (Förster 2005, 160; Ossowski 2014). Among the boats made in this way is an example dating from the 10th century discovered in Ralswiek (cf. Förster 2005, 160, there literature), as well as other vessels from the 10th–14th centuries found in

Pomerania (Ossowski 2014, 109). With the appearance of the first cogs, significant changes took place in the local shipbuilding industry. The previously used wooden pegs were replaced with iron nails, and the clamp method was used to seal the sheathing (Ossowski 2013, 182). These methods of constructing and caulking hulls were already used at the end of the 13th century, not only in the construction of seagoing vessels of the cog type, but also of smaller vessels intended for coastal and inland navigation. One example of this is the boat from Kobyla Kępa dating from that period (see Ossowski, Krąpiec 2001). The rapidly developing trade in the 13th century resulted in the increased construction of seagoing ships and various vessels used in inland navigation, which enabled communication with centres located inland (Ossowski 2009, 97).

With the chartering of towns, there were changes not only in the branches of craft production with pre-charter origins, but also in the development of new crafts specializing in the production of previously unknown products, such as the above-mentioned pewterers and bronze-founders, or those dealing with food production. The emergence of food crafts was a phenomenon closely related to towns with large populations, who were often deprived of agricultural facilities that would provide them with direct access to food products. Even though material traces of the activities of such craftsmen are relatively rare, they are recorded in layers related to the oldest phases of the development of municipal towns. These observations would indicate that specialists involved in food production – bakers, brewers and butchers – must have played an important role in the functioning of the towns of that time, from the very beginning of their existence (see also Tandecki 1993, 171 ff.).

According to the written records, there were millers in all towns. However, it is very rare to discover the mills themselves. These were most often powered by water and thus would be located on watercourses located in the immediate vicinity of the towns or in their vicinity (see for example, Koppmann 1896, 89 ff.; Johansen, zur Mühlen 1973, 78; Rębkowski 1996b, 135; Igel 2010, 121 f.). In late medieval towns, home grain milling was very limited or even non-existent. The most telling confirmation of the above may be the fact that – unlike in early medieval centres – querns are very rarely discovered in municipal towns.[6] The decline in the number of millstones used in late medieval towns is generally associated with the spread of mills and the monopolization of flour milling (see Buśko 2003, 274).

In addition to crafts related to the production of food, there are specializations that can be described as service crafts, such as bathhouse management, barbers,

6 One can mention here, among others: finds of quern stones from Greifswald (Schindler 2009), Szczecin (Janowski, Słowiński 2012) and Kołobrzeg (Wywrot-Wyszkowska 2016b).

or pharmacists. In the case of these craftsmen, the archaeological record contains few material remains of their activities. Only in Greifswald were relics of a medieval bathing establishment discovered (Enzenberger 1997; 2007). The finds recorded in Lübeck (Falk 1982) and Greifswald (Ansorge 2005d) that we can associate with pharmacy come, however, from the early modern period. The emergence of the above-mentioned professional specializations can be considered another factor that distinguished late medieval crafts.

In the light of the observations made, it can be said that at the threshold of the High Middle Ages, profound changes were taking place in the municipal towns of the region in the crafts conducted there that were of fundamental importance for economic development. On the one hand this was reflected in the increased professionalization, standardization and massification of production and the emergence of new specializations. On the other, in comparison to the earlier period, there was a significant reduction in the processing of some raw materials.

Craftsmanship in amber supplies a good example of the latter process. This is especially visible in the example of Gdańsk, where, in the 14th and first half of the 15th centuries, there was a significant reduction in amber production (see above). Similar changes are visible also in Wismar (Ansorge 2005c, 134), Rostock (Schäfer 2000, 63 f, there literature), Stralsund (Samariter 2010) and Kołobrzeg (Rębkowski 1996a; 1997; 1998; 1999b; Wywrot-Wyszkowska 2016b), where amber objects are relatively rare finds, although in the case of the latter centre, amber processing is confirmed for the early medieval stronghold centre (Tabaczyńska 1959). Only in the cases of Riga (Strēle 2005; Caune, Ose 2005) and Lübeck (Stephan 1978; Mührenberg 2002a; 2006) was intensive amber production carried out, with Riga craftsmen using local raw material and those in Lübeck using imported raw material.

In the 14th to the first half of the 15th centuries, the Teutonic State had a decisive influence on the exploitation and trade of amber obtained in the area of the Bay of Gdańsk and Sambia. The Order treated amber collecting as part of its regalia. Access to amber therefore depended largely on good cooperation with the stewards of the German Order, who monopolized the acquisition and trade of this raw material, mainly for export abroad (Hirsch 1858, 35, 121). It is possible that the situation had a negative impact on the development of amber craftsmanship in other towns located on the western Baltic coast, resulting in limited access to the raw material and, as a consequence, the marginalization of this field of craft activity.

5. Organization of crafts in the urban space

The establishment of municipal towns resulted in the intensive development of many branches of craft production, together with the emergence of new professional specializations, and the craftsmen themselves constituted a significant percentage of their population. For them, the city was not only a place of residence, but above all a place of work and the venue for the sale of their products and services. Typical of the economy of medieval urban centres was the combination of the place of residence with the place of work, and as a rule there was a consolidation of subsequent stages of production in one workshop, within one property (Wiesiołowski 1997, 262–263; Röber 1999, 9–12). The location of craft workshops was influenced by various factors, such as access to raw materials, the presence of running water, access to a market, transport costs, location in relation to main communication routes and the existence of cooperative connections between various fields of crafts. The type and amount of raw material used, the technologies used, and the availability of a sufficiently large area to enable the installation of the necessary equipment and the proper conduct of the entire production cycle were also of great importance. An equally important factor determining the place of a craft workshop in a hierarchised urban space was the social value placed on a given profession (Wiesiołowski 1997, 265).

Individual crafts, due to specific natural and economic conditions enabling production activities, as well as for social reasons related to the prestige of a given profession, settled in selected parts of the city or its suburbs (see, for example,

Janssen 1986, 315–317; Czaja 1992a, 133–135; 1997, 94, 96 ff.; Wiesiołowski 1997, 263–277; Röber 1999, 24 ff.). This phenomenon is reflected in the names of streets and some suburbs, which were very often based on the specialization of the craftsmen living there (see for example Wiesiołowski 1997; Maciakowska 2011).[1] Of course, for various – usually economic – reasons, with time a significant part of the inhabitants of a given street was often replaced by members of other groups (see Hammel 1987; Czaja 1992a; 1997; Wiesiołowski 1997; Igel 2010). Nevertheless, certain regularities of the localization of craft workshops, detectable on the basis of analyses of written records, are sometimes also confirmed in archaeological sources.

Due to the nature of their business, potters had to have sufficiently large facilities to accommodate pottery kilns and other production equipment, as well as fuel stores. Convenient transport of raw materials to the production site also played an important role. Their workshops were usually located in the outskirts of towns or sometimes outside the walls.[2] In Lübeck, in the oldest period of the functioning of the chartered town, pottery workshops were located outside its defences. The workshops at 15–16 Koberg Street (Meyer 1980) and 11 Kleine Burgstraße (Meyer 1993), dated to the first half of the 13th century, were located on the northern side of the hill on which the city was founded. This area was originally not covered by permanent buildings and was most likely incorporated into the urban area only during the 13th century (see Gläser 2001, Fig. 1). In addition to the possibility of obtaining large production facilities, the location of these workshops was probably determined by the clay deposits occurring in this area (see Gläser 1989b, 298, there further literature). Potteries discovered in other urban centres were located within the walls, but most often near them, and near the entrance gates, as was the case in Elbląg (Marcinkowski 2003a), Gdańsk (Kasprzak 2003b), Neubrandenburg (Schmidt 1989; 1990), Greifswald (Brandt 2000) (Fig. 53) and Stralsund (Schäfer

1 Issues related to the naming of streets in medieval towns have often been the subject of various historical studies – see, for example, Lemcke 1881; Koppmann 1902; Kübler 1918; Riemann 1924; Biederstedt 1982; 1983; Münch, Mulsow 2010.

2 Potters were the only craftsmen using kilns or other sources of heat whose workshops were consistently located in the outermost parts of the city. In contrast, the workshops of other craftsmen using hearths, furnaces, etc. (for example, blacksmiths and non-ferrous metalworkers and jewellers), could be located in densely built-up areas (see below). It seems that of basic importance for the location of pottery workshops was the acquisition of a sufficiently large area to enable production and the possibility of convenient transport of raw materials and firewood (for more comments on this subject, see Janssen 1986; Wiesiołowski 1997; Röber 1999; Hoffmann, Schäfer 2005). Moreover, potters, unlike blacksmiths or other metalworkers, were usually located in the lowest layers of the craft hierarchy, which also influenced the peripheral location of their establishments.

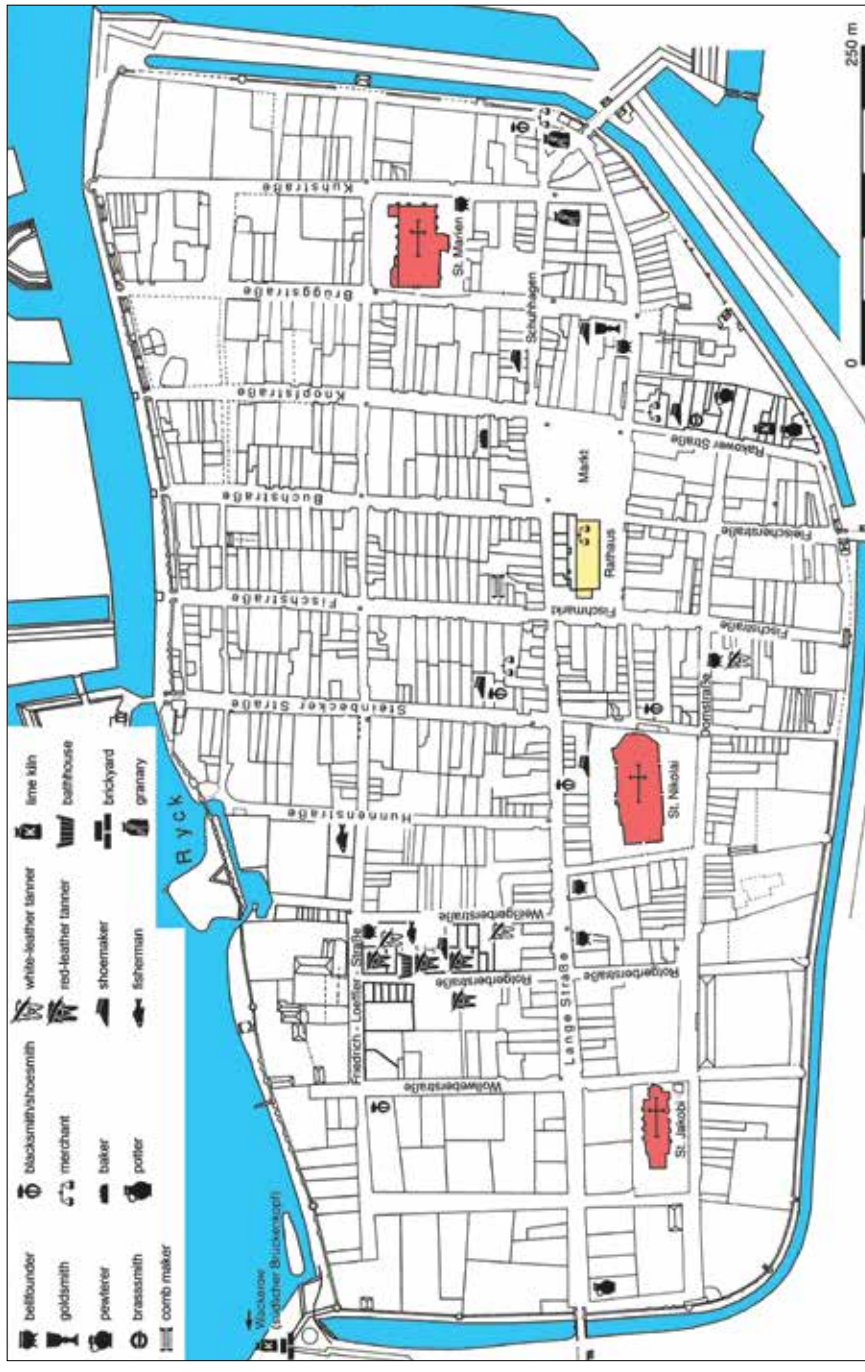

Fig. 53. Greifswald. Location of late medieval craft production sites in the light of archaeological sources (after Enzenberger 2007, Fig. 5, with additions by the author)

H. 2004a). In these centres, according to available sources, pottery workshops operated within the walls almost throughout the Middle Ages. Over time, they may have moved, but they still remained inside the defences of the city.

In Neubrandenburg, the oldest workshops were concentrated on the eastern side of the city, while in the 14th century they were already located in its western part (see Fig. 5). The reasons for these movements are believed to have depended on the places where the clay was obtained. In the earlier period, deposits located on the eastern side of the city were exploited. In the 14th and 15th centuries, clay was obtained from outcrops located on its western side (Schmidt 1997, 189). Moving the pottery to the western part of the city made it easier to obtain raw materials and probably significantly reduced the costs of transport of the products, all the more so in that some of them (for example the workshop located at the current Nr 2 Ringstraße) were located near the entrance gates (see Schmidt 1997, Fig. 1). The location of one of the fourteenth-century workshops in the market square is surprising, although it was located on a plot facing the Treptower Straße side street (Schmidt 1998). This location may have resulted from the relatively high economic status of its owner. We encounter a similar situation in Puck (Fig. 54), where a pottery workshop operated on the plot next to the market square (currently Nr 29 Plac Wolności) in the second quarter of the 16th century (Starski 2017b, 401, Fig. XV.15).

Other craftsmen who had to have sufficiently large production facilities were tanners. An extremely important factor influencing the proper conduct of their work was free access to running water. In Lübeck, the tanners' establishments were concentrated in the eastern part of the city, near Wakenitz (Mührenberg 2006, Fig. 19). In this area there was one of the shoemakers' tanneries, the relics of which were discovered at Weberstraße (Mührenberg 2006, 259; Bulach 2013, 276). A peripheral location, near watercourses, is very well illustrated by the workshops in Greifswald (on Rotgerberstraße; Fig. 53), Kołobrzeg (on today's Giełdowa and Narutowicza Streets; Fig. 55) and Pasewalk (on Mühlenstraße and near the buildings of the Holy Spirit Hospital).

In late medieval Rostock, the tanners' residences were concentrated in two areas of the urban complex (Bulach 2013, 220 ff.). One residence, where traces of their activity were identified through excavations, was located in the southern part of the city, on the southern section of Grubenstraße (Fig. 56). This street was built on the site of a small stream constituting the border between the Old and Middle Towns. The second area, located outside the city walls, stretched between the Old Town and the Unterwarnow riverbed. It was a marshy area that had already been drained by the 13th century. As one of the results of this work, three wide channels stretching east-west were created. Tanners settled on both sides of the middle

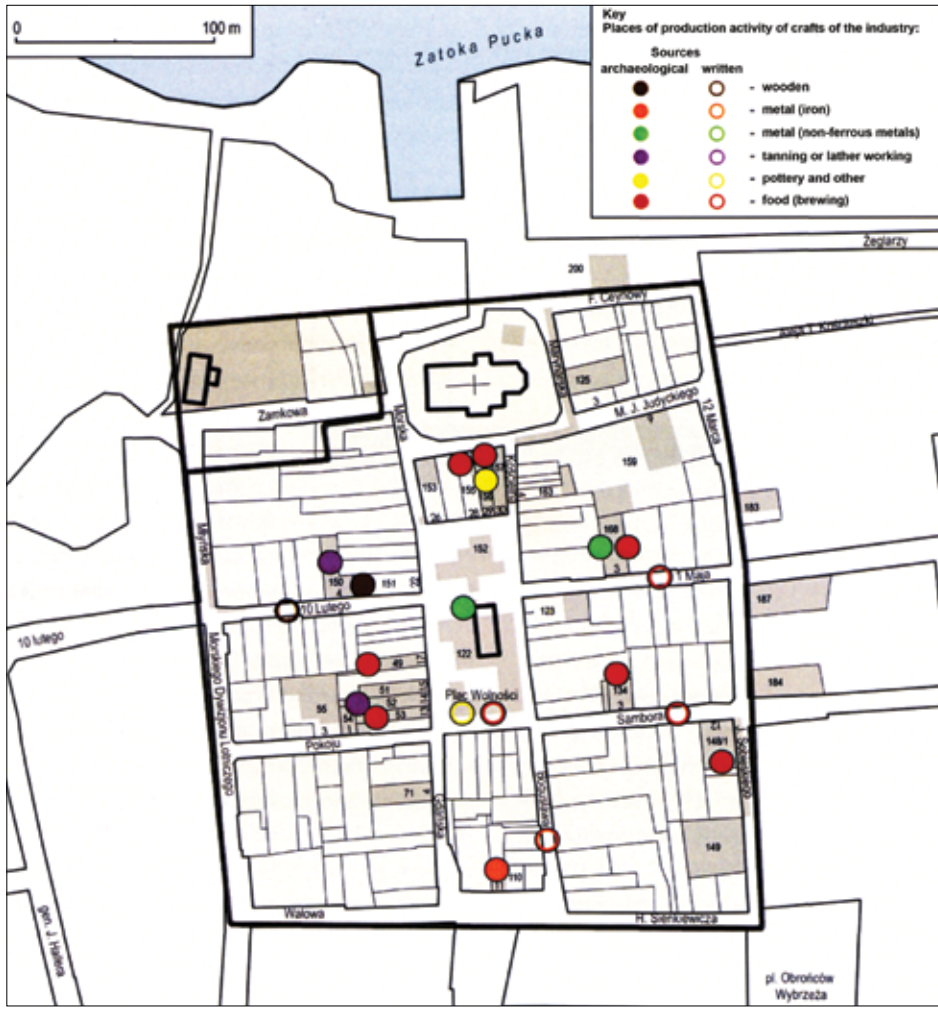

Fig. 54. Puck. Location of late medieval places of craft production in the light of archaeological and written sources (after Starski 2017c, Fig. XVIII. 1)

channel, known as Gerberbruch (Bulach 2006, 95; 2013, 220). Some tannery workshops still operated here in the first half of the 20th century (Lehmkuhl, Mulsow 2005, 280; Bulach 2006, 95).

The close vicinity of watercourses was a decisive factor for tanners when choosing a place of settlement, especially in the initial period of the existence of municipal centres. The density of development resulting from demographic growth, as

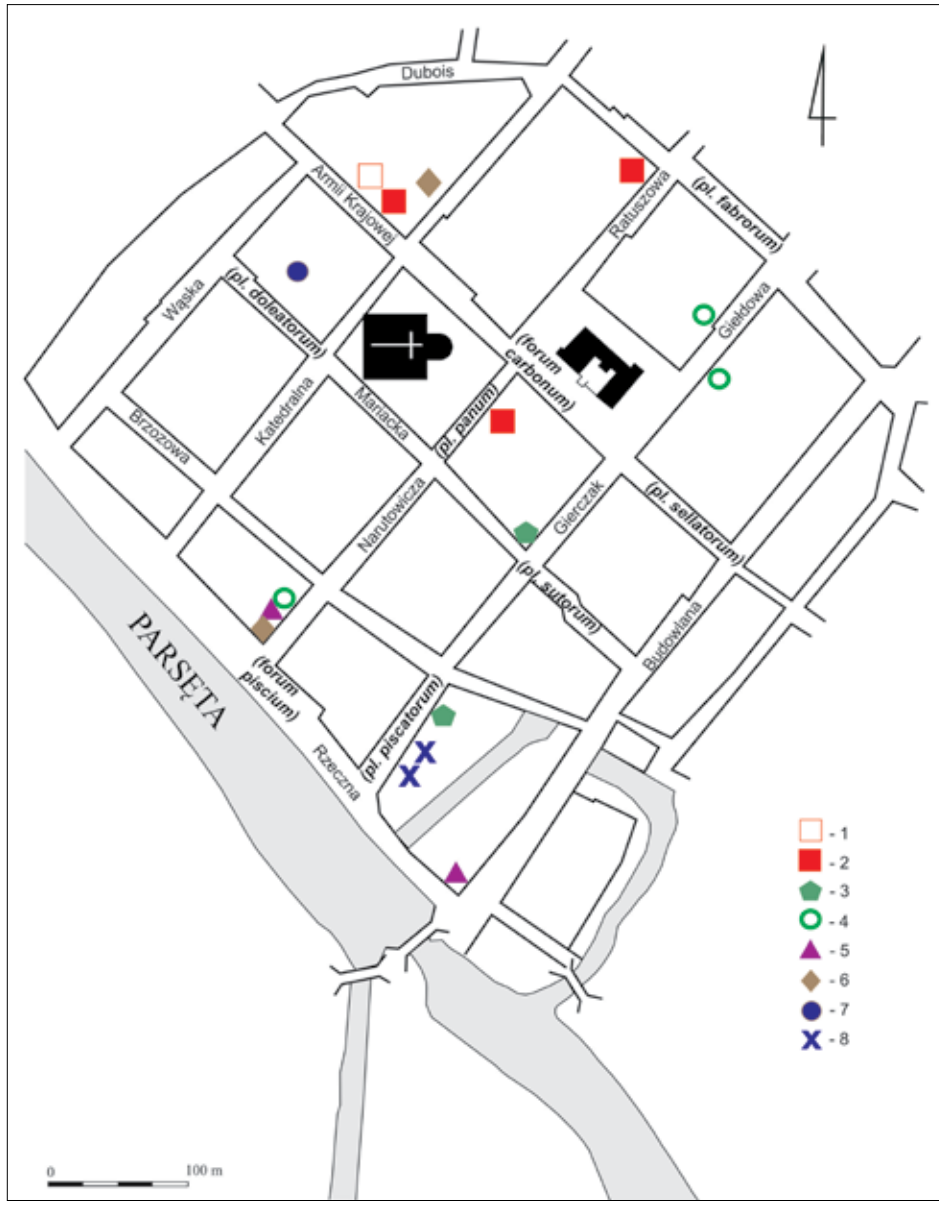

Fig. 55. Kołobrzeg. Location of medieval craft production sites identified by excavations. 1 – leather workshops, 2 – leather workshops with traces of horn-working, 3 – shoemaking workshops, 4 – tanneries, 5 – blacksmith's forges, 6 – bone/antler/horn-working workshops, 7 – bakeries, 8 – fishermen's residences (after Wywrot-Wyszkowska 2017, Fig. 1)

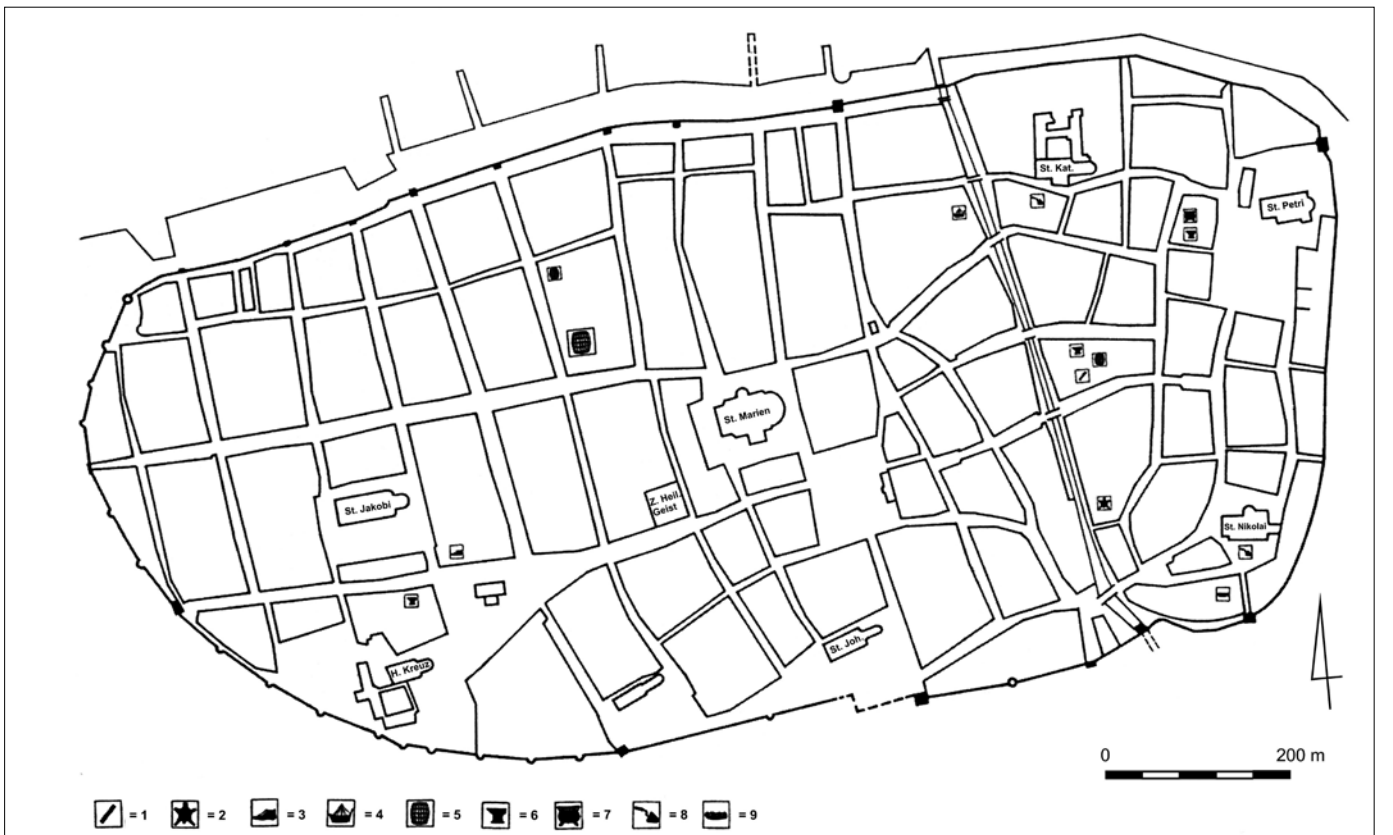

Fig. 56. Rostock. Location of excavated remains of medieval craft activity and production equipment (the sites of craft workshops?). 1 – comb-making, 2 – tanning, 3 – shoemaking, 4 – ship repair, 5 – cooperage, 6 – blacksmithing, 7 – non-ferrous metal casting, 8 – lime kilns, 9 – baking (after Mulsow 2006, Fig. 1)

well as changes in the natural environment – including the filling of watercourses located within towns or in their immediate vicinity – significantly hampered access to running water. These circumstances could have resulted in a change in the location of the tannery workshops or the introduction of other solutions enabling continued business operations. The above phenomena are very clearly visible in relation to Greifswald, Stralsund and Kołobrzeg. As already mentioned, in Greifswald at the beginning of the 14th century, the moat running between the Old and New Town was filled in. However, this had no impact on the further development of the tannery workshops located in the immediate vicinity on Rotgerberstraße. They obtained the water necessary for their operation from wells and a water pipeline (see Fig. 30), the main part of which ran in the area originally occupied by the moat (see also Enzenberger 2007, 56–58, 72, 79). A water supply was also used in some fourteenth-century Stralsund workshops, such as the workshop at Nr 10 Lobshagen Street (Kaute, Schäfer 2000, 199, fig 3), which was thus able to function for a long time in a densely built environment, far away from open water reservoirs.

The situation is slightly different in Kołobrzeg. All workshops discovered so far were located in sparsely developed areas, and their activity occurred during the initial period of development of a given area of the city, preceding its parcellation. There were no wells or watercourses found in any of these workshops – as the plots were demarcated and started to be filled with compact groups of buildings, making access to water difficult, the workshops were simply moved to another place. These observations seem to suggest that in the 13th and 14th centuries Kołobrzeg tanners used only water from open reservoirs. Unrestricted access to running water probably determined the choice of location for production activities (Wywrot-Wyszkowska 2017, 153). This factor must have played an important role also in the later period, as evidenced by written records, according to which the activity of tanners was concentrated in the southern part of the town complex, near the Parsęta River (Riemann 1924, 99). In the 16th and 17th centuries, there were production facilities leased by local leather workers on the river or on one of its side branches (Merten 1939, 111).

The type of activities performed and the relatively low social position of fishermen meant that they inhabited the outer parts of towns, located on or near watercourses. In Kołobrzeg, they inhabited a quarter on the lower section of modern Gierczak Street located on the Mill Canal, right by its confluence with the Parsęta River (Fig. 55). The fisherman's residence uncovered in Greifswald, in the rear part of the plot at Rotgerberstraße 25, was located on the bank of the moat that ran through this part of the town. Greifswald fishermen also inhabited a building block located near the Ryck River, on the northern side of today's

Friedrich-Loeffler-Straße, near the Dominican monastery (Fig. 53). The residences of Riga fishermen were in similar locations, and in the 13th and 14th centuries they lived in quarters located near the Dvina and Riga rivers. Later, they settled the suburbs and islands on the Dvina River (Caune, Ose 2006, 467 f.).

Bathhouses were also peripherally located, situated near the city walls, and sometimes outside them. Their location was determined by access to watercourses, which facilitated water supply and waste removal, as well as by moral considerations that required such places (which did not enjoy a good reputation) to be located far from the market square and other important communication routes (Enzenberger 2007, 93). This is precisely the case with the establishment excavated in Greifswald. The bathhouse on the Rotgerberstraße 25 property was located in an area originally bordering the moat (Fig. 53). It should also be emphasized that the building itself was situated some distance from the street, in the middle part of the plot (see Fig. 30).

A completely different situation can be observed in the case of the location of workshops where non-ferrous and precious metals were cast, and possibly also goldsmithing carried out. So far, only in two towns – Greifswald and Rostock – have the remains of such workshops been identified using archaeological methods. In both cases, they were located in central points of the urban complex. In Greifswald (Fig. 53), the goldsmith's workshop was located on the plot Nr 12a Markt (Schäfer, Ansorge 1995), and in Rostock on the plot Nr 19 Altschmiedestraße, located near the Old Town square (Kaute, Schäfer 2003). Also in Riga, goldsmiths could settle and work on plots of land located in the city centre, as evidenced by numerous finds related to such activities recorded in the vicinity of the market square.

The location of blacksmith's forges depended largely on the type of activity carried out there, which was most often of two types: production for sale, or services and work to order (see for example Wiesiołowski 1997, 272; Röber 1999, 33). Analysis of the location of the forges discovered so far has allowed the distinction of three location models.

The first location model, resulting from activities subordinated primarily to the production of products for sale, and to a lesser extent to the provision of services, was manifested in the pursuit of the best possible access to sites where commerce was conducted and to streets with heavy traffic. This resulted in the establishment of workshops along the main communication routes, streets that led to gates leading to port harbours, at (or near) their intersections, as well as in the immediate vicinity of (or a short distance from) market squares. This arrangement is very well illustrated by the Rostock forges on the plots Nr 33 Wollenweberstraße and Nr 9 Fischbank, located in the central points of the Old Town, near the market square

and more important streets (Fig. 56). The forges discovered in Tartu were located on Lossi Street (medieval Schmiedestraße), which led to the market square. Workshops excavated in Greifswald had a similar location – they were sited on the plots of Steinbecker Straße 26a (on the street leading to the port), Lange Straße 72 (on a street leading to a gate) and in the market square, close to shopping areas (Fig. 53). There was a similar case at Kołobrzeg, where the workshop on the plot of Nrs 16–17 Narutowicza Street (Fig. 55) was located near the fish market and the quay on the Parsęta River, enabling water communication between the city and the port. In the case of almost all of these workshops, it was found that they were the workplace of blacksmiths who were engaged in so-called 'small work'.

The second location model refers to workshops that provided services to those engaged in transport and transit, which did not exclude other small-scale production. These workshops were located at the exits of towns or on transit streets. There were forges located at the entrance gates on the Schuhhagen 1 property in Greifswald (Fig. 53) and on the plot at the corner of Budowlana and Rzeczna Streets in Kołobrzeg (Fig. 55). Another Greifswald workshop was located on a corner property on Mühlenstraße, which led directly from the Mill Gate (Mühlentor) to the market square. It is worth paying attention to the location of the medieval Schmiedestraße[3] in Kołobrzeg (Fig. 55), which ran along the walls, between the Stone Gate and the Panewników Gate, leading to the port (see Göbel 1927, Fig. 1; see also Rębkowski 2000, 37 ff., Fig. 1). The shortest road connecting the eastern and northern parts of the city ran along this street. It is highly probable that transit traffic towards the port passed here. Its considerable intensity probably encouraged the establishment of blacksmith workshops in this area.

The third type of location was conditioned by the cooperative connections between certain trades. A good example is provided by the forges in Stralsund discovered in the Port Suburb, at Wasserstraße Nrs 52–53, 55 and 56. Various items related to shipbuilding equipment were produced there (Kulessa 2000, 185 ff., Fig. 2; 2004, 132 ff.). Near these workshops, there was a specially designated place where worn-out ships were repaired and dismantled, and a little further south, behind the Holy Spirit Hospital, there were shipyards (Kulessa 2003, 249; 2004, 138; Möller 2006, 250). A similar consolidation of locations of related trades can be noted in the case from Kołobrzeg, confirmed in written records, of pansmiths working from their establishments in the Przedmieście Panewników [Pan-makers' Suburb] for

3 Currently this is S. Dubois Street.

the needs of local breweries. These specialists had their workshop located near the brewhouse (Riemann 1924, 59).

Some of the excavated blacksmith's workshops operated for a long period of at least several dozen or even several hundred years. Examples include those in Kołobrzeg (Nrs 16–17 Narutowicza Street and on the plot at the corner of Budowlana and Rzeczna Streets), Stralsund (at Wasserstraße 52–53, 55 and 56) and in Rostock (on the plot Wollenweberstraße 33). In such cases, it is not known, however, whether they were continuously owned by the same family or had different owners. It can be assumed that even if the owner of the property changed, the production facilities were often retained, especially since their construction and equipment required significant expenditure, and at the same time they constituted an investment of capital. Even if the buyer or tenant of the plot was not a blacksmith, he could always rent the forge located on the plot. Blacksmith's workshops are therefore a very clear example of long-term use of production places.

The analysis of the location of bronze-founding workshops showed that they were located in different parts of the city, although there is a quite close relationship between the place of production and access to the customer. Bronze-foundries were generally established near important communication routes. Those excavated in Rostock were located on corner plots at Wollenweberstraße/Amberg and Wollenweberstraße 33/Sackpfeife (Mulsow 2000a; 2006). Both properties were located a short distance from the market square (Fig. 56). The northern section of Wollenweberstraße, where the above-mentioned workshops were located, could have been called Kupferschmiedestraße in the 13th century and probably still in the 14th century (Rütz 2005, 296, there further literature).[4] Two of the bronze-foundries discovered so far in Greifswald were located on the western section of Lange Straße (on plots Nr 49 and 51; see Ansorge, Rütz 1999; Rütz 2002), which was an important communication route going from the entrance gate called Vettentor to the market square. Additionally, the workshop at Nr 25 Brüggstraße (Schäfer H. 1995) was located on one of the streets leading directly to the port. Near the port quays there was a workshop at Nr 38 Friedrich-Loeffler-Straße (Enzenberger 2007) (Fig. 53). The bronze-foundry discovered in Stargard (Majewski 2013), at Nr 12 Bolesława Chrobrego Street (the medieval Johanisstraße), was located on an important transit artery passing through the entire city, between the St John's Gate

4 The name of this street appears in documents as early as 1264, but there is no further information about its location. In the light of archaeological sources, its identification with the mentioned section of Wollenweberstraße is very probable (Münch, Mulsow 2010, 101).

and the Rampart Gate. This workshop, like the one in Rostock and some of the Greifswald workshops, was located on a corner plot. Having workshops in attractive areas of the city, distinguished by high value, also indicates the significant social and/or economic position of their owners. It is worth emphasizing that in the case of almost all the identified bronze-foundries, we observe a long period of use.

Different considerations as regard to the location applied to the bell-founding workshop that operated in the 14th–17th centuries and was discovered in Wismar, in the courtyard of the castle of the Dukes of Mecklenburg. Within it as many as ten metal melting furnaces and several extremely large foundry pits were recorded, where, among other things, bells were cast for local churches (Grabowski 2002a). The type and scale of business activity was decisive for its location. It would not have been possible to accommodate such a large number of features in one workshop (even a large one), that was sited among dense buildings, on a typical urban plot. The second important factor determining the location of production equipment here was probably the maximum shortening of the distance between the place where the bells were cast and their destination. It is not known, however, whether the bronze-foundry in question was constantly used throughout the above-mentioned period, or only occasionally during the execution of individual orders for casting bells or other large objects (Grabowski 2002a, 276 f.).

Traces of bell casting have been identified in the case of some other bronze-foundries, including from Rostock, Greifswald and Stargard. These were all located in densely built-up areas. However, the products made were small pieces that could be transported to their destination without any major problems. Transporting large cast items would have been associated with many difficulties and the possibility of damage to the products, which is why attempts were made to locate the casting site in close proximity to the structures for which they were intended, although this involved the construction anew of metal melting furnaces, foundry pits, and shelters for the drying of the moulds (Majewski 2006, 283 ff.). Traces of such production sites organized for individual projects have been discovered in Stargard (Majewski, Ogiewa-Sejnota 2017) and Ribnitz (Konze, Rütz 2008). In both of these towns, the temporary ateliers for bell casting were located in the market square.

In some cases, the siting of a workshop was dictated by the need to be in proximity to the destination of the products made there. There are two cases when this was especially common: the foundry of large metal objects such as bells, and also in relation to the building crafts. In case of larger investments, some of the materials necessary for construction were produced on site. This concerned primarily lime burning, as evidenced by the discovery of relics of lime kilns in Rostock by the church of St Nicholas, as well as next to the church of St Catherine belonging

to the Franciscan monastery (Mulsow 2006, 296–298). In Pasewalk, a lime kiln was discovered near the church of St Nicholas (Hoffman U. 1999, 44; Ansorge 2000, 141; 2005e, 309). A similar structure was also registered in Greifswald at Nr 5 Rakower Straße (Fig. 53). This kiln was most likely related to the construction of a large (20 × 7 m) house with a cellar located on the same plot (Ansorge 2000, 138 f.; 2005e, 308 f.).

Brickyards, in contrast to the above workshops, were usually situated outside the walls. The basic criterion for their siting was not only easy access to raw materials, but also a place that ensured a sufficiently large area necessary for the installation and proper operation of furnaces and the other devices related to the production cycle (see Bogucka 1962, 65 ff.; Wiesiołowski 1997, 265 ff.; Ansorge 2005e, 308). In Greifswald, the brickyard was located on the western side of the city, approximately three kilometres from its borders, on the bank of the Ryck River (Brandt, Lutze 2000). In Tartu, brick production took place in the Riga Suburb (Mäesalu 2006).

The location of shipbuilding yards was determined primarily by access to a sufficiently deep watercourse in which a ship could be launched. Another condition was to obtain a sufficiently large area on which to allocate space not only for the shipbuilding itself, but also to accommodate wood warehouses and storage buildings. These factors were taken into account when establishing the Gdańsk shipyard, which occupied a wide strip of land along the western bank of the Motława River. In Stralsund, the shipyard yards were located in one of the suburbs (Frankenvorstadt), extending east of the buildings of the Holy Spirit Hospital (Kulessa 2003, 248, there further literature). According to written sources, in the second half of the 14th and the first half of the 15th century, individual investors, most often coming from the circles of the wealthy merchants, organized separate shipyards for the construction of their own vessels. In such circumstances, up to a dozen ships could be built at the same time (Möller 2000, 166; Kulessa 2003, 248, there further literature).

Near the ports, as indicated by the discoveries from Stralsund and Rostock (Fig. 56), there were specially designated places where worn-out vessels were repaired or dismantled. Various materials necessary for ship repairs were also produced there, including caulking, as evidenced by traces of its production recorded in Stralsund.

Due to the considerable length of the yards used to twist the ropes, ropemakers had to work in open areas. Based on the available excavated material, it is difficult to say much regarding the location of their workshops. Only in the case of Gdańsk can it be stated that, from the second half of the 14th century, the residences of these craftsmen were located on the right bank of the Motława River, on plots of land at Długie Ogrody Street, distinguished by their exceptional length, which made it possible to set up rope yards (see Krzywdziński 2013; Maciakowska

2013). Here we would be dealing with a situation in which the workplace and the place of residence were located within the same plot.[5] Not every city had conditions for marking out such long plots, however. Typically, ropemakers set up tracks outside their homes, perhaps near them, where there was enough free space where the ropes could be twisted freely. This is evidenced by the previously discussed mention of the location of rope tracks in Tallinn, set up outside the city walls. The places of work of rope makers from Riga (Stieda, Mettig 1896, 15 f), Elbląg (Czaja, Nawrolski 1993, 93, Fig. 15) and Kołobrzeg (Riemann 1924, 58) were similarly located. Sometimes rope production took place within the walls, on peripherally located communication routes. In Lübeck it was on An der Mauer Street, originally called Hanfspinnerstraße, where the activity of rope makers was concentrated in the 15th and 16th centuries (Mührenberg 2006, 265, there further literature). In turn, in Greifswald, the ropemakers' workplaces were located near the port (Igel 2010, 263).

The lack of obvious remains in the archaeological sources of workshops of the various types of woodworker makes it extremely difficult to consider their location in the urban space. Without a doubt, the location of such workshops depended largely on the type of business conducted. Some specialists, such as wheelwrights, working mainly for transport purposes, could have had their workshops – like some blacksmiths – on streets where transit traffic took place (see Wiesiołowski 1997, 266).

The location of the workshops of coopers was largely determined by their cooperative connections with other crafts and trade. Sociotopographical research conducted for Elbląg based on the analysis of medieval archives showed that coopers' workshops were located near the establishments of the brewers for whom they made barrels that served as the basic packaging for beer (Czaja 1992a; 1997). Such cooperative connections that determined the location of coopers' workshops are also evidenced by the results of excavations in Rostock. In the northern part of the Middle Town, in the quarter between Wokrenter Straße and Lagerstraße (Fig. 56), a concentration of finds related to the production of barrels was recorded (Mulsow

5 In the first decades of the 14th century, the activity of Gdańsk ropemakers focused on the marshy area stretching along the western bank of the Motława (Maciakowska 2011, 35), which at that time was not covered by permanent buildings (see Polak 2007, 355). The existence of rope-makers' yards in this place is confirmed (Maciakowska 2011, 35) by the name of the street Powroźnicza [Rope-makers] (first appearing in written sources in 1354) – the name referring to the specialization of the craftsmen who previously worked here (Maciakowska loc. cit.). It is worth adding that during archaeological research carried out at Powroźnicza Street on one property (Nr 1 Powroźnicza), the remains of a structure that could have been the base of a windlass were discovered in the oldest layers (Polak 2022, 133).

2000a, 201, 213–214; 2005a, 272). This region was inhabited mainly by brewers, and Wokrenter Straße and Lagerstraße led directly to the quays of the port (Münch, Mulsow 2010, 34, 75 f). Another place in Rostock where the remains of cooperage were discovered was in the Old Town, in the building block between Grubenstraße and Fischbank (Mulsow 2000a, 214; 2005a, 271 ff.). This quarter was located near a port, which would suggest that barrel production for trade took place here. It is worth adding that in Elbląg and Lübeck the streets called Bednarskie [Coopers'] led directly to the port or were located near it. The workshops of Greifswald coopers, attested in written records, were also concentrated in the vicinity of the port (Fig. 57) (see also Enzenberger 2007, 22; Igel 2010, 263, 270).

One of the largest professional groups in late medieval towns were shoemakers. In economic terms, these specialists were usually located in the lower layers of the craft hierarchy (see, for example, Czaja 1992a; Goliński 1997; Wiesiołowski 1997). Even a cursory review of the location of the streets called Szewskie [Shoemakers'] indicates that they were secondary routes of minor importance for communication (such as at Kołobrzeg); sometimes they were located right next to the walls (as was the case in Stargard). In Greifswald, Schuhhagen was a small side street running from the north-eastern corner of the market square towards the Mill Gate (Mühlentor), although it did not reach the gate directly. As shown by historical research, shoemakers' workshops were widely dispersed, in different parts of urban centres with different values (see, for example, Czaja 1992a; Wiesiołowski 1997; Igel 2010). This is also confirmed by archaeological sources. The shoemakers' workshops that have been excavated so far include those that were situated on important communication arteries, such as streets leading to gates (for example, the workshop at Kröpeliner Straße in Rostock) or leading to a quay (for example, the workshop at Grubenstraße and Lagerstraße in Rostock; or that at Steinbecker Straße 24a and Brüggstraße 24 in Greifswald), sometimes distinguished by high status (for example, the workshop at Nr 7 Gierczak Street in Kołobrzeg; see Figs 53; 55–56). Some of them were located near the market square (for example, workshops excavated in Tartu, Greifswald at Markt 11 and in Puck at Nr 14 Plac Wolności; see Figs. 53–54) or in the side streets running nearby (a workshop within the shoemaker's houses in Elbląg, workshop at Nr 4, 10 Lutego Street in Puck, see Fig. 54), and sometimes also in the outskirts of the city (workshops at Hundestraße 95 in Lübeck and at Nr 37 Gierczak Street in Kołobrzeg, see Fig. 55).

The location of shoemaking workshops resulted from the combination of two basic factors: the economic situation and the suitability of the place for practicing the profession, i.e. the best possible access to customers and access to a market place. Despite the location of some workshops near market squares or along

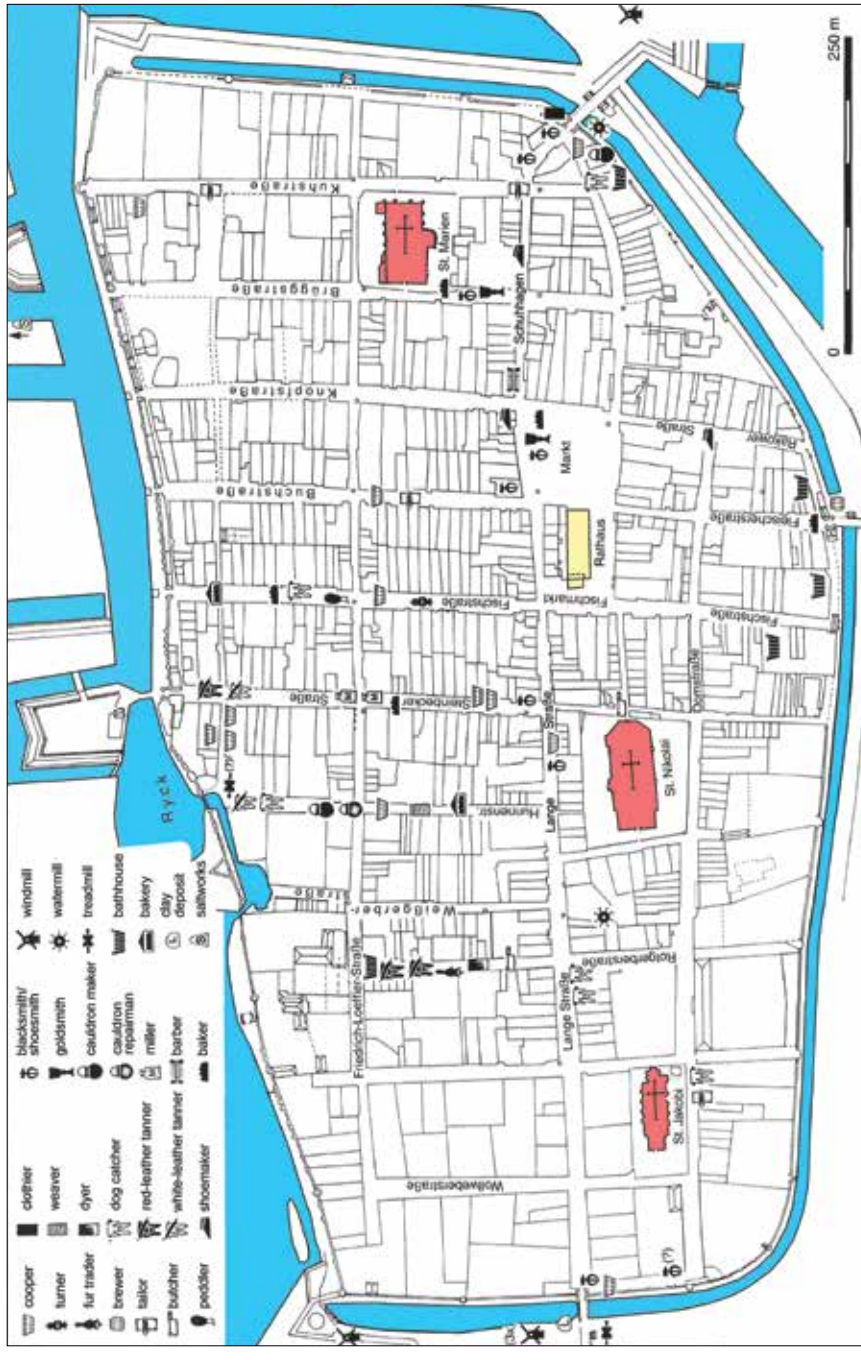

Fig. 57. Greifswald. Location of places of craft production based on mentions in the City Book (1291–1332) (after Enzenberger 2007, Fig. 4)

communication routes characterized by high value, it should be assumed that a significant part of them, if not most, could have been located in rented premises.[6] Running a workshop located in an area of the city that was attractive both in terms of prestige and suitability for practicing the profession did not have to mean owning real estate there. This may have concerned primarily those craftsmen who did not produce the leather themselves.

However, we need to look at the location of the workshops at Nr 7 Gierczak Street in Kołobrzeg (Fig. 55) and at Nr 14 Plac Wolności in Puck (Fig. 54) in a slightly different way. The Kołobrzeg workshop was located on a street that was highly valued in the Middle Ages and was the setting for the houses of wealthy townspeople (Riemann 1924, 32 f.; see also Rębkowski 1995, 103 f.). The Puck workshop was located on a plot next to the market square. Traces of leather tanning were recorded in both of these workshops. Running such a business required extensive premises and appropriate capital (see Bulach 2013, 205 ff.). We can therefore assume that the shoemakers working here owned these properties or rented them in their entirety, which also involved incurring appropriate costs. This location proves not only the optimal location for practicing the profession, but also the high financial status of these craftsmen.

Based on available archaeological sources, research on the location of workshops of other specialists involved in the production of full-grain leather products is extremely difficult. Only in Kołobrzeg was it possible to identify the remains of workshops producing various leather goods. Two of them were located on the current Armii Krajowej Street, and one at Nr 36 Narutowicza Street (Fig. 55). In the Middle Ages, the first of the above-mentioned routes was a street leading to a gate through which the road led to the port, while the second one had bread stalls and stalls of merchants. Their location on streets with significant traffic and commercial functions seems to be an optimal location for conducting sales-oriented activities for anonymous customers. However, it should be noted that the workshops on the plots at Armii Krajowej Street were in their rear. In turn, the atelier on the plot at Nr 36 Narutowicza Street was located in the basement of the frame-built house on the street frontage. These observations may indicate that the craftsmen working there did not own the plots, but only rented a workspace located there. Nevertheless, renting premises in an attractive area of the city had to be associated with considerable costs, although such a location facilitated the sale of goods

6 The valorization of a place of residence was influenced not only by its location, but also by the size of the plot and the type of buildings on it. The boundaries between wealth and poverty were therefore not only horizontal, but also vertical (Czaja 1997, 97).

and services, which could contribute to obtaining significant income (see Wywrot-Wyszkowska 2017, 157 ff.). However, it was not always possible for specialists producing leather goods to find an attractive location for their workshops. One such example is another workshop in Kołobrzeg, the remains of which were discovered at the back of the property at Nr 9 Ratuszowa Street, located in a peripheral quarter of the city, near the walls.

Due to the type of business conducted – focused on sales – it would be optimal for comb makers to locate their workshop near market squares or important communication routes; unfortunately, however, their low social position largely made such locations impossible. Comb workshops in Lübeck (workshops on the properties at Hundestraße 13–15 and Hüxstraße 80) and Rostock (workshop at Fischbank; Fig. 56) were located on side streets with little importance for communication. In Kołobrzeg, such a workshop was discovered on the property at Nr 18 Narutowicza Street, located in a peripheral part of the urban complex (Fig. 55). It is true that this plot was located near the fish market, but it had little importance in the economic life of the city. Only the Greifswald workshop discovered on the property at Johann-Sebastian-Bach-Straße 23 (medieval Büchstraße) was located on the artery leading towards the port (Fig. 53). In this case, however, the question arises whether the room used by the craftsman working here was his own property, or whether it was rented. Taking into account the low status of comb makers, the latter possibility is more likely. The comb workshop identified within the monastery of St John in Lübeck was distinguished by its specific location. This location may indicate that its activities were subordinated to the needs of the monastery itself.

The workshops of craftsmen producing bone buttons were also located in less attractive parts of the city or even in its suburbs, as exemplified by such places discovered in Elbląg at Nr 3 Św. Ducha Street and in Tallinn at Nrs 9 and 11 Roosikrantsi Street. There were also workshops located away from the main communication routes where traces of very limited production of bone objects were found (for example, in Kołobrzeg on the property at Nr 11 Katedralna Street, and in Elbląg on the Nr 5 Kowalska Street site).

Bakeries were usually located on plots located at street intersections or in their close vicinity (see Hammel 1981, 60). Access to customers and sales outlets was therefore a fundamental factor for bakers when choosing a place to site their ateliers. This is reflected in the archaeological sources. Some workshops identified in Lübeck (at Engelswisch 65, Große Altefähre 14) and in Stralsund (at Fährstraße 9) were located close to quays. This location suggests that their activities must have been, to some extent, focused on supplying ships (see for example, Gläser 1989a, 320). In turn, the Kołobrzeg bakery, uncovered on the property at Nr 19 Mariacka

Street, was located a short distance from the stalls selling bread (Fig. 55). A short distance from the market square, there was a bakery at Knopfstraße 13 in Greifswald (Fig. 54). The intensity of traffic, especially transit traffic, was also important, which caused bakers to set up their workshops near city gates or on important communication routes (Czaja 1997, 97). There were bakeries discovered on the properties of Mühlenstraße 65 in Lübeck and Mühlenstraße 2 in Rostock near the gates of both towns (Fig. 56). Interestingly, both were also located a short distance from the mills located outside the walls (Fig. 54).

Similarly to smithies and bronze-founding workshops, bakeries can also be classified as long-term production places. An example of the above are the workshops in Lübeck (at Engelswisch 65, Mühlenstraße 65) and in Rostock (at Mühlenstraße 2) that operated continuously for several hundred years. Although the rest of the discovered bakeries did not operate for that long, their period of operation can be estimated at least several dozen years. This is evidenced by repeated repairs (including the installation of subsequent levels of baking plates) of their ovens.

Significant traffic intensity was probably the decisive criterion for the location of breweries. The brewing workshops discovered in Stralsund were located on Frankenstraße, which is one of the most important streets leading to the port. There were also breweries identified in Gdańsk near the quays at Nr 7 Powroźnicza Street and Nr 3 Grząska Street. In Puck, the remains of brewing activities were excavated on the plot next to the market square (currently Nr 13 Plac Wolności; Fig. 54). The location of breweries in attractive areas of the city is an example not only of the choice of an optimal location for practicing a profession, but also indicates the high economic status of their owners.

In some towns, there was a concentration of workshops operating in a specific area and in the same period (mainly in the 13th–14th centuries), belonging to craftsmen of the same industry or different specialists using the same raw materials, although to a different extent. This is visible in the case of tanneries in Greifswald, located in the so-called crafts quarter between Rotgerberstraße and Weißgerberstraße (Fig. 53), and in Pasewalk, situated in the northern part of the Lower Town, near the Holy Spirit Hospital and at Mühlenstraße. It is also seen in Kołobrzeg, where the activity was sited in the extreme north-eastern part of the city, on the current Giełdowa Street (Fig. 55). All these establishments were located near watercourses, in areas that were – at least originally – sparsely developed. Therefore, it was the optimal location for practicing the profession. In turn, there was a similar consolidation of location in Lübeck, in the siting of the thirteenth-century pottery workshops (at Kleine Burgstraße 11, Koberg 15–16) and bronze-foundry workshops (at Breite Straße and in the area of Großen Gröpelgrube) located in the northern part

of the city, where, as previously mentioned, there were clay outcrops. Easy access to this raw material may have led to the establishment in this area not only of pottery, but also of bronze-founding workshops where clay was used to produce foundry moulds. Similar observations refer to the Neubrandenburg pottery dating from the 13th to the first half of the 14th century, the location of which in the eastern part of the city may have been mainly dictated by the proximity of clay outcrops.

Not only natural conditions but also the existence of cooperative connections between trades contributed to the long-term settlement of specific parts of the urban complex by specific specialists, which is visible in the case of forges located in the Port Suburb in Stralsund, working mainly for the needs of shipbuilding and shipping services.

We can also guess that the location of workshops of representatives of one profession in specific parts of the city was determined by economic factors. As the findings so far indicate, the establishments of shoemakers were concentrated in less attractive parts of the city complex. In Elbląg, this was in the north-eastern part of the city, and in Greifswald it was the plots at Rakower Straße, where there was also a tannery (Fig. 53). Regardless of specialization, in many cases a similar economic status probably determined the location of craftsmen's establishments in certain areas of the urban complex, distinguished by a specific value. In Lübeck, on Hundestraße, there were the workshops of shoemakers, rosary makers and comb makers (see also Hammel 1987), and in Kołobrzeg on the lower section of the current Narutowicza Street (Fig. 55), a tannery, a smithy and comb-making workshop were identified (see also Wywrot-Wyszkowska 2017). However, in Greifswald, in the quarter between Rotgerberstraße and Weißgerberstraße (Fig. 53), there were workshops of tanners, a shoemaker, a bronze-founder, as well as a fisherman's residence and a bathhouse (see also Enzenberger 2007).

The comments presented above indicate that the location of craft workshops was the result of several factors, such as the type of business conducted, which could depend on natural conditions, the existence of cooperative connections between trades, the nature of the activities performed (e.g. work to order, or provision of services), as well as the financial situation, enabling settlement in more or less attractive areas of the urban complex. All this meant that craft workshops, even of representatives of one profession, were often located in different parts of the city.

Crafts, the activities of which were not dependent on specific environmental factors or that did not require siting in order to benefit from cooperative connections with other trades, and where production did not require large premises, were characterized by a more dispersed location. This concerned primarily shoemakers, leather workers, comb makers, rosary makers, as well as craftsmen engaged in

diversified production, including, for example, casting of personal ornament and costume accessories, or the production of bone objects (rosary beads, buttons). These crafts were also characterized by greater mobility, which translated into relatively short-term use of production places. This is evidenced by the relatively few finds related to their activities recorded in some workshops.

Factors encouraging a longer term use of the production facilities by other craftsmen, on the other hand, included those who, due to the technologies used, had to employ stationary equipment in their work. These include tanners, blacksmiths, bronze-founders, bakers and potters. In the case of craftsmen using processes involving the use of furnaces, kilns or hearths, there is also a noticeable tendency to locate workshops on corner plots, which was probably also the result of fire prevention regulations introduced by the city authorities (see Gläser 1989a, 319, there further literature).

The natural and economic conditions specific to each city, the organization of space and the varied valorization of its individual elements influenced the shape of their settlement structure. As already mentioned, the place of residence was determined primarily by two factors, i.e. the criterion of the optimal location for practicing a profession and the social prestige of various parts of the urban space. Depending on the economic status and the nature of professional activity, particular social groups settled in specific parts of the city. Especially in larger centres where there was a great diversity of wealth, we are dealing with a division into better and worse regions, inhabited by population groups of similar social status (Wiesiołowski 1997, 239 ff.). Based on the available archaeological data, supplemented by the results of historical research on the written records, these issues can be considered in relation to craftsmen in the example of three towns: Greifswald, Puck and Kołobrzeg.

In the Middle Ages, Greifswald was one of the larger and richer port cities on the southern coast of the Baltic Sea. This centre was distinguished by its developed crafts, which were characterized by great professional diversity (Kattinger 2000b). Based on the analysis of the entries contained in the City Book from 1291–1332 (Enzeberger 2007, 20–24), it has been shown that the craftsmen's residences were concentrated in the south-eastern part of the city, near the Butcher's Gate (Fleischertor) and the Mill Gate (Mühlentor), as well as in the area between Fischstraße and Rotgerberstraße (Fig. 57). The above-mentioned quarters also housed various economic facilities: for example, granaries, mills, a treadmill and a fulling mill were located on the lower sections of Hunnenstraße and Weißgerberstraße (Igel 2010, 265). The existence of granaries in the south-eastern part of the city, near the Mill Gate, is confirmed by archaeological sources (Schäfer

C. 1997a, see also Fig. 53). Single workshops, including blacksmiths, goldsmiths, bakers and shoemakers, were located on one of the main streets leading from the western entrance gate (Vettentor) towards the market square and on the market square itself, as well as near St Mary's Church. However, in the quarters located on the northern side of the market square, between Knopfstraße and Fischstraße, only a few craft workshops belonging to coopers and tailors are mentioned. This region was characterized by high property values and was inhabited by the richest townspeople who sat in the city authorities, as well as by merchants engaged in long-distance trade and rich landowners (see Igel, 2010, 262 ff.). This settlement pattern, most likely already existing at the end of the 13th century, is also confirmed by the results of analyses of later archival records (see Igel 2010, 261 ff.) and archaeological sources (Fig. 53).

We are dealing with a different situation in the case of Puck. The location of production sites reconstructed on the basis of documents and archaeological finds indicates their considerable dispersion (Fig. 54), which may suggest that there was no regionalization of craft production in the town (Starski 2017c, 486). These activities were conducted in different parts of the urban space, depending on the individual needs of individual specialists. This state of affairs may have resulted from the fact that there was not much wealth diversity among the inhabitants of Puck. The results of the analysis of the credit market also indicate the low wealth of the place's medieval residents (Kardasz 2017, 84). These circumstances probably made it easier for craftsmen to obtain a favorable location, even in the case of crafts of low social status or considered burdensome. An example of this are the remains of a pottery and shoemaker's workshop discovered in the plots by the marketplace, where leather was also tanned (Starski 2017c, 484–487). In larger urban or port centres, with a developed economy and extensive trade contacts, where there was also a large wealth diversification, locating such workshops in their centre would have been impossible. The scattered location of craftsmen's ateliers could therefore have been a feature typical of small towns located in the hinterland. The results of historical research conducted in relation to smaller centres of the Duchy of Szczecin also seem to confirm this phenomenon (see Piskorski 1987).

In the case of Kołobrzeg, due to the lack of historical studies, issues related to the topography of crafts can only be considered on the basis of data obtained during excavations. So far, over a dozen craft workshops have been discovered in the city. This is not a very large number, but analysis of their distribution yielded some interesting observations. Most of the ateliers were located in the northern, north-eastern and southern parts of the city. Only single workshops were identified in the

blocks near the marketplace (Fig. 55). The relative lack of any traces of craft activity on the excavated properties located around the market square should be considered significant. This may be partly due to the limited number of finds obtained there, as archaeological excavations most often covered only the front parts of the plots, where, as a result of various construction works carried out since the 14th century, the bulk of the earlier layers within them have been destroyed (Wywrot-Wyszkowska 2017, 164–165). However, in the light of written sources, the market square plots, especially from the second half of the 14th century, when the town hall was built, were distinguished by high value and were inhabited by the richest townspeople (Riemann 1924, 56).

There is a certain relationship between the period of operation of individual workshops and their location. This was probably related to the spatial development of Kołobrzeg. Initially, the city occupied only a small moraine elevation, and apart from the permanent buildings, there were riverside quarters located on the flood terrace of the Parsęta River. The activity of almost all workshops located in the area covering the original area of the city occurred in the period between the mid-13th and mid-14th centuries. Starting from the second half of the 14th century, craft activity was concentrated in the riverside area. It can therefore be assumed that with the inclusion of the Parsęta flood terrace within the town, which was initiated around the mid-14th century, significant transformations occurred in the settlement structure of individual parts of the urban complex. They were manifested primarily by the migration of craftsmen from the northern and north-eastern quarters of the city to the riverside area. They could even have constituted the core of the population inhabiting the newly developed area, as evidenced by the relatively large number of workshops discovered here (see Fig. 55; see also: Wywrot-Wyszkowska 2017, 165). According to the analysis of later documents, various economic facilities were also located in the riverside area, including a mill for grinding bark, a tannery and a fulling mill, used by local craftsmen (Merten 1939).

6. Elements of unification and regional differentiation

A characteristic feature of the municipal towns discussed here was the unification of certain patterns regarding spatial planning and the organization of many areas of life of their inhabitants. This unification was the result of a large-scale colonization campaign, which was associated with the emergence of cultural patterns previously unknown in the region, but was brought to the newly founded towns by settlers coming mainly from northern and central Germany (see Piskorski 1987; 2000; Militzer 2012). Among them were also craftsmen who had a significant role in the creation of new centres (Blümcke 1884, 85; Schildhauer 1995, 83; Kattinger 2000a, 81). A phenomenon accompanying the colonization action was the transfer of technology, which contributed to the unification of craft production, significant changes in the set of manufactured products, and the intensification of their production. An equally important factor influencing the standardization of craft production was easier access to many raw materials, which were the subject of local exchange and long-distance Hanseatic trade (see Bogucka 1962; Molenda 1989; 2000; Ansorge 2005c; Heußner 2005). The above factors contributed to the processes of unification of craft production and its subordination to the laws of the free market that are confirmed in the archaeological sources.

Not only the raw material and technological aspects had a significant impact on the standardization of craft production in individual centres. New patterns of the organization of craft production itself were important here. The establishment of

towns under German law is precisely related to the creation of guilds, i.e. professional groups gathering craftsmen of a given specialty or related professions (see, for example, Lesiński 1956, 282; Tandecki 1993, 172; 2004, 256; Kattinger 2000a, 81). Craft corporations ensured proper control over the quality of goods and enabled regulation of production. This was supposed to ensure equal access of all masters to raw materials and the market, and also served to protect against competition in a given town and beyond. The guild system also guaranteed proper education of craftsmen (Samsonowicz 1986, 200; Schildhauer 1995, 83 ff.; Tandecki 2004, 256 ff.). The control of the quality of goods intended for regional, supra-regional and long-distance trade was also one of the functions of a guild (Hammel 1981; Bulach 2013).

Also typical for the economy of medieval towns was combining the place of residence of the craftsman with the place of production (see Wiesiołowski 1997, 262–263; Röber 1999, 9–12). The analysis of the sites of craft workshops showed certain regularities determining their location in specific parts of the urban complex, i.e. on selected streets located in the central or peripheral quarters of the city or in its suburbs. Regardless of the size, economic importance or trade connections of individual urban centres, the location of craft workshops was subject to other factors such as access to raw materials, running water, the sales market, cooperative connections between certain crafts, or location in relation to main communication routes. Such patterns of location undoubtedly would constitute a unifying element, and the regularities established on the basis of archaeological sources are often confirmed in written records and in medieval street names.

Although the process of unification of craft production affected all the towns discussed here, some differences can be noticed in the pace of transformations, as well as in the assortment of products manufactured and raw materials used, at least in the initial period of development of these centres. This state of affairs could have been influenced by several factors, such as the survival of local manufacturing traditions, the nature of the natural environment, access to specific raw materials, or economic connections and political conditions.[1]

Not without significance were the origins of the settlers who came to the individual towns, which also had a significant impact on the development of crafts within them. The population originating from Germany instilled cultural patterns

1 The influence of political conditions is most visible in relation to the urban centres located in the area of the Teutonic Order, i.e. Elbląg and Gdańsk. The monastic authorities not only interfered in matters relating to craft production or the functioning of guild organizations (see, for example, Tandecki 2004, 259–261), but also controlled or even monopolized the trade in certain raw materials, for example amber (Hirsch 1858, 121; Bogucka 1962, 197–198).

appropriate to their home areas, while the autochthonous population remained attached to local production traditions. This is especially visible in the centres located on the eastern part of the Baltic Sea coast area.

The observations of the excavated material provided a lot of data allowing us to discuss the elements that unified craft production in the urban centres of the southern Baltic coast. Of equal importance, the analysis of archaeological sources also enable presentation of those elements of craft production that were characteristic only of certain towns or a certain group of centres located in a specific area or functioning in specific state structures.

Among the discussed branches of production, pottery can be considered one of the most unified crafts. In the urban centres discussed here, from the very beginning of their development, there was production on a mass scale of vessels fired in a reducing atmosphere in two-chamber kilns. While in all centres grey ceramics were mass-produced, constituting the basic element of the kitchen and tableware of the town inhabitants, there are noticeable differences in the range of vessels manufactured (Rębkowski 2001, 199).[2]

The above remarks apply primarily to the production of pots with convex and flat bottoms. Pots with convex bottoms were produced mainly in towns located in the western zone of the discussed region. The presence of such vessels was found in the excavated material, including from Schleswig, Lübeck, Rostock, Stralsund, Greifswald, Neubrandenburg, Strasburg (see Lüdtke 1985; 2001; Gläser 1987; Schmidt 1989; 1990; Schäfer H. 1997b; 1997c; Drenkhahn 2015; 2017a), Szczecin (Rębkowski 2001, 2014), Stargard (Fig. 58) (Rębkowski 2001, 2014; Zyśko 2011; Romanowicz, Zyśko 2012), Pyrzyce (Cnotliwy, Nawrolski 1996; Dworaczyk 1998) and Kołobrzeg (Rębkowski 1995; 1999a; Dworaczyk 2016a). Vessels with convex bottoms are a regionalism typical of northern Germany. They dominated the assortment of products made by potters in the areas located in the western zone of the Baltic Sea (see, for example, Rębkowski 2001, 160, further literature there). In the light of recent findings, the eastern border of this area can be located along the eastern borders of the Duchy of West Pomerania and the Margraviate of Brandenburg (Rębkowski 2014, 523). The widespread use of such products in the western zone of the Baltic coast should be associated with settlers coming from

2 Due to the lack of studies on larger series of pottery finds from Riga, Tallinn and Tartu, it is impossible to conduct comparative analyses for these centres and trace various phenomena related to pottery production and the types of vessels used. So far, imported pottery has been more widely studied, but only in the case of western Estonia (Russow 2006).

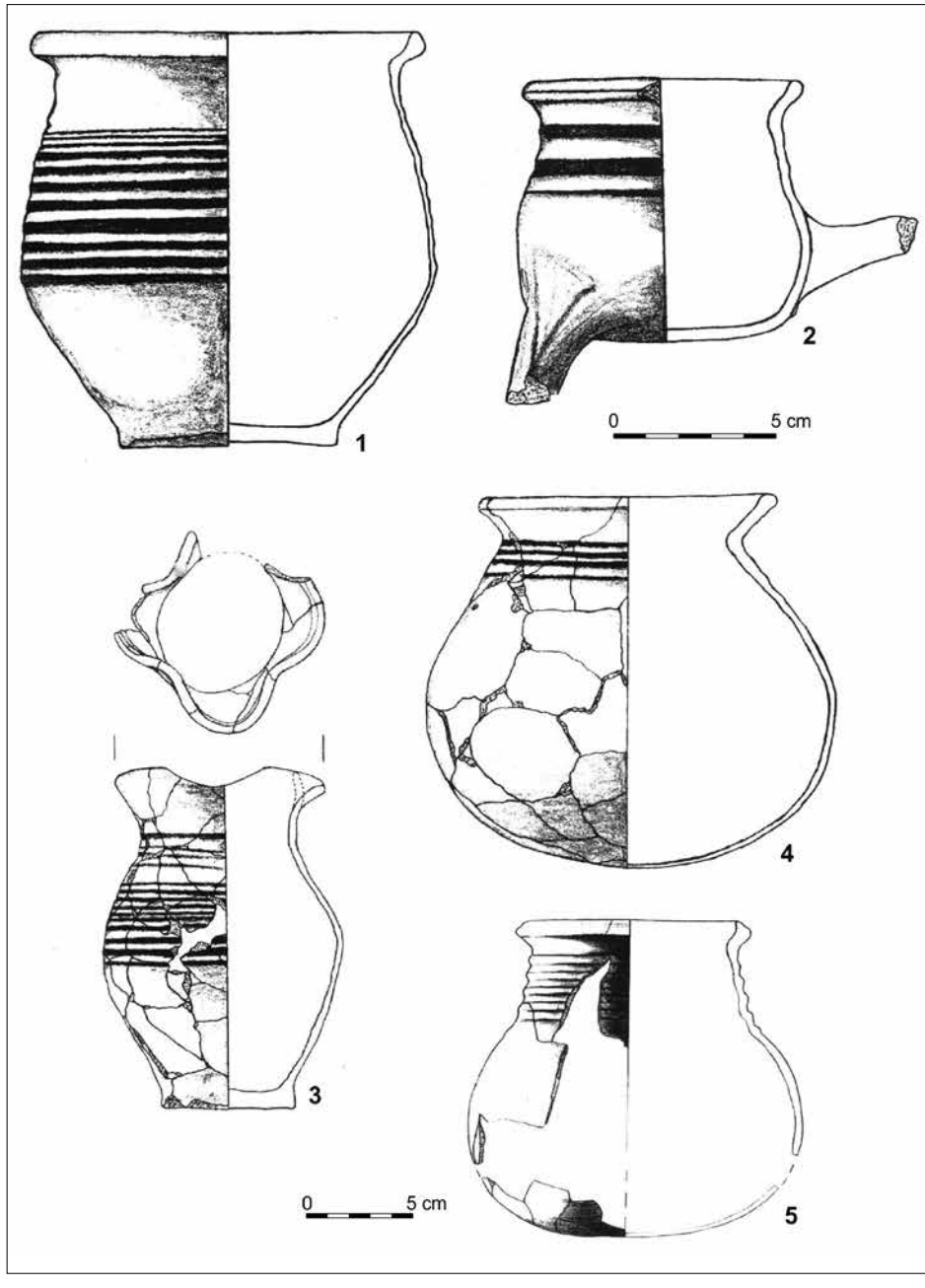

Fig. 58. Stargard, western part of quarter V. Selection of greyware ceramics (after Romanowicz, Zyśko 2012, Figs. III.12; III.13)

northern Germany, who disseminated both the production of grey ceramics and specific types of vessels.

We encounter, however, a different situation in Gdańsk Pomerania and Prussia, where convex-based pots are rare. So far, only a few such vessels have been recorded in the excavated material from Puck (Starski 2016), Gdańsk (Kościński 1998a; 1998b; 2003; Trzeciecka, Trzeciecki 2002) and Elbląg (Marcinkowski 2006a). In these centres, pots with flat bottoms were extremely popular (Fig. 59). These should be considered a regionalism typical of central Germany, i.e. Thuringia and Saxony. The settlers who came to the above- mentioned centres most likely originated from these regions, which resulted in the dissemination of a set of vessels that were typical of the products produced and used in those areas (Marcinkowski 2006a, 295; Starski 2016, 201 ff.)[3]

Greywares were the main product of pottery workshops in the urban centres of the southern Baltic coast. In some towns located in the western zone of the area of interest to us, i.e. Lübeck (cf. Braun 2002; Drenkhahn 2017b, 392) and Neubrandenburg (Schmidt 1990, 37 ff.; Jantzen 1997, 183 ff.), glazed redware pottery was also produced, which clearly distinguishes them from other towns. This activity proves a certain innovativeness of the local craftsmen, who tried to make their set of products more attractive by producing decorative tableware. It should also be assumed that decorated glazed vessels were produced in the above-mentioned urban centres, primarily in Neubrandenburg, only for the local market and could hardly compete with products from Scandinavian and/or Dutch workshops.

As already mentioned, in the urban centres of the southern Baltic coast there were very significant changes in the production of small wooden vessels commonly used in households. What comes to the fore here are characteristic bowls made of small, trapezoidal staves. The numerous finds of such products indicate the widespread activity of craftsmen specializing in their production (Fig. 60). These vessels were made of coniferous wood – usually pine and spruce, less often from larch or fir (see Baran 2003, 111; Ulbricht 2006b, 158–160; Kozakiewicz 2017). Interesting results were obtained from dendrological analyses carried out on assemblages of stave-built vessel finds from Szczecin, Stargard and Kołobrzeg. Among the products from Szczecin (Baran 2003, 111) and Stargard (Bobik 2012, 190), vessels made of pine wood predominate, while in Kołobrzeg (Polak 1996b, 331; 1997b, 231; Bobik 2016, 152) they are made of spruce wood. In one of the groups of material from Kołobrzeg that was entirely subjected to dendrological analysis, stave-built vessels

3 For more information on the directions of the inflow of German settlers to the Baltic towns, see Piskorski 2000, see also Militzer 2012.

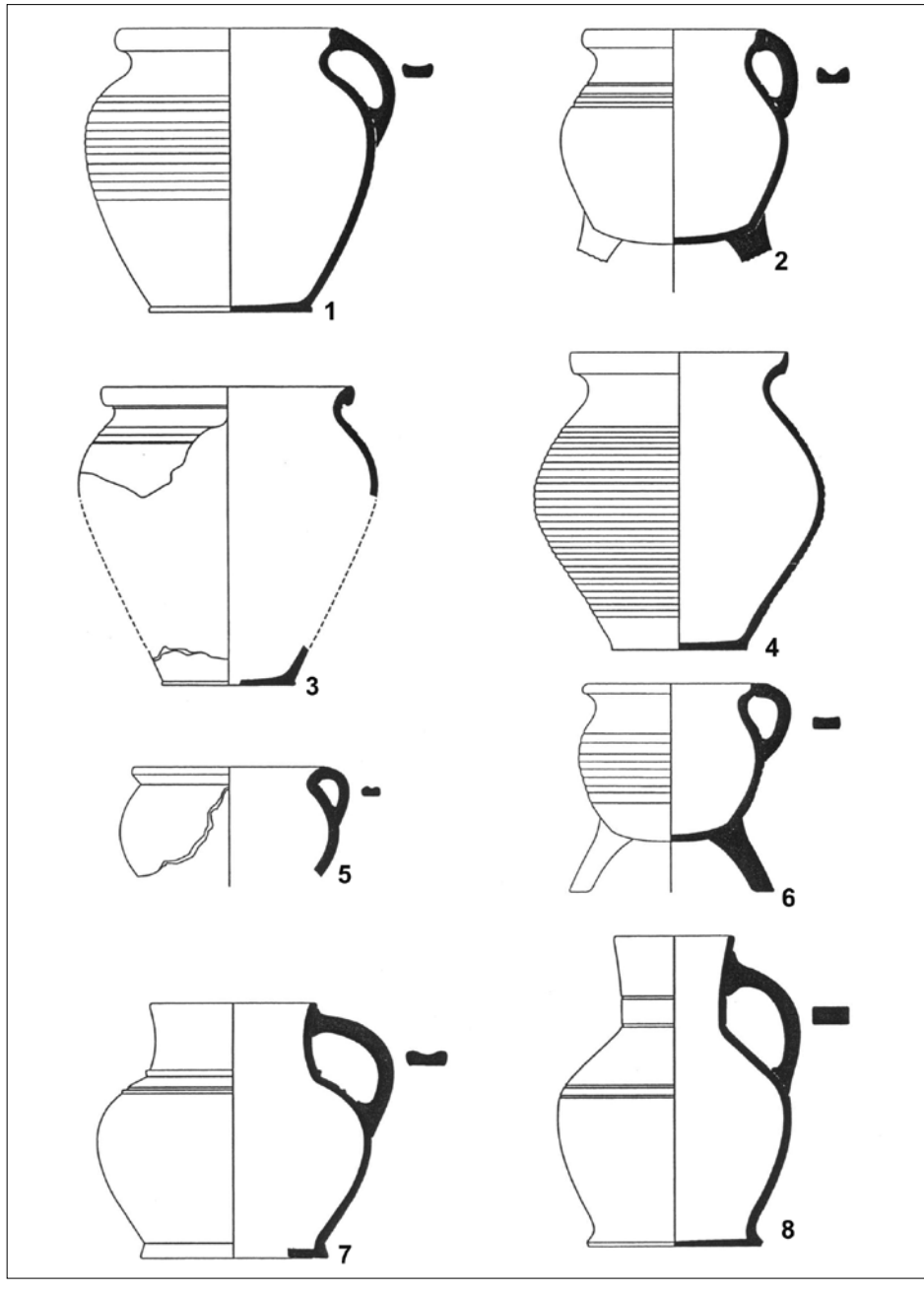

Fig. 59. Gdańsk, Nrs 1–5 Szklary Street. Selection of greyware ceramics (after Trzeciecka, Trzeciecki 2002, Figs. 2; 3)

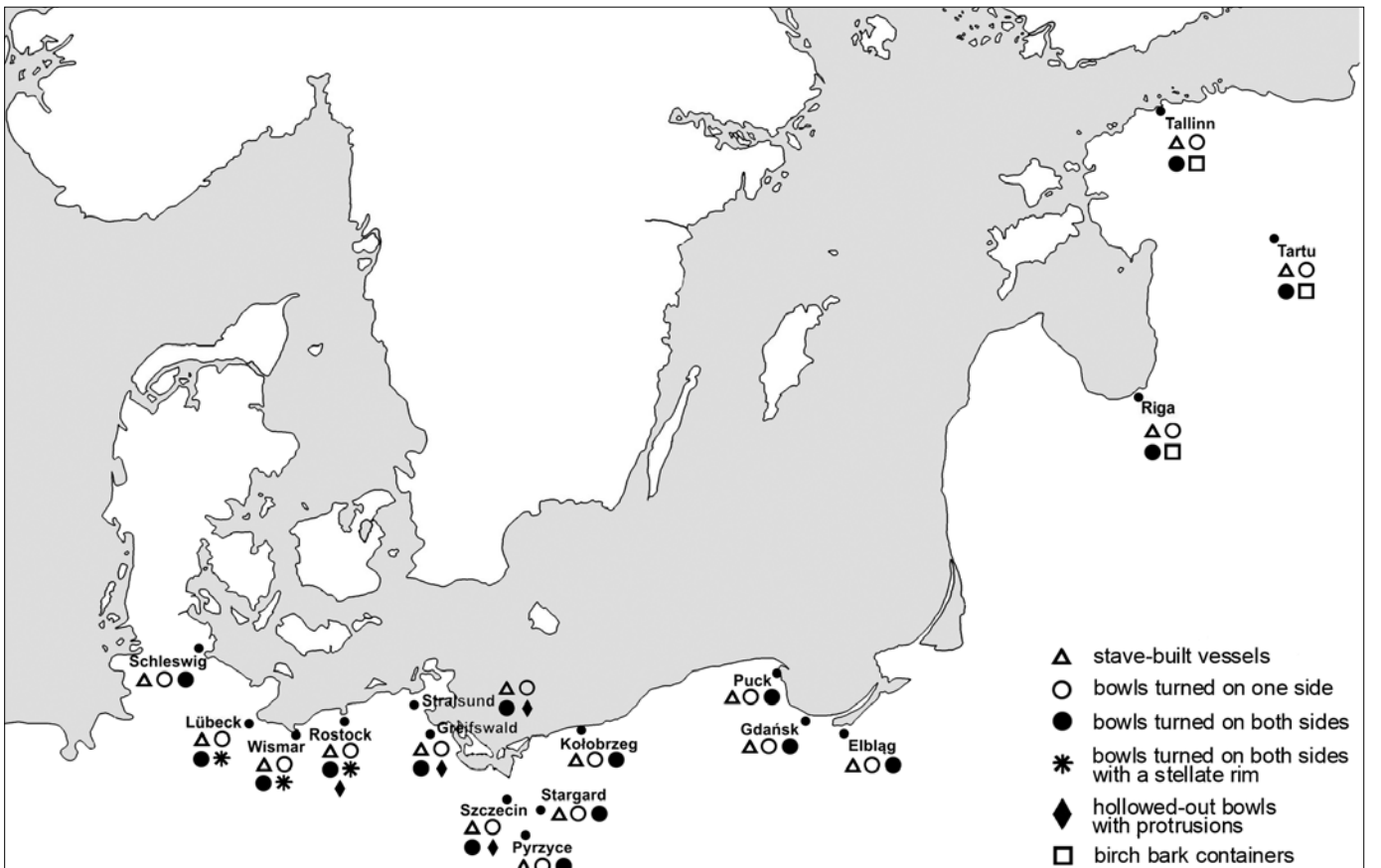

Fig. 60. Assortment of wooden vessels and containers manufactured in Baltic cities (prepared by B. Wywrot-Wyszkowska)

almost exclusively made of spruce were identified (87%). Only a small percentage were made of larch wood (8.9%) and pine wood (3.8%). Apart from staves and vessel bottoms, no other products made of spruce were recorded (Bobik 2016, 152). In the Middle Ages, of the above-mentioned tree species, only pine existed in Pomerania (Baran 2003, 23 ff.). Spruce and larch wood could have been imported to Pomeranian towns from the region of the Sudeten mountains (cf. Baran 2003, 111).

It is currently difficult to explain the reasons for the very high frequency of stave-built vessels made of spruce in Kołobrzeg, with only a small quantity of products using pine. It is assumed, among other things, that spruce wood used for the production of vessels could have been imported in the form of semi-finished staves and bottoms (Baran 2003, 111; see also Ulbricht 2006b, 159). It is possible that stave-built vessels were made from such prefabricated elements by Kołobrzeg craftsmen. At the same time, it should be borne in mind that obtaining local pine wood would probably be less expensive than importing spruce, especially since, already in the period preceding the chartering of the town, significant amounts of wood were floated to Kołobrzeg along the Parsęta River from the southern areas of Pomerania for the needs of local salt works (Leciejewicz 2000, 64). Nevertheless, it can be assumed that Kołobrzeg craftsmen made extensive use of imported raw materials, or perhaps they had to cope with a large influx of products of foreign origin. Perhaps the cache of several dozen stave-built vessels discovered on the Rynek 2B site, instead of being local products, were vessels brought to Kołobrzeg.[4]

Although products of pine wood dominate in Szczecin, it should be noted that nearly a third of the bowls covered by the raw material analysis were made of spruce wood. These observations became the basis for the assumption that in Szczecin a certain part of the vessels were made from raw materials delivered in the form of semi-finished staves and bottoms, and even ready-made products could have been imported. Single-hooped vessels predominate among the spruce wood vessels, the percentage of which reaches 75%. It is highly probable that such vessels were brought from Silesia, mainly from Wrocław (Baran 2003, 111).[5] It is possible that similar vessels discovered in Kołobrzeg also came from this centre.

4 This assemblage, consisting of at least 65 vessels, was dominated (83% of the collection) by single-hooped bowls characterized by unified workmanship and size. Of the seven items examined by dendrological experts, as many as six were made of spruce wood (Polak 1997b, 230; Rębkowski et al. 1997, 71 ff.).

5 An argument in favour of such an interpretation is the fact that craftsmen from Wrocław specialized in the production of single-hooped stave-built vessels made of spruce wood (see Świętek 1999; Wysocka 2001).

Similarly to Kołobrzeg, products made of spruce wood dominate (over 92%) among the stave-built vessels discovered in Schleswig. There are very few pieces made of pine and white fir (Ulbricht 2006b, 159, Table 3). None of the tree species mentioned occurred in the area of Schleswig-Holstein during the Middle Ages (Ulbricht 2006b, Fig. 4). The presence of waste from the production of stave-built vessels in the excavated material from Schleswig indicates that they were produced on site. It is assumed that spruce wood could have been imported to the town by sea from the regions bordering the Baltic Sea on the east and southeast, as well as from Sweden (Ulbricht 2006b, 159–160).

Another group of wooden vessels produced on a mass scale in Baltic towns were small bowls with a round or polygonal shape and an irregularly cut exterior but which were lathe-turned on the interior (Fig. 60). These products, apart from small stave-built vessels, constitute a significant percentage of all wooden vessels obtained during archaeological fieldwork. Based on the existing analyses of the excavated material, no significant differences were found in the manufacturing technique or in the raw materials used in their production. It can therefore be assumed that this sector of production was characterized by a great degree of unification. These single-sided turned bowls were produced in Baltic towns until the end of the Middle Ages (see Baran 2003, 84–85, Schäfer H. 2005b, 336).

In the analysed urban centres, in addition to bowls with only the interiors turned, small bowls with both exterior and interior turned were also produced. Also in the case of these products, a significant unification of shapes and dimensions can be noticed, although in the excavated material from Lübeck (Neugebauer 1954, 183, Fig. 4; Falk 1987, Fig. 50:15), Wismar (Bucholz 1994, 81–82) and Rostock (Schäfer, Lange 1988, 223) a significant frequency of characteristic vessels with the so-called stellate rims also occurred (Fig. 60). These vessels are not known from other towns. The exception here is Szczecin, where only two such vessels were found, and they were considered imported (see Baran 2003, 76–77). The above data would indicate that the production of double-sided turned bowls with stellate rims was regional in nature and was carried out only in urban centres located on the western coast of the Baltic Sea.[6]

Equally interesting is the production of carved bowls with characteristic protrusions cut into the edge of the rim. They were excavated in very large numbers

6 Based on the analysis of iconographic sources, D. Baran (2003, 77) assumes that such products could also have been produced in southwestern Germany. However, this does not change the fact that, in relation to the southern coast of the Baltic Sea, their production was associated only with centres located in Schleswig-Holstein and western Mecklenburg.

in Greifswald (Schäfer, Schäfer 1999; Ansorge et al. 2003). They were much less frequently discovered in Rostock, Stralsund, Anklam and Prenzlau (Schäfer, Schäfer 1999, tab. 2, Figs. 12, 13, 15) and in Szczecin (Baran 2003, 142–144) (Fig. 60). No such vessels were found in other towns. This indicates that in the case of carved bowls with protrusions, we would also be dealing with a certain regionalism typical of craft production in centres located in the Oder region of Western Pomerania and eastern Mecklenburg.[7] According to H. Schäfer (2005b, 335–336), the production of such vessels could have started around 1380/90 and lasted until the second half of the 15th century.

Another notable phenomenon concerns the characteristics of the production of vessels and various wooden containers obtained by excavations in Riga, Tallinn and Tartu. In these centres (in addition to stave-built vessels and lathe-made bowls turned on the inside or completely turned), fragments of small containers made of birch bark (Fig. 60) are also frequent finds. With the exception of the above-mentioned centres, there are no artefact assemblages that contain this type of material from urban centres located west of the Neman. It can therefore be assumed with high probability that they were a regionalism typical of the eastern area of the Baltic Sea. The production of birch bark containers predates the chartering of the towns. In the Livonian and Estonian municipal towns the production of these vessels should probably be associated with local manufacturing traditions. It was most likely done by craftsmen originating from the indigenous population, who produced everyday items typical of the native material culture.[8]

Among the factors stimulating and unifying cooperage in Late Medieval Baltic coastal towns were cooperative connections with trade and other crafts, primarily brewing, which had a significant impact on the range and the volume of production. Barrels intended for storing and transporting various goods had to meet certain size standards (Robben 2008, further literature there). Research on the products discovered in Greifswald is interesting in this context. The excavation material identified barrels representing three size groups, differing in height and capacity. The first one included products with a height of approximately 60–80 cm and a capacity of 50–200 litres, the second one with a height of 110–160 cm and a capacity of just under 400 to 800 litres, and the third one with a height of 170–180

7 Several fragments of bowls with small protrusions were recorded in late medieval deposits from Magdeburg (Nickel 1980, 22), but they were less elaborate than the products discovered in the Baltic towns. According to D. Baran (2003, 143), knowledge of the production of carved bowls could have reached Magdeburg via Szczecin, which was facilitated by close trade contacts between both towns.

8 It is also probable that such products could have been made by craftsmen originating from a Ruthenian population.

cm and a capacity of up to 1000 litres (see Robben 2008, 78, Fig. 2; 2009, 170 n., tab. 2). These observations indicate that late medieval coopers produced at least several types of barrels standardized in terms of capacity, adapted to transport specific goods (Robben 2008, 79). It is also worth adding that the production of barrels used to transport certain products was covered by legal regulations. They concerned, among others, packaging used in the herring trade. In the 14th century, the so-called Kołobrzeg standard, i.e. barrels with a volume of approximately 325 litres, was the accepted unit of measurement. Later, the Rostock model was introduced, i.e. barrels with a capacity of approximately 630 litres (Gralak 2010, 38–39, there further literature).

Carpentry is another craft that exhibits significant unification of production techniques. The most clear example of this are the techniques of building houses, especially the rapid spread eastwards, along with the foundation of chartered towns, of frame-built structures in urban construction, a technique that over time almost completely replaced traditional building methods, namely the wattle-and-daub and horizontal log techniques (see Rębkowski 2001, 154 f; 2007a, 105; Müller 2005b, 133 ff.). These latter methods of building houses were still being used in some towns for a certain period after their chartering. This is known, for example, from centres such as Kołobrzeg and Szczecin (see Rębkowski 2001, 125–127, 143), Gdańsk (Paner 2001, 491–494), Elbląg (Nawrolska 2001, 488) and in Riga (Caune 2001, 551 f.). Nevertheless, here too, frame-built structures appear as early as the 13th century. To construct their supporting structure (skeleton), oak wood was most often used, but exceptionally beech, alder and ash wood was used. The walls were filled with various materials – clay, boards, and with time also bricks (Rębkowski 2001, 155). Frame-built structures, as evidenced by the number of examples found in the areas of the centres studied here, very quickly became a characteristic element of urban construction (see Lübecker Kolloquium 2001; Blusiewicz 2017b).

While in the case of wooden buildings, we can talk about structural solutions and building materials that are unified in individual towns, in the case of brick architecture, certain differences are noticeable, primarily in the materials used. The use of brick or stone in masonry construction was determined by the natural environment. In the western coastal zone of the Baltic Sea, in Pomerania and Prussia, there were no natural resources of building materials apart from wood, clay and rock raw materials of Fennoscandian origin. In contrast, there was a different situation in the eastern coastal zone of the Baltic Sea. There, in addition to abundant resources of wood, erratic boulders and clay deposits enabling the production of building ceramics, there were relatively easily accessible deposits of limestone and dolomite, especially in the areas of northern Estonia and central Livonia (Arszyński 2002, 77).

It was therefore mainly the geological conditions that determined the materials used in construction, which had to be either processed (stone) or produced (brick). This, of course, had an impact on the specialization, number and development of construction crafts in individual towns. In the centres located in the western region of the Baltic coast, in Pomerania and Prussia, where the basic building material was brick, we are dealing with a very unified construction technology. This involved the establishment of brickyards that employed diggers, brickmakers, tile makers, etc., as well as the construction of lime kilns. Therefore, in these towns there had to be teams of ceramic and bricklaying crafts that dealt with individual construction projects.

Greater diversification occurred, however, in centres located in the eastern Baltic region. In Tartu – similarly to the western coastal zone – ceramic and masonry crafts must have been active, because brick architecture also dominated here (Mäesalu 2001, 586 f.). In Riga, in addition to brick, dolomite was also used (Caune 2001, 558 f). A completely different situation is observed in the case of Tallinn, where the main building material was stone, primarily limestone (see e.g. Gläser 2002, 45). This resulted in a significant number of craftsmen processing it for construction purposes. In fact, stonemasons were among the most frequently mentioned craftsmen in written records (Vissak 2006, 505 ff., there further literature). Therefore, groups of both stonemasonry crafts as well as those related to bricklaying must have existed here. It should also be added that in the immediate vicinity of the city there was a brickyard specializing in the production of roof tiles at least since 1369 (Johansen, von zur Mühlen 1973, 78). However, this does not change the fact that the basic material used in Tallinn's construction was limestone.[9]

The research results so far indicate that in towns located in the western coastal zone of the Baltic Sea and in Pomeranian and Prussian centres, the leather crafts were one of the most unified branches of production. This is especially visible in relation to the manufacturing techniques used, the assortment of products produced, and, to a large extent, the types of raw materials used. In all these towns, cattle skins were of fundamental importance in the production of various items. Other species, including very good quality goat skins and skins of animals from the deer family, were used to a much lesser extent, and the varying degree of their use is noteworthy. Among the centres for which we have specialized analyses of raw materials, only in the excavated material from Kołobrzeg was a relatively high percentage of deer skins recorded (close to 10% – see Wywrot-Wyszkowska 2008, 17 ff., Fig. 2).

9 Limestone mined near Tallinn was also an important export (Johansen, von zur Mühlen 1973, 78).

In none of the assemblages collected so far from other Baltic towns has such a high proportion of raw materials obtained from wild animals been recorded. For comparison, the percentage of 'deerskin' in Puck is approximately 4% (Blusiewicz 2017a, 310 ff., tab. XII.4), and in Stargard it does not exceed 3% (see Wywrot-Wyszkowska 2009b, 127 Fig. 2; Stań 2012, 171, Fig. VI.1). In Szczecin (Kowalska 2013, 80, 239–250, Fig. 50) and Lübeck (van Berg, Groenmann-van Waateringe 1992, 348, Fig. 3.1–3; Volken 2002, Fig. 11) this material was only sporadically utilised. In Schleswig, however (Schnack 1992, tab. 6; 1998; van de Walle-van der Woude, Groenman-van Waateringe 2001, 11–13), no products made of deer skin were recorded. The above data may indicate that the tanners of Kołobrzeg, even in the late Middle Ages, still had relatively easy access to such raw material, which had also been used on a significant scale in the early medieval period (Wywrot-Wyszkowska, Radek 2007, 216, Fig. 214). However, it should be emphasized that over time, the use of this type of leather by Kołobrzeg craftsmen was gradually marginalized (Wywrot-Wyszkowska 2008, 20, Fig. 3).

Of equal interest is the extent of the use of goat skins. In Kołobrzeg (Wywrot-Wyszkowska 2008, Fig. 2) and Schleswig (Müller 2005a, Fig. 1) their percentage is around 20%, and in Lübeck it reaches even 40% (van Berg, Groenmann-van Waateringe 1992, 348, Fig. 3.1–3). In the late medieval materials from Szczecin, the incidence of goat skins among production waste is only slightly over 8%, and among finished products about 25% (Kowalska 2013, 80, 88, Figs. 50; 55). In Stargard, their frequency, depending on the assemblages examined, ranges from approximately 6% to 12% (Wywrot-Wyszkowska 2009b, 127, Fig. 2; Stań 2012, 171, Fig. VI.1), while in Puck, it is approximately 4% (Blusiewicz 2017a, 310 ff., table XII.4). Different percentages of goat skins seem to reflect the varying degrees of availability of this sort of raw material. This could have been caused by specific connections with the agricultural base for each city, which translated into a diversified supply of specific species of slaughter animals.

However, when considering issues related to the range of products produced by the leather crafts, it should be noted that in towns located on the western Baltic coast, they were highly standardized in terms of the design and decoration methods used. However, there is an interesting situation, mainly related to shoemaking, in the towns of Livonia and Estonia. The assemblages of footwear finds obtained in Riga (Bebre 1983; 1987), Tallinn (Sarv 2006) and Tartu[10] have a varied character. On the one hand they include multi-piece products that, in terms of technology, design and ornamentation, met the standards typical of late medieval shoemaking

10 This material is known to me from personal examination.

in the rest of the northern zone of Central Europe. On the other hand, they also include examples of shoes made of one piece of leather that were already a kind of anachronism in the younger phases of the Early Middle Ages in the western zone of the Baltic Sea, but were still used in its south-eastern and eastern regions. The presence of such products, although not very numerous, in the late medieval settlements of Riga, Tallinn and Tartu proves that local manufacturing traditions continued in the period after the chartering of these towns. These items of footwear may have been the work of manufacturers originating from the local population. In fact, the written sources from Tallinn contain information about craftsmen – including shoemakers – of local origin (Kaplinski 1980, 90, 183, tab. 5).

Another field of crafts that was characterized by advanced standardization of production techniques was weaving. During the 14th century, fabrics made in a 1/1 plain weave became very popular in the towns of the region, which almost completely replaced products woven in a 2/1 twill weave (see Maik 2005, 84–92, Figs. 15.1–15.3; Tidow 2006, 259–260). The rapid dissemination of this weaving technique was the result not only of the transfer of production technologies and migration of producers, but also of the intensification of the Hanseatic cloth trade, which in a sense forced local craftsmen to strive to simplify and cheapen the production of fabrics, and thus increase competitiveness in relation to imported products (see Maik 1997a, 26; 2000a, 234; 2005, 92; 2016, 174 f.).

Only in Schleswig (Maik 2005, 84, Fig. 15.1) and Kołobrzeg (Maik 1996; 2000a, 234, 2016, 173 ff.) in the 14th and 15th centuries were fabrics in a 2/1 twill weave still widely produced, which clearly distinguishes these centres from other towns in the discussed region. According to J. Maik (2016, 175), the predominance of fabrics woven in a 2/1 weave in Kołobrzeg may indicate that the local cloth industry was for some reason not particularly exposed to competition from Western European manufacturers in the 14th–15th centuries. Although imported fabrics are found in the city, they could have been used by wealthier townspeople. The poorer population probably obtained supplies from local craftsmen. It is possible that Kołobrzeg weavers sold their products in nearby towns. They also had to be relatively cheap products that could effectively compete with Western European cloth at a low price, and thus reach a relatively large group of local customers.

However, it is difficult to clearly explain the reasons for the high frequency of such fabrics in Schleswig. Perhaps the traditionalism of the local textile industry was the result of the inhibition of economic development and the related limitation of long-distance trade contacts, which is also reflected in the archaeological sources. This is especially visible in the example of pottery. The groups of products dating back to the 13th–14th centuries are distinguished by a much lower percentage

of imported vessels than those from the 11th–12th centuries (Lüdtke 1985, 129, Fig. 67). Their later reduced inflow to Schleswig could be related to its decline as a centre of supra-regional exchange, caused by the rapid development of Lübeck and that city's monopolization of the maritime trade in this region of the Baltic Sea already in the 13th century (Lüdtke 1985, 130; Vogel 1997, 190). In the late Middle Ages, Schleswig was a centre of only local importance. This may also have affected the nature of the local cloth industry.

Bone and horn processing is also one of the most unified fields of production in terms of the manufacturing techniques used and the range of products produced. In almost all towns, bone raw material was widely used, which successfully replaced deer antlers, which had been so commonly used in the period preceding the chartering of towns. Bovine bones and horns were the basic raw material used in comb production. The exception here are three centres – Kołobrzeg (Wywrot-Wyszkowska 2016b, 183 f.), Gdańsk (Hilczerówna 1961, 50–53) and Elbląg (Marcinkowski 2004a, 449 f.; 2004b, 81), where in the 14th century deer antlers were still used – and on a large scale – to produce double-sided three-layer combs. It is possible that these differences resulted from certain environmental and economic conditions. There were extensive forest complexes around Gdańsk and Elbląg from which (among other things) it was possible to obtain this material as a result of collecting shed antlers (see, for example, Hilczerówna 1961, 51). All these centres also had close connections with further hinterlands and acted as intermediaries in the trade of forest products (Lesiński 1960, 28; Czarciński 1993, 148). These circumstances probably contributed to easier access to this raw material, valuable for this industry (cf. Wywrot-Wyszkowska 2016b, 186).

Based on the available archaeological data, it can be concluded that bronze-founding was particularly developed in the towns located in the western zone of the Baltic Sea, i.e. in Lübeck, Wismar, Rostock, Stralsund, Greifswald, Güstrow and Stargard, which clearly distinguishes them from the East Pomeranian,[11] Prussian, Livonian and Estonian centres. The intensive development of the craft of bronze-founding in the above-mentioned urban centres was largely the result of easier access to raw materials that were the subject of organized trade. It was through Szczecin and Gdańsk that the export routes for copper mined in Slovakia led (Molenda

11 We currently do not have archaeological sources that would prove intensive bronze-founding in late medieval Gdańsk. This situation may seem surprising; after all, this centre was one of the most important ports through which copper, tin and lead were exported to Western Europe (see Molenda 2000, 200 ff). However, in the light of historical research, the intensive development of bronze-founding in Gdańsk took place only in the modern period (see Bogucka 1962, 108–110, 120–122).

1989, 811). Lübeck, on the other hand, controlled trade in this raw material from Sweden, among other places, and that which had been transported through the ports of Gdańsk and Szczecin (see Majewski 2005, 31, further literature there). In all these centres, three-legged cauldrons were produced on a mass scale, unified in terms of shapes and dimensions, the production and sale of which were subject to separate legal regulations.[12]

Specific types of production included the casting of various ornaments and costume accessories from non-ferrous metals. Among the centres analysed here, the ones that produced the most finds of stone casting moulds were Riga and Tallinn. These artefacts testify to the quite intensive manufacture of ornaments in these centres, also in the late Middle Ages. It is worth emphasizing that their design and decoration refer to the style typical of the traditional material culture of Livonia and Estonia (Müller 2005b, 127, further literature there).

Also typical of Riga and Tallinn is the production of glass beads, used to make various decorations, mainly necklaces. In the south-eastern part of the Baltic Sea, especially in Livonia, glass bead decorations were very popular already in the 12th century (Caune 2004, 463). Their production continued in the municipal towns. In the light of comparative analyses of the chemical composition of the beads obtained from excavations in Riga with analogous finds from (mainly sepulchral) sites located in its vicinity, it seems that the products of local glassmakers were purchased not only by the inhabitants of the city, but also by people living in nearby settlements (Caune 2003, 55 ff.; 2004, 463). It seems that it would have been the same situation in the case of the craftsmen of Tallinn.

Riga is one of the few municipal towns on the Baltic coast where traces of intensive amber production have been found (Strēle 2005; Caune, Ose 2006). Its development in this city was certainly facilitated by easy access to local amber deposits. Amber craftsmanship was a dynamically developing field of crafts also in Lübeck (Mührenberg 2002a; 2006), located in an area devoid of natural resources of this raw material. This was possible thanks to the good cooperation of Lübeck merchants with the stewards of the Teutonic Order, who monopolized amber mining and trade (Hirsch 1858, 121). However, what is noteworthy is the very limited

12 As mentioned earlier, matters related to the production of bronze cauldrons and their sale were discussed at meetings of Hanseatic towns. Among the centres analysed here, Lübeck, Wismar, Stralsund, Rostock, Greifswald and Szczecin took part in these deliberations. The presence of representatives of Szczecin would indicate the importance of bronze-founding in the economy of this city. This is also evidenced by written sources (see e.g. Blümcke 1884, 108 ff.). Unfortunately, archaeological methods have not yet been able to identify physical traces of this kind of metalworking in Szczecin.

amber production in Gdańsk in the period from the 14th to the first half of the 15th century (see Wapińska 1967; 1993), which resulted from difficulties of access to this raw material in this period. Intensive development of this field of crafts took place in Gdańsk only in the second half of the 15th century, when, after the fall of the rule of the German Order, the city's Council took over control of amber mining in the city's territory (Hirsch 1858, 323; Bogucka 1962, 197; see also Paner 2006b).

The differences presented above in the raw materials used, or those relating to the range of manufactured products, indicate that despite significant technological unification and similar production organization, in many towns we would be dealing with a certain degree of local variety. This could be due to several factors. The most important was the natural environment, which determined access to specific raw materials. The above may be reflected in the fact that slightly different types of raw materials were used to produce specific products, depending on the location of the city. This is visible, for example, in leatherwork, comb-making, the production of wooden vessels and small wooden containers, as well as the construction crafts. Access to raw materials depended not only on environmental conditions, but also resulted from trade connections. The dynamic development, especially in the western zone of the Baltic Sea, of some crafts, such as bronze-founding, blacksmithing, cooperage and even amber-working, would only be possible thanks to the import of raw materials, sometimes coming from distant regions. They would mainly have been imported from the area of Central Europe to the south, the British Isles and Scandinavia, as well as from the areas located on the south-eastern coast of the Baltic Sea. These would have been the sources of the iron, copper, lead, tin, coal, wood, rock raw materials, skins, furs and amber used in production. An important role in the trade in these raw materials was played by Tallinn, Riga, Elbląg, Gdańsk, Szczecin, Greifswald and Stralsund, as well as Lübeck, which controlled or even monopolized the exchange of certain goods, for example copper (Irsigler 1979, 16). It should therefore be assumed that a significant part of these raw materials must have gone to local craftsmen.

In Livonian and Estonian towns, a quite diverse range of products was produced, including products typical of all the centres analysed here, as well as those that were unique to the local cultural environment. The most traditional features are visible in leather and glass production, as well as in the production of the wooden containers and also personal ornaments made of non-ferrous metals. These observations indicate that, in all probability, in these urban centres we are dealing with two circles of craft production. One of them included immigrant people and the other was composed of indigenous inhabitants. Therefore, each of these population groups would have included both producers and consumers.

In almost all these centres, craft production was local or regional. The vast majority of manufactured products went to the local market, while the people living in the immediate vicinity of the towns were probably also supplied. In port centres, a significant number of craftsmen would have worked for the needs of trade and shipping (see, for example, Tandecki 1993, 171; 1997, 82; Schildhauer 1995, 84; Kattinger 2000a, 82). Among other things, an important role was played here by crafts related to food production. Representatives of these crafts even located their workshops near port harbours.

The production and sale of crafts could be largely stimulated by regional and sometimes long-distance trade. Craft products were the subject of regional exchange, which was facilitated by a developed system of fairs (see, for example, Samsonowicz 1986; Veronesi 2006; Bulach 2013). Based on the observations of the excavated material, it can be concluded that wooden spoons manufactured in Szczecin were sold in Kołobrzeg and Pyrzyce (Bobik 2016, 154). Fragments of turned wooden bowls with the so-called stellate rims, which were made in centres located in Schleswig-Holstein and western Mecklenburg, have been recorded in Szczecin (see Baran 2003, 76 f.).

Archaeological sources, supplemented by information contained in written records, indicate that products of the bronze foundries were also the subject of long-distance trade. As previously mentioned, bronze tripod cauldrons with the coat of arms of Stralsund and Lübeck have been found in Denmark and southern Germany (Vellev 1998, 218 ff.; Ansorge 2005a, 127 f.). In addition to the towns mentioned above, Greifswald may have been involved in this trade, which is evidenced by the fragments of foundry moulds with marked emblems and the city's coat of arms recorded in the excavated material (Schäfer H. 2000b, 447 ff.). Maker's marks were also recorded on foundry moulds found in Güstrow (Fries 2014, 108, Fig. 2:a–b) and Anklam (see Hoche, Fries 2004, 578). It is therefore likely that tripod cauldrons cast in these towns also found their way to a wider market.

Apart from bronze cauldrons, it is difficult to clearly determine, on the basis of the analysis of archaeological sources, which of the other products manufactured in the Baltic towns could have been the subject of organized long-distance trade. An important place for their sale was the fair in Scania (Möller 2008, 543 ff.). Mention may be made here of the sale in other fairs too, including in Skanör and Falsterbo, of clay vessels made in Greifswald and Stralsund (Möller 2002, 27). The products of Kołobrzeg shoemakers also went there (Riemann 1924, 156; Tepp 1980, 525). The products of Lübeck shoemakers and patten manufacturers were exported

to Scania and other regions of Scandinavia (Bulach 2013, 201 ff.). Scandinavia was also the main export destination for bread made in Lübeck and Rostock (Hammel 1981, 50 ff.).

Written records also contain information about the export trade in amber rosaries made in Lübeck (Stieda 1887, 101), amber beads made in Gdańsk (Hirsch 1858, 323) and wooden basins made in Szczecin (Baran 2003, 145, further literature there). Beer was an important export product of, among other places, Lübeck (Mührenberg 1994, 81 f.), Stralsund (Ansorge, Wiethold 2002, 164), Greifswald (Kattinger 2000b, 35), Kołobrzeg (Lesiński 1960, 24), Gdańsk (Bogucka 1962, 20) and Elbląg (Tandecki 1993, 174). It seems, however, that in the Baltic towns – despite their extensive trade connections – craft production was focused mainly on selling goods on the local and regional market. All this meant that none of them became a significant producer of products that were subject to mass export.

7. Concluding Remarks

This work certainly does not exhaust all issues related to craft production in late medieval towns of the southern Baltic coastal region. The available sources have, to varying degrees, made it possible to study over twenty areas of crafts. They constitute only a small part of the craft activity carried out in these centres. Despite certain limitations related to the quantity, quality and nature of the sources obtained, the excavated material seems to reflect significant differences not only in the size but also in the diversity of craft production between port cities and those located inland. It is significant that in the centres located in the hinterland (for example, Pyrzyce, Pasewalk, Strasburg and Neubrandenburg), the most frequently recorded fields of activity were pottery, blacksmithing, tanning/shoemaking, as well as the production of bone objects. In the case of Neubrandenburg, it can be assumed that pottery was a dynamically developing branch of crafts open to innovation, playing an important role in its economy and distinguishing it from many other Baltic centres. Neubrandenburg is one of the few towns on the southern Baltic coast where glazed redware ceramics were produced.

Analyses of written sources also indicate that smaller centres were characterized by a rather limited number of craft specializations. It is visible among other things in relation to the cities of the Duchy of Szczecin, where, in addition to the crafts mentioned above, weaving is also mentioned (Piskorski 1987). It can therefore be assumed that in smaller towns located in the hinterland, there were most

often crafts that provided residents with the basic products necessary in everyday life (see also Kardasz 2017, 81). Agriculture played an important role in their economy. It was the basis for subsistence for a significant part of the inhabitants (see, for example, Piskorski 1987; Kardasz 2017, 82). This specific type of economy had an impact not only on the number of crafts practiced, but also on the limited professional diversity within individual branches. In Puck, among the craftsmen involved in leather production, only shoemakers were identified in archaeological sources. Observations of the excavated material also indicated that they were involved in the production of raw materials, although there were no traces of specialized tanning activities. Most likely, in medieval Puck, the only craftsmen involved in the production of leather raw materials were shoemakers. This assumption is confirmed by 16th-century documents that mention only shoemakers and furriers. However, there is no mention of tanners (Kardasz 2017, 81; see also Blusiewicz 2017a, 352).

A completely different picture is painted in the case of port cities, for which the list of specializations confirmed in archaeological sources is much longer. They included not only crafts typical of this type of centre, i.e. shipbuilding, ropemaking, cooperage and brewing, but also many others, such as pottery, blacksmithing, bronze-founding, goldsmithing, turnery, carpentry, furniture making, wheelwrighting, red- and white- leather tannery, shoemaking, leather-working, comb-making, amber-working, cloth-making, baking, bathhouse services and glass-making. Port cities, unlike centres located inland, had a much larger number of inhabitants who were potential buyers of goods and services. Moreover, for craftsmen from Lübeck, Stralsund, Greifswald, Szczecin, Kołobrzeg, and other places, an additional market for goods were the cyclical fairs organized in Skåne (see for example, Tepp 1980; Hammel 1981; Möller 2008; Bulach 2013). Another factor stimulating craft production in port cities was easier access to imported raw materials, especially iron, copper, tin and lead, than in the case of centres located further afield. This allowed blacksmithing (and in some cases bronze-foundries) to develop dynamically there.

In the light of the studies carried out, it can also be said that in the initial period of the development of municipal cities, craft production did not yet bear the signs of the high professionalization that was manifested by the creation of new professional specializations. This is evidenced by the discoveries of production sites where remains were recorded of various types of production occurring together. We can mention here the bronze-founding workshop at 26 Breite Straße in Lübeck, dating back to the first half of the 13th century, which, in addition to casting of bronze pipkins, was also involved in the production of iron objects. The shoemaking workshops in Kołobrzeg and Puck, operating in the initial phase of

the development of these cities, dealt not only with the production and repair of shoes, but also with the production of other leather items.

A very clear example of combining diverse production in one hand are the workshops in Kołobrzeg from the end of the 13th and 14th centuries, discovered in excavations on Armii Krajowej and Narutowicza Streets discussed above. The craftsmen working there were engaged in making sheaths and knives, leather goods, iron fittings for sheaths, and also items made of bone, antler and horn, including handle linings, gaming utensils and most likely combs. In Rostock, in the thirteenth-century bronze-founding workshop at Wollenweberstraße 33/Sackpfeife, in addition to the production of bronze pipkins, ornaments and costume accessories were also cast, and even dice were made. A similar situation was noted in the case of the 14th-century Stralsund workshop, located near Semlower Tor, where Jew's harps and ornaments were cast from copper alloys, and bone and amber rosaries were made. All these workshops produced a diverse range of items using various raw materials, the processing of which was generally handled by separate craft industries. At the current stage of research, due to the insufficient scope of analytical studies, it is difficult to assess the scale of this phenomenon, although it should be assumed that it concerned all the urban centres that we are interested in.

The process of separating professional specializations in individual centres took place at different paces and intensities. It probably depended on the number of inhabitants, the level of development and the economic condition of a given city. It should also be remembered that the establishment of a guild and obtaining a statute mark the *terminus post quem* of the emergence of specific specialists. The small number of guild documents from the 13th century and their significant percentage among sources from the 14th–15th centuries may not only be the result of the insufficient state of preservation of older archives, but also to some extent reflect the process of intensification of the emergence of new craft specializations.

The traces recorded in the excavated material of various production activities carried out in the same workshop may to some extent reflect a situation that could have differed significantly from the one we see based on the analysis of written records. The realities of everyday life may have somehow forced craftsmen to undertake various activities that were not always consistent with the provisions contained in the statutes. This may have involved, for example, the production of an extended range of products, which was aimed at increasing income, ensuring subsistence. Additional evidence for this are the records of numerous disputes over competences between representatives of related professions or branches of production, or concerning the efforts of many guilds to obtain favourable privileges to facilitate the purchase of raw materials or the sale of goods. There were also

craftsmen in individual corporations who did not always comply with the statutory provisions (as indicated by the provisions in these documents on penalties for failure to comply with recommendations regarding production volumes or for other offences). Moreover, in virtually every large city there were craftsmen who were not associated in corporations and were not obliged to comply with guild regulations (see, for example, Bogucka 1962; Kattinger 2000a).

Regardless of the number of specializations, crafts in the urban centres of the southern Baltic coast were characterized by standardization of production techniques, a similar set of manufactured products and a similar organization of production. This was the result of transferring new cultural patterns to these areas, which were of fundamental importance in the formation and development of crafts in municipal cities. Despite the significant unification of craft production, some differences are noticeable in some of the cities discussed. They concerned primarily the raw materials used and the range of products. These differences resulted from the directions of settler inflow and the ethnic structure of the inhabitants. The natural environment was also important, determining access to specific raw materials, as well as economic connections with the closer or further hinterland and participation in long-distance trade. These circumstances meant that craft production in towns located on the western part of the southern coast of the Baltic Sea had a slightly different character than that in centres located in its eastern region.

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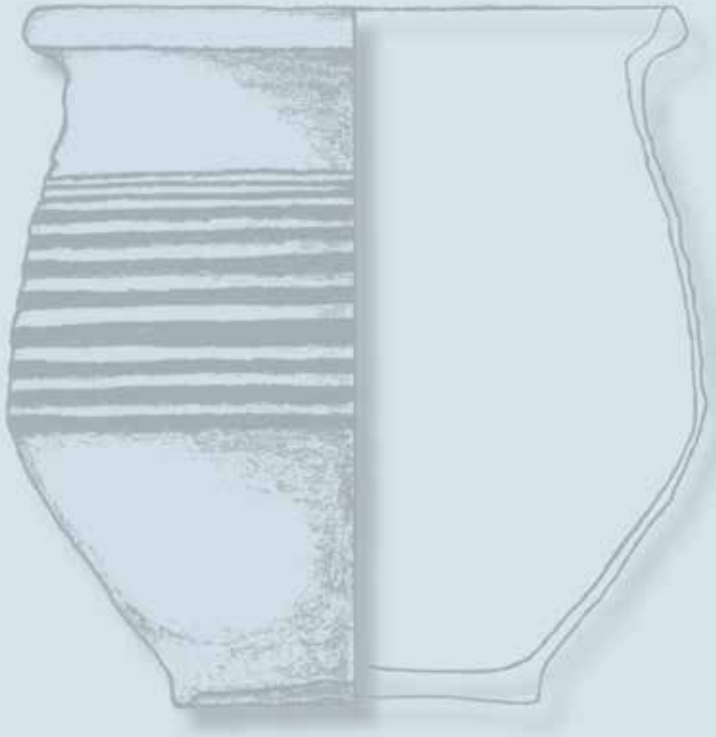

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