The important craft

Textile tools and production in kv. Trädgårdsmästaren in Sigtuna

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Abstract

Finds associated with textile production, are often not given any greater emphasis in the archaeological research. The craft has been regarded merely as a domestic chore, and thus not assumed to be particularly significant, neither in social nor economic respects. This study treats the textile production in one block in Sigtuna, kv. Trädgårdsmästaren during the early Middle Ages, and illustrates this phenomenon from different perspectives. I focus on the tools used for spinning threads, spindle whorls, and a particular attention is given to the spindle whorls imported from Kiev Rus, made from red slate, and the spindle whorls that has likely been produced locally, made of bone. Based on functional parameters, such as weight and diameter, but also the height and diameter of the spindle hole, it has been possible to draw conclusions on the types of threads that have been produced with these tools. In addition, I have conducted analyses on the distribution of textile tools in time and space, it is possible to draw some conclusions on the organisation of the craft production and how it has changed over time. A comparison with textile tools from Birka was carried out in order to observe differences and similarities on a few aspects regarding the textile production, and thus if this could demonstrate changes in occurring in the dynamic period between the Viking age and the Middle Ages. I draw the conclusion that from an early stage in Sigtuna's history, textile artisans had access to spindle whorls possible to produce both fine and coarser threads, intended for fine quality textiles, ordinary textiles and sailcloth. The organisation of the production has most likely been varied through time and in space. I suggest that the main period for textile production in this contexts was during the mid-11th century to the end of the 12th century, when I argue that the horizontal loom was introduced, and the textiles produced also could have been intended for a wider market, besides the members of the domestic unit.

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1. Introduction

1.1 Aims of the study

The use of material culture as a source is incredibly valuable, and it provides archaeologists with opportunities to form ideas of different phenomena, processes and stages in the past. It is not merely the function of the objects that arouses an interest, but also how the material culture has been used as expressions of individuals, groups and entire societies, which is the essence of archaeological research. How these expressions are interpreted depends on what aspects we choose to emphasize, such as economical, **functional** and social, to name a few. The ideal is to examine all the mechanisms involved in any process or phenomena and their implications on society, however, this is a difficult task in any archaeological research. By connecting empirical data with its context and acknowledging several of these aspects, since they in fact have been entangled in the past, we may reach an understanding of how everything has been connected. Only then can we get closer to new perceptions of what humans of the past thought of themselves and others, how their actions affected them and their environment and what contained value and meaning in their everyday life.

Textile craft is one of the earliest craft technologies in human history, and the manifold applications of textiles in society can be associated with both the household and beyond (Andersson et al 2010:150; Good 2001:209). Clothing for everyday use and utilitarian textiles have been an important part of the maintenance of households, but also delicate high quality textiles aimed to express wealth and social identity have been essential aspects of daily life. The manufacturing of sails have had a major impact on the economic and social development during the Viking- and early Middle Ages in Scandinavia, enabling long-distance travels across the seas. The increased awareness of textiles, and their economic, political and social value in past societies have contributed to new perspectives on the field (Andersson 1999a, 1999b; Andersson & Batzer 1999; Brandenburgh 2010; Gleba 2008). Within current research on archaeological textiles and the tools used in the process of production, the complexity of the craft has been brought forward, which has increased the understanding of the variations in the production, its organisation and that artisans with different abilities and social backgrounds have made different technological choices and have had the capability to truly influence the outcome (Andersson 1999a, 2003; Dobres 2000; Good 2001:213). The lack of knowledge of tools used in textile manufacturing in the past and the absence of the final products, has contributed to a situation where the mere existence of finds related to the craft has been noticed, but often not been investigated further (Andersson 1995:12ff). Textile production has been an important part of society and like other crafts, involved people with a great deal of knowledge, experience and skills. There is often a great interest in exclusive and valuable objects and how people have used them to express social identity and affinity with others, and textiles should certainly be seen as important in these circumstances (Good 2001:216).

My aim with this thesis is to provide a picture of parts of the textile production in one block in the early medieval town of Sigtuna in Sweden, by investigating qualitative and quantitative aspects concerning two categories of textile tools from the excavations in kv. Trädgårdsmästaren in 1988-1990, and the context in which they were recovered. A spindle whorl is one element of a tool used for spinning threads in the past. Based on analyses of different parameters important for the function of the tool, the thread quality possible to spin can be suggested, and thus it is also possible to draw some conclusions on the kind of textiles that have been manufactured at the site (Andersson 2003:55, 2009:5). I am interested in studying the variation in textile production through time and space, to highlight the dynamics and possible changes, both locally and regionally. Thus, I intend to compare the results from the analyses with chosen textile tools and the production at Viking Age Birka, located in the same region.

I have chosen to work with this specific material and site to explore the potential to highlight the variation and complexity of the production of textiles, and due to a great personal interest in the dynamics of the centuries in the transition between the Viking- and early Middle Ages. The theoretical discussions on craft and production has been strongly focused on the way the production was organised within different societal structures. A variation of aspects have been highlighted, such as the economic effects, division of labor and trade/exchange, more recent discussions have added a social perspective on the studies to emphasise social identity, technology, practice theory, agency, ritualisation and the value of the products (Costin 1998; DeMarrais 2013:345; Dobres 2000; Flad & Hruby 2007:1). Thus, the artisans have become an increasingly important factor in the dynamic processes of production, from an archaeological point of view. As Costin, and many other researchers stress, there is a great value and need for an understanding of the choices made by the artisans, since it is somewhat fundamental for understanding other events, processes and relationships in society (Costin 2000: 380; Zagal-Mach Wolfe 2013). I intend to use a social perspective on the production which can bring forward the actors performing the craft and their role in the materialisation of the concepts that constitutes the finished products.

Since the larger excavations in Sigtuna began in the early 1980s, there has rightfully been a focus on finds and production which clearly indicates the special characteristics of the town throughout the early Middle Ages, but also more common finds which has yielded new interpretations on crafts and the interaction with social groups from the continent. Some of the most interesting aspects of the town is its early urban character and the many finds which highlight the connections with areas outside of Scandinavia. What has been produced within this environment can surely give some hints about the people living, and visiting this place during the early Middle Ages.

The main questions for this study are:

- What different types of spindle whorls can be observed in the material? And why have these tools been chosen in this specific context?

- What kind of threads can be inferred from the analysis of spindle whorls made of Volhynian slate and bone? What can the results imply when provenance is considered?

- At what scale were the artisans producing textiles in kv. Trädgårdsmästaren? Can the distribution of the textile tools implicate specific areas for the production of textiles?

- It is possible to discern an organised craft production of textiles during any of the phases, on account of changes of activity areas, tool function and production scale? If so, what was the nature of the textile production in kv. Trädgårdsmästaren during the early Middle Ages?

- Is it possible to see changes in the textile production over time within the block, and between the two urban sites Birka and Sigtuna? How can the results be viewed in relation to other crafts?

1.2. The material

Usually when studying craft production the material available is either debris, tools, the final products or, at best all these components. The preserved textiles from Sigtuna are however, quite few and a majority have not been analysed, which means that they can not adequately display the variations of the production in the context (Costin 1991:1). This leaves me with the tools used in the production of textiles.

The primary source material in this study consists of 214 spindle whorls from the excavations of one city block, kv. Trädgårdsmästaren, in Sigtuna. I have chosen to study 108 of the finds more thoroughly, however, all finds of spindle whorls will be presented, analysed and discussed on the basis of their material, weight and spatial distribution. I have divided the spindle whorls into groups according to the material, and the finds that have been chosen for a more close-up analysis are the two groups of spindle whorls that represent the majority in this context and comprises one half of the entire study material; spindle whorls made from Volhynian slate and bone. They can also be viewed upon as two distinct groups, based on provenance, since the Volhynian spindle whorls have been brought into Sigtuna, most likely as whole objects, while the spindle whorls made from bone have most probably been manufactured on location. Differences and similarities within, and between the two groups may suggest some important aspects of their function, and social value in this context. To facilitate the study and making my documentation available for further research, I have created databases with the information relevant for the function of the spindle whorls (Appendix 1). I also introduce another category of finds, loom weights, which are used in warp-weighted looms to weigh down the warp threads while weaving. The reason for including this category is to further understand where the textile activities have taken place within the town plots, and the extent to which the production has been pursued.

The databases with information on the finds from the excavations have been used in order to obtain information on the textile tools that has not been available for a close-up analysis, such as the remainder of spindle whorls, the loom weights and objects within the context which has been relevant to the study. The excavation reports and documentation have provided me with spatially and chronologically valuable information, which has allowed me to interpret the material in a close relation to the context it was recovered in. Previous research on Sigtuna have been useful, and has provided me with details and important aspects regarding the context, its relation to places outside of Scandinavia and the nature of other craft activities. The analyses of textile tools from Birka, carried out by Andersson has been fundamental for the comparative analysis (Andersson 1999a, 2003, 2007).

1.3. The Research Method

The subject of craft production is in itself a very complex phenomenon to study and understand, and several aspects must be taken into account in order for the interpretations to be useful. Primarily, it is important to develop an understanding of the pre-conditions of the craft, the process of production, and its implication on the society under study. In my view, the tools, their users and the context where the performances have occurred is fundamental for this study, and therefore my intension is to examine these elements and how they are related. The creation of archaeological knowledge is a process that can not be seen as simple in any way, since the material culture have many strengths but also weaknesses. There are no simple ways to approach these matters and surely, since we are dealing with the fragmentation of the past, many "answers" can't be reached unless we dare to ask questions that the material culture explicitly can't express. My view on this is that there is a need for a hermeneutic and contextual approach where theories of agency, practice and social identity can be used as perspectives for highlighting the relationship between the material culture, the agents of craft production and the context. A contextual approach requires for similarities and differences of quantitative and qualitative patterns related to the material culture being studied in time and space, to be identified as thoroughly as possible, in order to reach a better understanding of the objects, their users and the social environment in which the craft was performed (Hodder 1987:5f).

The empirical analysis is fundamental in this study, and both quantitative and qualitative methods are needed in order to answer the questions. A typological classification of the spindle whorls have been made on a chosen set of finds, which represent locally manufactured tools and tools that have been brought in from another cultural sphere. In the qualitative analysis of the empirical material, my intension has been to focus on the functionality of the object as a tool for thread production. The strategy for achieving this has been to incorporate a set of parameters that have been important for the functionality of the spindle whorl such as weight, height, diameter (spindle whorl), diameter (hole), and register the spindle whorls accordingly. By performing an inductive analysis, I have been able to detect certain qualitative factors that indicate some aspects about the thickness and quality of the thread that has been spun. The

chronological and chorological relationships between the textile tools and the context allow for an understanding of the nature of the craft production and its development within the block, the different plots, and have contributed to an appreciation of how these activities has been carried out. As my intension have been to use a contextual approach, a focus have been directed towards the relationship between the tools, and as many aspects of the context as possible.

In order to enhance an understanding of the nature of production in kv. Trädgårdsmästaren, I have conducted a comparative analysis between the material from Medieval Sigtuna and Viking age Birka. The selection of the site has been made with the aim to observe changes in the textile production over time, and to investigate whether the different characteristics of the sites may have had resulted in qualitative differences in the production of textiles. How the textile production and the tools might have changed during this time period is thus of interest for, and can contribute to the overall discussion on urbanisation, and differences and similarities in craft-tradition. Since I only have access to a limited material, the comparison between the tools will be focused on spindle whorls made of bone that occur in both contexts. I will present a general background of Birka to highlight the main characteristics, describe the finds associated with textile production, and discuss the similarities and differences with the results from my analysis.

There are a several source critical aspects related to the material and the method. As in all archaeological contexts, the problem of preservation of organic materials and disturbances of cultural layers are issues that affects the representativeness. The impact of these aspects for the analysis should be evaluated based on the prevailing conditions in the context and time period. Another aspect to consider is that the textile analyses of the tools from Birka and kv. Trädgårdsmästaren, have been carried out on different levels. My aim is, however, to observe trends and general differences and similarities between parts of the materials from both sites, and not to make a strict comparison presenting exact correlations. Factors such as the scale of the excavations, and the methods used will nonetheless affect the representativeness when comparing materials from different sites. However, I believe that by focusing mainly on the qualitative aspects, the comparative analysis of the textile tools and activity areas can provide new insights.

1.4. Previous research- Textiles, tools and production

In this chapter I will present some of the previous research which has contributed to the development of research methods and theoretical perspectives concerning textiles, tools, and production. I also intend to describe the current research situation, and issues and critique that have been brought forward.

Research concerning the finished products, the textiles and their composition and style, has long been a focus in archaeology. Bender Jørgensen's studies on textiles in Scandinavian and northern European contexts should be mentioned as very important contributions (1986). During the past decades the tools used for producing textiles have become an increasingly important aspect to study, in particular for archaeologists. Textile implements have been studied

on the basis of aspects which are important for their function, which has brought forward interesting and valuable data to consider in relation to the context and for interpreting the variations in textile production. The research on archaeological textiles is today rather multifaceted, and combines scientific analysis of materials, experimental archaeology, iconographic studies of costume condition, qualitative and quantitative analyses of the tools and their contexts, to discuss organisation, social identity, agency (Andersson 1999a; Brumfiel 1996, 1998; Costin 1998a, 1998b; Gillis & Nosch 2007; Gleba 2008; Mannering 2006; Mårtensson et al. 2006). The analyses of the textile tools recovered in Birka carried out by Andersson, has allowed her to make assessments on the technology available and how the textile production was organised (Andersson 1999a, 2007), and Walton Rogers has treated textile tools found at Coppergate in York in a similar manner (Walton Rogers 1996).

Discussions regarding textiles in Scandinavia have touched upon the origins of the fine-quality textiles in Birka, and whether these products can be considered to have been imported or produced locally. It is however difficult to determine their origins based on textile analyses alone. There is a great need for methods that enable archaeologists to reach an understanding of the type of production that has been performed in these contexts, and with the tools as source material this is a possibility. The textiles from the Birka graves have been of great importance for the knowledge about Scandinavian costumes and the occurrence of fine-quality textiles, and was first treated by Agnes Geijer in 1938 and later Inga Hägg in 1974 (Andersson 2007:150; Gleba & Mannering 2012:353). Both Geijer and Hägg have suggested that the fine-quality textiles in Birka were imported, however, in Andersson's study on the textile tools from the site, these hypotheses have been challenged (Andersson 1999a:107). By analysing the tools and combining the results with analogies from experimental archaeology, Andersson has introduced the possibility that some of these textiles could have been produced at the site (Andersson 1999a:107). The research and experiments were carried out in collaboration with professional textile artisans at CTR (Centre for textile research) at the University of Copenhagen, and in collaboration with the historical archaeological research centre in Lejre. The experiments have yielded many valuable observations on the textile tools and raw material and different aspects of the performance, such as the time and skill needed for different kinds of production, which has opened up new doors for further research where technique, knowledge and skill can be considered essential for the quality of the product (Andersson 1999a; Mårtensson et al. 2006a, 2006b). The experiments has also demonstrated the relevance of studying all stages of the production process, and not only the finished products.

Textile tools have also recently been treated by Zagal-Mach Wolfe (2013) in her dissertation, where she studies the concepts of craft tradition and technology and develops a research method with the aim to gain an understanding of these phenomena in a case study on the introduction of sails in southern Scandinavia. The extensive analysis covers textile tools from all over Skåne during the Vendel and Viking age, and she demonstrate that a large-scale analysis can provide very valuable information about general changes in craft tradition. Her study also bring forward the issues concerning field documentation, and the lack of sufficient information to make these studies possible, and hopefully an increased awareness of the importance of accurate documentation in field, will follow.

A plurality of publications on production and craft specialisation have been produced within the fields of anthropology and archaeology and in current research, theories of agency, social identity, practice, gender and ritual, can be incorporated within the studies on crafts to highlight the social elements around the production and the interaction between humans and material culture. From a gender perspective, Brumfiel has used spindle whorls to study what kind of thread quality women in different time periods in Aztec and colonial Mexico, were producing (Brumfiel 1996, 1998) Costin have also used perspectives of gender and social identity in her research on the production of cloth in the Late prehispanic Andes (Costin 1998a). Callmer's research on crafts in southern Scandinavia, has contributed to new understandings on their organisational variation. Callmer has also stressed the importance of putting more effort into approaching textile production in a more comprehensive manner and asking more problem-related questions, in order to enhance our understandings of the nature of production (Callmer 2003:345). Studies on craft production at different sites can thus become more substantial and varied.

In the current theoretical discussions on craft production, criticism has been directed towards concepts and typologies used for determining the organisation of production (see Clark 2007; Costin 2007; Flad & Hruby 2007; Li 2007, and others in this volume). The concept of "specialisation", i.e. when crafts are carried out with the aim to produce goods for other members than those within the household unit, has long been in focus for many studies on craft, and it has almost become a search for specialised production (Clark 2007). This may be due to a desire to detect the prerequisites for major changes that have affected society and been a part of the development, from simple to complex (Clark 2007:20; Hendon 1996:49; Kenoyer et al. 1991:44). Thus, crafts associated with the household, and usually also women, have not been explored to the same degree as the craftsmanship linked to political actors and major social and economic changes. The main concern in the recent discussions is that the concept of specialisation has too many definitions, and thus it has become difficult to incorporate in analyses of archaeological material and compare it with different interpretations (Clark 2007:21). Clark (2007) has explicitly expressed the need for a redirection of the theoretical approaches and that the focus instead should be on all types of craft production, and not on the search for specialisation.

I agree that the goal must not be to search for specialised production, but rather to study the craft activities and the context carefully. I believe that the nature of the production is difficult to grasp properly, and it is very context-specific. Since the characteristics of the craft production is closely tied to the context, the actors, ideological and political aspects and to other craft activities, it may become challenging to provide a universal typology since it might not be applicable in every situation. However, typologies are constructed to describe general phenomena, and facilitate comparisons with similar activities or phenomena at other sites. I therefore stress that it is essential to view the context where the craft is performed, as unique and focus on several aspects that distinguish it from others, but also perceive it as a part of a whole. We should be able to relate occurrences between various contexts, and use similar definitions and terminology since this allow for the interpretations to be compared in a valid manner. It is important to recognise the challenges surrounding the research on craft and

production, and the many difficulties which becomes apparent when the empirical data challenges theoretical models introduced in past research. Craft production is an extensive issue for archaeologist to grasp, and many aspects must be taken into account for the interpretations to be useful.

1.5. The important craft- theoretical perspectives on textile production

The title of this chapter and thesis is intended to highlight the importance of addressing textile production in a similar manner in which other craft activities has been addressed in previous research. Due to the important development in research on textile tools carried out in recent years, this is a possibility (Andersson 1999a, 2003b; Mårtensson et al. 2006). By asking relevant questions and challenge previous assumptions, the activities associated with textiles can be placed in relation to other kinds of production and be viewed as essential elements within society in various ways, as socially and economically valued activities. In this chapter, the perspectives will be introduced and discussed and I will clarify some concepts that are associated with textiles and craft production and present the theoretical model I use as a basis for the discussion on organisation of textile production in kv. Trädgårdsmästaren. An attempt to connect the material, its functionality and spatial distribution within the site to a wider context, where the crafters are seen as actors involved in material and social reproduction, can bring forward various alternative interpretations on the nature of the production.

1.5.1 Performing craft and creating identity - an agency perspective

When studying material culture it is essential to see beyond function, and to be able to highlight other aspects associated with the artefacts. In order to grasp as many levels of the textile production in kv. Trädgårdsmästaren in Sigtuna as possible, it is pertinent to bring forward the humans in action, the actors of craft. I will use an agency perspective to highlight these actors involved in the process of production of textiles and their capability to make technological choices based on their own knowledge and skills, and understanding of the norms and values within the context they found themselves in, to influence the outcome by performing craft.

Central to theories of agency is that individuals and groups have the capability to create and influence their environment through performance, whilst they are affected by the environment they find themselves in (Dornan 2002:304,315; Giddens 2013:9; Joyce & Lopiparo 2005:368f). In other words, how the individuals are actively a part of transforming the society, at the same time as their choices and performances are influenced by the society. Anthony Gidden´s structuration theory and Pierre Bourdieu´s concept of habitus, has been greatly influential in this field, and has been widely used as theoretical premises for studies on agency in archaeology. Giddens promotes the notion of "the duality of structure" which entails that we cannot study individuals and social structures separately, as they are in fact a part of the same unit, and that human practice are in fact what forms society structures (Giddens

2013:24ff). He views social structures as both constraining and enabling, and that an awareness of the social rules it comprises should be seen as the characteristics of human agents (Giddens 2013:21f). The concept of habitus can be defined as a system of internalised structures, schemes and actions which are common to the members of a certain group or class, which will affect their choices and performances (Bourdieu 1977). Although new research are critical against many of the ideas promoted by the aforementioned researchers, they function as fundamental building blocks which has evolved in new directions.

Researchers have during recent years confronted the different possibilities in adopting an agency perspective in order to use it in a satisfying manner in archaeological research, where an understanding of the materiality of the past and its social significance, the importance of the motivations of human practice, and the duality of agency and structure, should be the main focus (Dobres & Robb 2005:8). Dobres and Robb argue that agency could also be defined as "*a socially significant quality of action rather than being synonymous with, or reducible to, action itself*" (Dobres & Robb 2005:8). They advocate the concept of *chaîne opératoire*, as a useful way to link social and material reproduction and combine everyday material practice, embodiment, and identity, in archaeological research (Dobres 2000:156; Dobres & Robb 2005:163). The performance of craft is viewed upon as a social process where artisans involved have the potential to affect every steps of the process, in different ways. It is what affects the choices made by agents that contribute to a certain performance, which is essential to the concept of agency.

Craft or production is essentially the transformative process where raw material is formed into an object by humans (Costin 1991:3). It is thus a practical phenomenon which in many ways are fundamental to the manifestations of human expression. It is, however, also a social process that requires negotiation between people (Gilchrist 1999:40). Cultural specific norms and values associated with the social environment are embedded within the concept of what constitutes an object, and the performance of craft is the materialisation of these concepts (Costin 1998:3). The material culture associated with craft production in archaeology, such as tools and raw materials, are often very diverse in the archaeological contexts and can be understood as traces of evidence for a diversity of technologies, which reflects the many ways of performing craft. It is essentially the material remains of a specific craft-tradition in a certain time period and context that is being studied (Zagal-Mach Wolfe 2013:40). Artisans in past societies have not unknowingly handled tools that they were randomly assigned, and thus they should be viewed upon as active agents having the ability to make choices, and perform in their own right. The actors are conscious of their activities, in the sense that they can give an account of them (Giddens 2013:5f). The capability to make choices, is central to the making of objects, and what determines these choices represents the agency of the craft producers. Small alterations along the way, whether it is in the choice of raw material, the spindle whorl used for spinning the thread, or the loom setup, will result in different outcomes. I like to stress that the choices were affected by the nature of the production and the social environment, in which it was carried out. Nonetheless, small alterations in any of these performances could contribute to greater changes over time. It enhances the role of the craft producer as active in making decisions regarding her or his performance and that the choices they make, whether to

maintaining the production in a certain manner or to alter it, will have an impact on the environment over time.

Textiles are markers of identity in many different settings. They can be used to express gender, social status, and ethnicity, and thus artisans creating them are functioning as mediators of certain social codes, which may be explicitly or implicitly displayed in the dress or in the composition of the fabric (Andersson Strand et al. 2010:150; Costin 1998a:123). And equally, the social identities of the artisans are reproduced by their capability to, through materialisation, affect and recreate the identities of others (Costin 1998b:3). In Costin's study on the cloth production in the Inka Empire she argues, by emphasising aspects of craft production and social identity, that the state redefined the social identities of artisans in order to gain control over the symbolic significance of the products (Costin 1998a). Costin states that in order to understand the role of textiles in society, we must understand the organisation of the craft production and distribution and further suggest that we must also consider the relation between the social identities of the artisans and the consumers, the rareness of the material and the labor invested in producing the products, as essential for the value and meaning of the textiles (Costin 1998a:125). This brings forward the qualitative aspects within the study of textile production in a certain social setting. By focusing on the context and the different actors involved in creating and defining material culture, textile production at various levels, can be viewed upon as both the expression and creation of social identity (Costin 1998, Zagal-Mach Wolfe 2013:31).

I emphasize the importance of understanding the artisan's role in the materialisation of a concept that constitutes an object, which is made up of ideas and norms in a given cultural sphere. Using an agency perspective on textile production, the importance of the recognition of strategies and technological choices made by the artisans based on their social environment, can be highlighted. The nature of the production will affect these choices, and be affected by them. Experimental archaeology contributes to several important observations on the creative process and the potential and limitations of the tools, and is thus vital for an understanding of how aspects such as skills, knowledge and experience can affect the production process. However, the context should be carefully studied for an understanding of the social environment in which the artisans are operating, which has formed the basis for the activities. In my view, the variations of tools, and the changes of that are visible to archaeologists can reflect different relationships between people and objects, in time and space and demonstrate the many ways to perform craft. By viewing craft production as a creative and social process formed by the cultural norms of the environment, the complex relationships forming the material culture can be highlighted.

1.5.2. Between household and workshop- perspectives on organisation and "space"

In urban contexts textile production may involve various levels of professionalism (Callmer 2003:345). What often is referred to as domestic production, where artisans can possess

different skills but produces merely for the members within this sphere, is set apart from a specialised, or professionalised production where the final products are intended to reach a wider community outside of this sphere (Costin 1991:2ff; Hendon 1996:2). The contrast which has been built up between the domestic sphere and the public domain is keeping important elements of society in the shadows. The concept of the household is often viewed upon as an immutable sphere within society, and just as the household is kept separate from public space the domestic craft is kept hidden behind the walls of the household and not perceived as an important part of society, either economically or socially (Brumfiel & Robin 2008:3; Hendon 1996:46; Hirth 2009:1). It is almost perceived as a counterpoint to the craft performed in distinct workshops. This view prevents archaeologists from discussing the possibilities of different kinds of organisational modes concerning crafts mainly associated with "the household" in the early Middle Ages.

The household during the early Middle Ages might not have been composed of one family connected by kinship, as we know the term today, rather the household unit could be composed by different kinds of social assemblies and individuals with different identities (Hendon 1996:46). During this period slavery was still common, and should be seen as an important part of the domestic unit (Brink 2007; Roslund 2013:128). To be unfree would not necessarily mean that the individual was without legal rights, and there were probably slaves with different social status in the early medieval society (Callmer 2003:153; Brink 2007). For an understanding of the domestic unit and its social and economic implications on other parts of society, the activities performed by its members are crucial to study (Hendon 1996:45f). Primarily, the household should not be seen as an invariable sphere where activities always remain the same throughout long periods of time (Hirth 2009:2). The household was a social and political unit, entangled in the society structure, and how this unit was organised effected other elements within this structure (Hendon 1996:46f). Thus, the domestic sphere and the public domain are not to be perceived as two different worlds, but rather as spaces for different kinds of social organisations.

A provision of textiles for the household has always existed, and thus different levels of production may be difficult to identify in the archaeological material. The mass material will be grouped together and regarded as signs of domestic chores. Hendon has argued that domestic and specialised production should not be seen as separated, as the activities carried out by artisans in the domestic sphere could be of specialised nature and be intended for a wider market (Hendon 1996:55). An example from anthropological research shows how silversmiths at Zuni in New Mexico in the 1920s, moved the craft activities from a few workshops into the household when there were a sufficient amount of tools to keep all the artisans in practice (Mills 1995:149). In this case, the workshop was used by a smaller group of artisans in order to facilitate the utilitarian aspects of production before the craft was intensified. Milek´s (Milek 2012) interdisciplinary study concerned with the activity areas for textile craft on Iceland in the early Middle Ages, introduces some interesting interpretations on the spatial aspects of textile craft. By analysing the micro refuse, geochemistry and micromorphology of floor sediments, the function of pit-houses in the Viking age could be associated with textile production. These buildings were abandoned in the 12th and 13th century, when textile production was intensified

and moved into the main dwelling houses, as the craft became an important economic contribution to the family. The examples can demonstrate reasons to consider a variety of organisations and movement patterns for craft production in the archaeological material.

1.5.3. The organised production

The relationship between producers of craft and the consumers can take on many forms. The concepts of independent and attached specialists has been used by Brumfiel & Earle (1987), Costin (1991) and others, and is widely accepted as useful for describing the nature of these relationships.

- ***Independent specialists*** refers to artisans who produce goods or services to unspecified consumers, which can vary according to social and economic needs in a specific context. The economic aspects are stressed here, and the goods that are produced can often be said to be of a subsistence nature (Brumfiel & Earle 1987:5).
- ***Attached specialists*** on the other hand, are artisans that produce for specific consumers, elites or state institutions, and they are provided with raw materials and subsistence goods by these authorities. The political authorities can be said to control the production and the products, mainly exclusive and luxury goods, which provides them with the ability to gain and maintain a certain social status and create social bonds (Brumfiel & Earle 1987:5; Callmer 2003:337). Social reproduction are therefore stressed in situations where attached specialisation can be determined, and is often connected to milieus where political manifestations are displayed.

In discussions on craft production beyond the domestic unit, two categories of goods, subsistence goods/commodities and wealth/gifts, are too often seen as rather clearly defined and implicit types where an object either belongs to one category or the other. Although, there probably have been great differences of value and use of the material culture in the past, as today, the relationships between humans and objects might not have been as straightforward (Andersson 1999a:28; Callmer 2003:338; Flad & Hruby 2007). Subsistence goods are defined as products, made with the aim to support the needs of the household. In other words, these could be described as necessities, which are mostly connected to non-specialised producers and independent specialists. Objects of wealth on the other hand, as Brumfiel and Earle define the term, have been used for display, ritual and exchange (Brumfiel & Earle 1987:4). The term is often used in connection to artisans, attached to a political authority. These concepts could be criticised for being too wide, since the division implies that objects have either been economically or socially valued in past societies (Flad & Hruby 2007:10). The implications the production and the products could have on different spheres of society should therefore be stressed. Textiles could be used as gifts and manifestations of identity, and thus be very desirable items for political and ideological utilisation and negotiations (Andersson Strand et

al. 2010:150; DeMarrais 2013:346). The need for textiles and clothes for everyday use must also have been great, and necessities such as fishing nets and ropes would definitely have been of importance in Sigtuna considering its location. Production of sailcloth enabled people to travel across the seas, and build social bonds with others and could be regarded as a produce with major implications on society (Roslund 2005:37). Textiles have thus been desirable for individuals in all social spheres, and not only the high quality fabrics have been of social and economic importance. It is not only the effect of the products on society that should be noted here, but how the urban craft production have been organised and rearranged to meet the needs.

The premise is that there are several types of organised production, which can be defined by different relationships between artisans and consumers and the context of production. These relationships may not be explicit in the archaeological record, however some general variables can be stressed, and function as general parameters which can facilitate the interpretations on the production organisation. Christophersen connected spatial analyses of craft with change in production and introduced a model for the development of craft production in Lund during the Middle Ages, by analysing debris from comb manufacturing (Christophersen 1980). He proposed empirical criteria to define different types of production. I am inspired by the method and the observations are important, however, I do not use specific quantitative distinctions. The three stages of production he propose are: *husflid,* meaning that the production is aimed for the household members and there are no production of goods for external consumers. At *Kundeproduksjonsstadiet,* itinerant professional artisans have direct consumer relationships and the production is secondary and provides the non-producing population with goods. *Markedsproduksjonsstadiet* is when the craft production becomes stationary and the professional artisans produce for a wider market with unknown consumers. Production at this stage is considered to be of major economic importance to the urban society. Christophersen stresses that the results demonstrate a heterogeneous development process where different levels of professional crafts and household production have been operating simultaneously (Christophersen 1980:126). This is a very important observation for an understanding of the development of early medieval towns such as Lund and Sigtuna. Christophersen's model has influenced researchers involved in studies on medieval towns and their development and continuity, and corresponding models have been proposed by others.

Costin (1991:8) has introduced four general parameters which should be considered in regard to the organisation of production: The ***context***, which refers to the nature of the society structure in which the production activities are carried out, and the relationship between producers and consumers. The context and the social structure is crucial for the understanding of the products that has been produced and why. When textile activities are concerned, there are certain difficulties in assessing how the craft was organised, as textile production for the members of the household always would have been necessary. Usually this has not been a priority in archaeology, and thus the documentation and reports do not include all the information needed for such an assessment. The ***concentration*** of the production refers to the spatial distribution of the production and the producers within the different farm plots, and the ***scale*** refers to the amount of artisans working within a production unit. At last, the ***intensity*** of the production can describe the relative time spent on the production (part-time or full-time)

(Costin 1991:8). The intensity will not be addressed here, since it is not possible for me to ascertain the relative time spend on all the steps in the production process. What can be stated is that textile production was very time consuming, in particular the spinning of threads. Spinning a fine thread with a very light spindle whorl would be more time consuming than spinning a coarser thread with a heavier tool. These parameters are fundamental for any study on production and can be used as guidelines for describing the organisation of textile production.

Andersson, influenced by Costin's typology, has presented a model of four different levels of textile production in, in her studies concerning Viking Age Birka (Andersson 2003b:47; Costin 1991:10). This model is relevant to use in this study as I intend to compare the results from the analysis with the textile production in Birka. There can be several kinds of organisations in one society simultaneously and variations within these, and thus the typology should be used in this study as a theoretical basis from which a discussion can be further developed.

- On **a *Household production*** level, the production covers the needs of the members of the household. The raw material is accessible, which means that the members of the household have easy access to the sufficient amount of raw materials for their needs, without being depended on a patron for the supply.

- At a ***Household industry*** level the production is organised at a household level, however, the production *scale* is larger than what is required for supplying the members of the household, and the products can be distributed to consumers beyond this sphere. The surplus produced may be intended for trade/exchange or as tax payment. At this level, the artisans are not performing the craft full-time, and can be involved in other activities.

- At an ***Attached specialist production*** mode, the artisans have a specialised knowledge of the craft technology, and importantly, are dependent on a patron for a supply of raw materials and other necessities for the household to be able to work full-time. The products are of very good quality, and may be used in gift-giving systems.

- At a ***Workshop production*** level, artisans produce goods intended for a market, and this will affect the choices made in the craft process. If the demand for a certain product is great, the products ought to be standardised and efficient to manufacture in order to produce high levels. The time spent on manufacturing should be reduced in various ways.

2. Sigtuna- A historical background

Sigtuna is considered to be the earliest medieval town in Sweden. The written sources are few in this early period, and thus the material remains are important for the interpretations regarding the function and social structure in the town during the early Middle Ages. The knowledge that currently exists and the interpretations that have been made, are largely based on the archaeological investigations from the 1980s and onwards. The large excavation in kv. Trädgårdsmästaren in 1988-1990 yielded a large amount of finds, both locally produced, and imported.

During the last decades of the 10th century, urban sites characterised by royal power and the increasing influence of the Christian Church began to emerge in Scandinavia. Sigtuna's establishment during the 980s must be seen as an important part of this development. The general view is that he town was founded by royal authority to gain power over the area of Lake Mälaren, and there are several indications in the archaeological record, both in written sources and material culture, which could further strengthen this notion (Tesch 2007:95). Sigtuna is mentioned in the Icelandic sagas from the mid-11th century, indicating that the site was well-known among the Nordic rulers (Tesch 2007a:78).

During the excavations in kv. Trädgårdsmästaren, it appeared that the plots and buildings followed a regular pattern at an early stage, and a similar situation can be observed in medieval Oslo and Trondheim, in Norway (Tesch 1990:30). This In Sigtuna, the town plots consisted of four to five houses during the 11th century, and the various functions of the houses also seem to follow a pattern with craft workshops along the main street, multi-functional storage houses, dwelling houses with corner hearth and a hall buildings at the far end from the street (Tesch 2007:88). New houses appear to have been built on the same spot as the previous ones, in several cases. Only a few buildings in the early phases have indications of animal husbandry, which can be seen as a rather clear indication for a dependency relationship between Sigtuna and its surrounding countryside, for a supply of necessities and raw materials for craft production (Tesch 2007a:88). A similar situation had most likely existed in Birka during the previous centuries (Ambrosiani 2008:98). A variety of specialised craft activities and a large number of finds indicating trade and exchange beginning in the second half of the 11th century, separates Sigtuna from its surrounding countryside and accentuates the urban character.

Although the traces of intensive craft production and evidence for trade appear frequently at the site, the reasons for Sigtuna's emergence has been interpreted to be ideological rather than commercial (Tesch 2007:93ff). The King Erik Segersäll is assumed to be the initiator of the establishment, and one early indicative evidence for royal presence in Sigtuna is the coinage, existing between 995 and 1030 AD, most likely initiated by Olof Skötkonung (Tesch 2007:12). The remains of a site, interpreted as a royal estate in medieval town center, should be considered as particularly important in relation to the material remains from kv. Trädgårdsmästaren. A bone with runic inscriptions from the 12th century was recovered from kv. Trädgårdsmästaren, suggesting that the king was generous with food and gave most of all. This has been interpreted as an indication for the hypothesis that the king's power was legitimised through gifts and great feasts (Tesch 2007:76). In the Norwegian king sagas, it is described how the king established

towns and built churches, and gave farms to the people he cared for, merchants or those who wished to build. This may suggest something about the relationship between the king and the people who were settled in the town. However, I believe that these kinds of analogies should be used with caution, as it provides a simplified picture of the power relations between authority and inhabitants, and there are several aspects to consider regarding the social structure within the town and its surroundings.

Tesch has put forward a model of the religious development within the urban landscape, and he views the late 10th- and early 11th century as a period when the representative residence buildings in the farm yards have served as places for religious ceremonies (Tesch 2007a:101). Private stone churches were built in the late 11th century, and Tesch argues that it is possible to assume that these has been preceded by churches built in wood (Tesch 2007a:101). Adam af Bremen denoted Sigtuna as "civitas" during the 1070s, suggesting that the town was an episcopal see during this time, and thus an ideologically important place. The Episcopal Church is assumed to be S: ta Gertrud which was located in close connection to kv. Trädgårdsmästaren (Tesch 1990:14). Once the building of churches had begun, it is reasonable to assume that the craft producers in the town was highly involved, and provided various products needed for such a large project. A similar development is to be seen in Lund, which also became an episcopal see during the same period (Andrén 1985:185). Sigtuna´s days as an episcopal see ends during the 1160s, when Old Uppsala instead is receives this privilege, and from the 13th century, parish churches and church institutions characterises the urban landscape. The cultural layers from the 13th century and onwards are poorly preserved, meaning that the source-critical aspects increase when studying this period. Sigtuna's functions and activities are presumed to have been transferred to Stockholm during this period (Tesch 1991:15).

From an early stage in the history of the town, there are thus several indications for a royal and ecclesiastical presence. Tesch stresses ideological and political reasons for the establishment of the town, and that trade and crafts has been of secondary importance. Although ideological and political reasons should be regarded as fundamental prerequisites for the emergence of Sigtuna, craft production and trade had an important role to play and was essential for the continuity of the site, in both social and economic respects.

2.1. Influences from the East

The exceptional finds from Sigtuna reveal cultural influences and imported items, arriving from both East and West. The eastern contacts from Kiev Rus are most apparent in the material culture. Marriages strengthened the ties between noble families from countries around the Baltic coast. The presumed initiator of Sigtuna, King Erik Segersäll, had strong connections with Slavic areas as he married a Polish princess (Roslund 1990a:59). It is on the basis of the creation of these social ties that the situation in Sigtuna during the towns early days should be viewed, and the material culture testify to this relationship in many ways. Among the find material in kv. Trädgårdsmästaren are temple rings from the West Slavic area, amphorae from

Byzantium which came with ships from Novgorod, and glass rings manufactured in the Slavic area, to name a few (Roslund 1990a:55ff; 2001:521).

The pottery from the context has been treated by Roslund and the category can provide a lot of information on how the external contacts and visitors has influenced people and the craft-tradition in Sigtuna (Roslund 2001). Baltic ware derives from a craft tradition originating in Slavonic pottery production, recovered in areas outside of this sphere from the 11th century and onwards (Roslund 2009:183). During the 10th century, Slavic pottery occurred sparsely and was brought in from the Slavic areas by merchants. An interesting observation is that the vessels brought in by merchants were all very similar in character, in contrast to the large variety of vessels that existed in Rus, which suggests that they have been selective in terms of functionality (Roslund 2001:521). From the third quarter of the 11th century and until the 13th century, Baltic ware predominated, and in the 12th century, the presence of cultural influence from Rus was at its peak (Roslund 2001:518). Specialists from the Eastern Slavic area were working alongside with local artisans, resulting in both hybrid types of Baltic ware made by Scandinavians and products manufactured by Slavs (Roslund 2001:470). This means that the Eastern influences in Sigtuna during the early Middle Ages, cannot merely be represented by individual objects arriving from Slavic areas. The pottery rather reflects a cultural change occurring in urban Sigtuna (Roslund 2009:184).

The most prominent finds in the Sigtuna material arriving from this cultural sphere is the spindle whorls made from Volhynian slate, treated in this study. The finds represent a category of material culture which can be considered as very unique for this context, and certainly reflect the contacts Sigtuna had with Kiev Rus. The material, the red coloured slate, derives from an area near the Ukrainian town of Ovruch, and occurs in many contexts during the 11th to 13th centuries in the whole Kiev Rus area, with a concentration in the 12th century (Gabriel 1991:259; Sherman 2008:15). The spindle whorls were manufactured in workshops in Ovruch and Kiev and have been uncovered in both rural and urban contexts (Martin 1995:67; Gabriel 1991:258). In the material from Staraia Lagoda, a total of 83 spindle whorls made from Volhynian slate can be dated to the 11th century (Sherman 2008:15). In Novgorod, these types of spindle whorls are also very common, and the majority of the finds have been dated to the 12th century (Rybina 1992:114). An interesting phenomenon related to the finds from these areas is that many of the spindle whorls have inscriptions, associated with ownership, and female names are most common (Franklin 2002:79; Rybina 1992:162). Although this phenomenon is far from common, the inscriptions may testify to some kind of personal possession and that there was a value assigned to the tool, which may be ascribed to a certain individual or artisan. The slate spindle whorls were also used as a substitute for small change, instead of coins during the 12th to 14th century in Kiev Rus (Rybina 1992:162). Thus, the spindle whorls had different functions and meaning for different people in this context. The Volhynian slate, was also used as building material for churches and Sarcophagus for Kiev Princes, and the red color was associated with Byzantine Emperors which gave it a special meaning (Androshchuk 2009:17).

2.2. Influences from the West

About thirty rune stones are known from the town and its surroundings, and inscriptions on two of these speaks of a Frisian guild. The stones have been dated to the first half of the 11th century, based on stylistic features (Roslund 2010b: 240). By organising guilds, merchants could assure their safety when traveling and engaging in trade (Roslund 2010b: 240). In Sigtuna, there are some indication in the material culture which suggest that there have been a connection between the town and areas in the western part of Europe. Two Alsengems, small blue glass objects displaying two figures interacting, dated to the beginning of the 12th century. These objects originate from the Lower Rheine and Frisian area, are particularly interesting finds from the urban site. These have been interpreted as possessions belonging to merchants, used as markers for identity and to demonstrate affiliation to a guild (Roslund 2010b:244). Other indicators of trade and exchange with areas in Western Europe are shards of ceramics. Pingsdorf ware from the Cologne area, dated to the 11th century, have been recovered at the site. The more common Kugeltöpfe ware from Frisia and Saxony was brought to Sigtuna during the 12th century (Roslund 2011: 241). Tiles of green porphyry, usually functioning as covers for relics, were found in close connection to hall buildings and have been associated with early religious practice. These finds have been interpreted as parts of portable altars, used in the context before the existence of churches in the town, and they were brought to Sigtuna from the Cologne area (Tesch 2007b; Roslund 2011:244).

The Frisian cloth, "pallia fresonica" or "Wede" has been discussed in relation to the fabrics found in Scandinavia, England and northern Germany, and is mentioned in several historical sources from the areas of Werden at Ruhr and Fulda northeast of Frankfurt (Andersson 1999a:32). The quality of these kinds of fabrics are very high, and the raw material, the wool, used have been very consistent. The discussions regarding the "pallia fresonica" have been concerned with whether the cloth was made in the Frisian area, or if the term referred to Frisian merchants who traded with these goods (Andersson 1999a:33). Bender Jørgensen has divided the Scandinavian textile finds of these kind in the Birka type, and the Hessen/Elisenhof type. The Birka type have been recovered in western Norway, Kaupang, Hedeby and Birka, while the Hessen/Elisenhof type has been found mainly in the Frisian area (Andersson 1999a:33). Where the textiles have been produced are still not known, however, it is interesting to speculate in what way these fabrics may be connected to a Frisian presence in the Lake Mälaren area in the 11th century. Perhaps raw material was imported to production and trading places in Scandinavia, and enabled the artisans to produce fabrics of a certain quality.

Essentially, the material culture can testify to connections and visitors from places outside of Scandinavia. The eastern contacts, in particular, were frequent and well established during the early Middle Ages. In this sense, Sigtuna should certainly be viewed as a contact space for different cultural meetings. The inflow of material culture and people from outside of Scandinavia had an impact on the culture and the local craft-traditions and also contributed to the forming a specific urban identity of the people inhabiting the town.

2.3. The urban craft- Views on craft production and urbanisation in Sigtuna

Studies on urbanisation and the processes involved, have often emphasised trade and craft as essential factors for urban development (Andrén 1985:14; Andersson 2001:2f; Callmer 2003: 337). The lack of written sources mentioning these activities in the early Middle Ages have made it difficult for archaeologists to understand the nature and scope of them. During the 1970s and 80s, the importance of a political power was central to explanations of how the landscape was changed and used (Andersson 2001:4). The variety of urban environments have emerged due to various pre-conditions and needs, and production can often be seen as a driving force for the continuity of towns. The early Middle Ages in Scandinavia is an intriguing time period characterised by many changes. The establishment of the Christian church, the emergence of urban sites, increased trade and new tax regimes altered the landscape in many ways (Magnusson 2001:361). It is important to highlight, and give attention to how textile production has affected the entire society (Andersson et al. 2010:150; Wilkinson et al. 2014:50). The need for textiles may have been one driving force for greater changes in the landscape, urban or not. The process, from raw material to finished product, has not merely involved one individual, and the production for consumers outside the household has demanded organisation and a division of labor (Magnusson 2001:363). The supply of raw material would have involved agriculture, animal husbandry and resource exploitation, and an increased demand for textiles would result in changes in these areas accordingly, to adapt to existing conditions (Andersson et al. 2010:150).

In Sigtuna, a variation of crafts on different levels have been important for the continuity of the site, and a reflection of the nature of these crafts can put the production of textiles into a wider perspective. The general picture of the craft production provided so far by previous research, appears to be very dynamic with changes over time. The craft activities in kv. Trädgårdsmästaren in the late 10th century, are sparse and the general views on the activities emphasise a household production mode for all crafts (Roslund 2001:472; Söderberg 2011:23). The excavations in kv. Trädgårdsmästaren and kv. Urmakaren in Sigtuna have likewise demonstrated that the metal craft has not been very extensive before the mid-11th century (Söderberg 2013:59). Silver and bronze workshops, previously existed in Birka, came gradually to appear in Sigtuna where the remains of crucibles, casting molds and other tools can testify to specialised activities, in some periods (Gustavsson & Söderberg 2007:32f; Nordin 1991:73). In kv. Urmakaren on the other hand, the craft production seems to have been more extensive, due to the coinage activities connected to Olof Skötkonung in the end of the 10th century (Ros 2002; Pettersson 2007:36). The excavation also yielded indications of a production of weights, which is also directly linked to the royal authority (Ros 2002; Söderberg 2006:66).

Views on 11th century craftsmanship, emphasises the itinerant artisans who manufactured prestigious objects for elite consumers, functioning as gifts to build social bonds and in return, the elite provided the artisans with necessary goods and raw materials, i.e. an attached specialised production where the domestic unit consisted of free and unfree individuals (Söderberg 2011:25; Gustavsson & Söderberg 2007:36; Roslund 2001:473). Andrén has described the craft production in Lund during this time as feudal, i.e. a majority of artisans were

legally free, but financially bound to an authority, who has required a supply of products from the artisans. Changes in the town's topography can give hints on the development and the organisation of craft production during the late 11th century and early 12th century. A comparison between Sigtuna and Lund can be made in many respects. At the two urban sites, the establishment of workshops along the public areas in this period, can suggest a development towards a market directed production (Andrén 1985:84f; Roslund 2001:476). Even though the artisans remain anonymous in the written sources, there are reasons to believe that their social status changed gradually as the established workshops appeared (Andrén 1985:84).

In general, the craft production in the 12th and early 13th century in Sigtuna appear to have been stationary and directed to an external market (Söderberg 2011:25). The craft production in the farm yards in Sigtuna intensifies and the area closest to the main street are further developed into a zone characterised by specialised craft activities. The craftsmanship associated with these buildings are mainly metal crafts and comb manufacturing (Petterson 2007:13; Gustavsson & Söderberg 2007:37). The comb manufacturing is characterised by an increasingly evident large-scale production in this phase, which reached beyond the households own needs. The production of bolt locks may also have been of such nature. The pottery also changed during the first half of the 12th century, and new forms of Baltic ware were introduced, which imply increased influences from the Rus` area (Roslund 2001:483). Thus, an increasingly intensive craft production, in several cases most likely intended for an external market, and a strong influence from areas outside of Scandinavia represent this period. The textile production in kv. Trädgårdsmästaren must be viewed in the light of these circumstances.

3. Textile tools and production in kv. Trädgårdsmästaren in Sigtuna

In this chapter, the spindle whorls from kv. Trädgårdsmästaren in Sigtuna will be presented and analysed. The process of manufacturing textiles will be presented briefly to demonstrate the importance of different aspects concerning the production process. The material from Sigtuna will be treated from different perspectives; in the qualitative analysis of the spindle whorls, the focus will be on the function of tools made from two different materials. It is essential to observe the similarities and differences between the two material groups, but also to discuss the results in relation to provenance. The spatial distribution of all known finds of spindle whorls and loom weights will be analysed in relation to the context and the chronological timeframe, to examine where the textile craft could have been performed, its relation to other crafts and how it changed over time within the town plots. The results will be compared with analyses of some of the textile tools from Birka, in order to put the textile production in kv. Trädgårdsmästaren into a wider geographical and chronological frame and if the tools manufactured in Sigtuna differ from those manufactured in Birka.

3.1 The process of production

3.1.1 Raw material

The choice of raw material and how it is prepared is essential for the quality of the thread, and hence the finished fabric (Mårtensson et al. 2006a:4f). The sorting and processing of wool has been important in order to facilitate the work of spinning but also to ensure that a certain quality of thread was obtained (Andersson 1999a:9). The thread could become uneven and break easily, if the sorting of wool is not made properly. The importance of the nature of raw materials in the process of textile production, has been observed in the experiments conducted by the Centre for textile Research (CTR) where the wool, which was obtained from several sheep, displayed apparent differences in quality even when obtained from the same part of the animal (Andersson 2003a:17). To be able to get a homogeneous thread quality, the sorting of the wool into various fiber groups are of great importance, and demands a certain knowledge of the nature of the raw material. In order to sort the wool, a wool comb could be used to facilitate the work (Mårtensson et al. 2006a:5). Finds of wool combs are rare in the archaeological material, since they often are made of organic materials. The sorting and preparing of wool will result in a waste of raw material, which gives an insight into the large amount of wool needed for a major production of textiles (Andersson 2003b:48ff; Mårtensson et al. 2006a:5). It also increases the understanding of the need for the working process to be organised based on local preconditions, if the production is beyond the household level. The manufacturing of sails for example, could not be carried out if there was not a large provision of wool, linen or hemp, and several people working during a long period preparing, spinning, weaving and sewing the cloth (Andersson 2003b:49f; 2009:4).

What type of raw material was used for manufacturing textiles in Sigtuna, and how was it supplied to the textile artisans? If we consider the situation in Birka, the conditions for both sheep rearing and the cultivation of flax and hemp have been favorable in the area during the Viking age, which may serve as a good indication for a similar situation in Sigtuna during the centuries that followed (Andersson 1999a:42, 2007:150?). The lack of material remains of stables and barns within the town farms may suggest that the need for wool most likely required a supply of raw materials from the surrounding countryside (Andersson 2007:149; Tesch 2007a:88). According to pollen analyses, there was a substantial expansion of hemp cultivation between 600 and 1000 AD in the area, which may be attributed to the production of textiles (Andersson 1999a: 42; Engelmark 2011:3). There is also the possibility that some of the raw material, principally wool, was imported from other places to Sigtuna. Perhaps a certain type of wool has been preferred for a particular type of textile production. As Andersson points out, the situation can be compared to the import of other commodities that were intended to supply the artisans in Birka (Andersson 2007:152). If there have been a large scale production of sails or other garments in Sigtuna, it may have become necessary with a larger supply. Since various goods and items were traded from other places to Sigtuna, imports of a particular type of wool could be considered a possibility in this context.

3.1.2. Textiles from Sigtuna

There are several finds of textile fragments from the Sigtuna. Although most of the fragments are not thoroughly analysed, the descriptions in the find documentation can suggest the kind of raw material available in Sigtuna. Three fragments from the excavation have been analysed by Eva Lundvall (Lundwall 2004). One fragment, composed by silk threads with a plain weave, can indicate that some textiles were imported to the site. However, more relevant for this study are the other two fragments, made from wool and hemp. The wool fragment is created with a plain weave and is interpreted as an imported fabric (Lundwall 2004). The other fragment is a coarse net made of hemp, and there are no interpretations of its origin in the documentation.

3.1.3. Spinning

Production of textiles was most likely a substantial part of the everyday life for many people during the early Middle Ages, and the most time consuming individual activity may have been to spin the thread (Andersson 2003b:49). The spindle consists of different elements; a spindle whorl attached to a spindle-rod, where the thread is secured. While rotating the spindle rod, the fibers are pulled and twisted into a thread and the whorl is used to weigh the spindle down and to keep the force while spinning (Andersson 1999a:11f; Walton Rogers 1996:1731). According to observations during the spinning experiments carried out by CTR, the weight of the spindle whorl affects the thickness of the thread, and even a small difference of less than 5 grams can be decisive in this regard (Andersson 1999a:13; Mårtensson et al. 2006a). The diameter of the spindle whorl, and the hole, will also influence how tightly the thread can be spun, and thus for an accurate registration, these parameters should be incorporated. The experiments was made using spindle whorls of 4, 8 and 18 g, to obtain knowledge of how differences in weight affected the entire production process when using different types of wool as raw material. It appeared that in addition to the weight, the selection and the preparation of the raw material was crucial for the quality of the thread, when using the lighter 4g or 8g spindle whorl. The lighter spindle whorls also required a lot more effort and concentration, and the spinner could not be involved in other activities simultaneously (Mårtensson et al. 2006a:9). It is also relatively time consuming to spin with the lighter whorl (Andersson 2007:5). The thread thickness is also significantly thinner when comparing the results from the use of a 4g spindle whorl with the ones of 8g and 18g. This implies that it is important to recognise and document small differences in weight when registering spindle whorls, since the differences can reflect the skill of the spinner, the time required to perform the work and the thread quality. Another very important result from the experiments was that the property of the tool was one of most critical aspect which affected the thread quality, since spinners with different backgrounds in textile craft produced approximately similar threads with the same tool (Mårtensson et al. 2006:17). Hence, for the artisans to perform in a good manner they are dependent on the quality of the raw material and the tools, primarily. In regard to this, the nature and variation of tools should reflect the variations in techniques applied (Zagal-Mach Wolfe 2013:35f)

3.1.4. Weaving

The quality and thickness of the spun thread affects the type of fabric that can be manufactured. The finer and tighter spun threads used in the weave, the finer the cloth quality will be. Due to this, it is possible to estimate the properties of the finished fabric from the tool's ability to spin different qualities of threads. However, the fabric could be produced with different techniques, and therefore also vary accordingly even if the same thread quality is used. The skill of the weaver would be of significance for the results as well, but it would be difficult to estimate without analysing the finished product. When analysing textiles, the number of warp and weft threads in the fabric is observed. The warp threads run parallel to the long side of the loom and is held extended by loom weights, while the weft threads go under and over the warp threads (Andersson 1999a:14ff). For a fabric to be considered balanced, the warp and weft threads should be of even number, e.g. 20/20thr/cm, and the higher the number of threads per cm, the denser the fabric (Andersson 1999a:14ff). Remains of looms in the archaeological record might suggest where the activities occurred, and the extent of the textile production. An accumulation of loom weights is usually the most visible trace of a warp weighted loom, since wooden constructions rarely are preserved (Zagal-Mach Wolfe 2013:194; Øye 2011:342). The horizontal loom was introduced in the middle of the 11th century in North Western Europe, which had implications for the textile production and professionalisation and can be viewed as an urban phenomenon in the early stages (Øye 1988:72f; Callmer 2003: 345f). Remains of a horizontal loom from the 12th century has been uncovered in Sigtuna (Øye 1988:73).

Although, the majority of the textile fragments from the context have not been analysed and can not be used in this study, it is important to understand the implications of the different tools used in the processes which have formed the patterns seen in the archaeological record. The artisans working with textile production possessed knowledge of the different steps of the production and performed techniques adapted to the needs of the environment in which they operated (Dobres 2000:165). Many useful observations have been made within experimental archaeology which has facilitated and improved the manner in which archaeologists document and study textile tools. The combination of finds from all the different stages would idealistically be a preferable situation for an investigation, but the reality is more fragmented.

3.2. The registration of tools

The spindle whorls treated in this study derives from the excavations in kv. Trädgårdsmästaren in Sigtuna between the years 1988-1990. I have divided the spindle whorls into material groups where two categories; spindle whorls made from Volhynian slate and bone represent the majority. The finds from the two material groups have been registered and closely analysed. It is of great interest to investigate whether there might have been functional differences between the two categories in this context. The spindle whorls have been registered based on a number of parameters that have been important for the function of the tool: ***material***, ***diameter*** of the spindle whorl and of the hole, ***weight***, ***height***, and the ***shape*** of the spindle whorl and the hole

(Andersson 1999a). Additionally, traces of ***decoration*** have also been observed. These elements are documented, analysed and compared. The typological classification of the spindle whorls within the two material groups is made according to material, shape and other characteristics which may be relevant. For determining shape, previous research is much useful and the classification is made in accordance with the finds and their features, allowing divergent shapes to be separated from others and "new" shapes which are not to be found in the publications on the Scandinavian textile tools, to be brought forward (Andersson et al. 2011:28). A tool's properties do not only suggest its function, but consists of common cultural traits where different elements contribute to the creation of the tool (Roslund 2005:17). Thus, I have divided the spindle whorls according to various shapes, and also considered the smaller details that may have had both cultural and functional significance and could suggest individual expressions and technological alterations.

It is essential to be as precise as possible when documenting and comparing tools within the same category from different areas, since the minor details could testify to different traditions of manufacturing or adaptions to certain types of production. What differences and similarities that may have had significance in the past is not possible to answer, however, variations in the material culture may suggest that some elements have changed more than others, or retained and been repeated continuously over a long period of time (Hodder 1987:7f). Standardised tools may suggest that there has been a specific demand for certain types of tools, and threads, which can represent different kinds of production and thus similarities between the tools are relevant to observe (Zagal-Mach Wolfe 2013:168). I have not been able to register other categories of textile tools due to limited time, however, the weight and spatial information on all spindle whorls and loom weights have been registered during the excavation. During the registration of spindle whorls from the two material groups, I have experienced that the weight of the spindle whorls weighted in field was fairly correct and thus this information have been used in this study.

3.3. Spindle whorls- An overview of all finds

The number of spindle whorls recovered from the excavations in kv. Trädgårdsmästaren during 1988-1990 are 214, and they are made of several different materials (fig 1). Spindle whorls made of bone (28%) and Volhynian slate (23%) are most common in the context. Other material groups representing a significant part of the find material are stone (22%) and clay spindle whorls (14%). A small percentage are made of lead (4%), glass (4%), antler (3%) and wood (1%). In general, the largest percentage of spindle whorls are made of various rock types, including limestone, sandstone, amber, slate, soapstone and Volhynian slate. Volhynian slate represents a material group which originates from an area outside Scandinavia, Ovruch and Kiev, and has been brought in to Sigtuna during the early Middle Ages, and differs in that aspect. Due to the significant amount of finds of spindle whorls made from Volhynian slate in the context, it is of great interest to compare the tools from this material group with the locally manufactured spindle whorls of bone. The weight distribution ranges between 1 to 124 g, which

may suggest that a great variation of thread qualities have been produced in this context (chart 1). The large amount of lighter spindle whorls is remarkable and suggest that the production of very fine quality threads has not been an exception in this context.

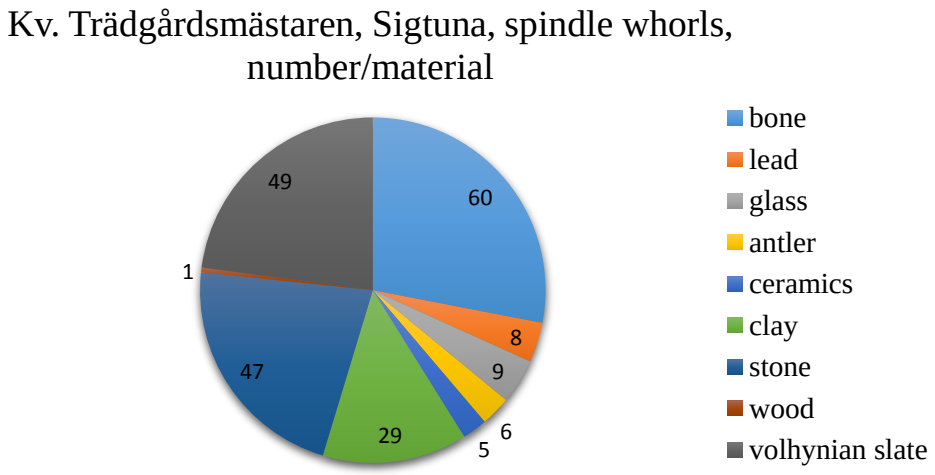


Figure 1. All spindle whorls from kv. Trädgårdsmästaren in Sigtuna, number/material

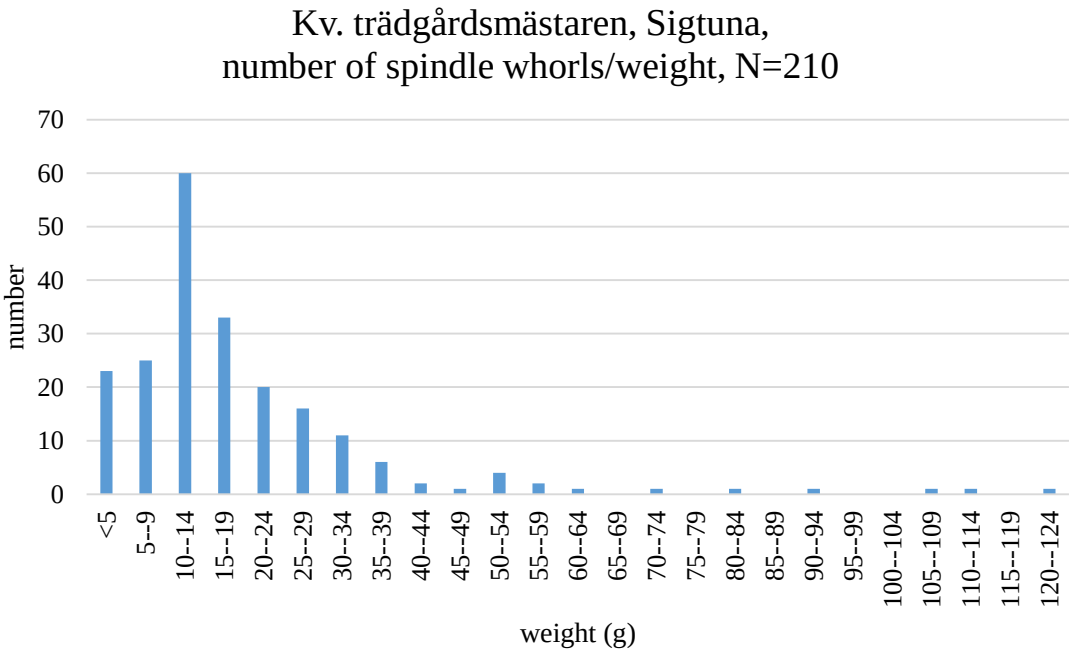


Chart 1. All spindle whorls from kv. Trädgårdsmästaren in Sigtuna, number/weight

3.4. Spindle whorls of bone and Volhynian slate

3.4.1. Shape and decoration

The largest material group is bone consisting of 60 spindle whorls, and it has been possible to determine the shape for 53 of them (chart 2). There is a significant majority of spindle whorls made of joint balls from cattle (82%). Three finds are intermediates which can support the notion that at least a few of the spindle whorls made of bone have been manufactured in Sigtuna. 8 finds, also made from joint balls, display some deviations and appear to have been processed with the intention to alter the shape of the whorl. It is of importance to separate these finds, as they are representing deliberate alterations made, most likely by the artisans, to acquire the tools suited for their specific needs. There are rarely obvious traces of further processing of spindle whorls of made from joint balls, and for that reason it is important to highlight (Andersson 1999a:50). The finds are combined into the category *processed joint ball*. In this category, 2 finds seem to have been flattened at the bottom and carved around the body to become straight (fig 7). One of the spindle whorls appear to have been carved into an almost biconical shape, and another has been altered to become lenticular in shape. Perhaps these are examples of adaptions of the tools to fit a certain type of thread production. Nevertheless, the spindle whorls in this category can reflect the existing knowledge of technical factors which probably may have affected the production process. The next most common shapes of spindle whorls made of bone, are conical (6%), convex discoid (2%) and spherical (2%). In contrast to the joint ball types, all spindle whorls from these three categories appear to have been carefully manufactured.

Out of 49 spindle whorls made of Volhynian slate, the shape has been possible to establish for 47. A total of 14 Spindle whorls (30%) with a biconical shape can be determined, and 33 spindle whorls (70%) with a shape, reminiscent of spherical but with flat top and bottom (chart 3). At Coppergate in York, several spindle whorls made of stone display a similar shape, which is referred to as Type C by Walton Rogers (1997:1738ff). The shape is commonly displayed in the Middle Ages in northern and eastern Britain, however, it is not represented in publications concerning the prehistoric Scandinavian textile tools. There are different features on a few spindle whorls within these two types which separates them from the rest. Among the biconical spindle whorls it is possible to recognise at least two pieces that are flatter in the design, i.e. they differ more between height and diameter than others.

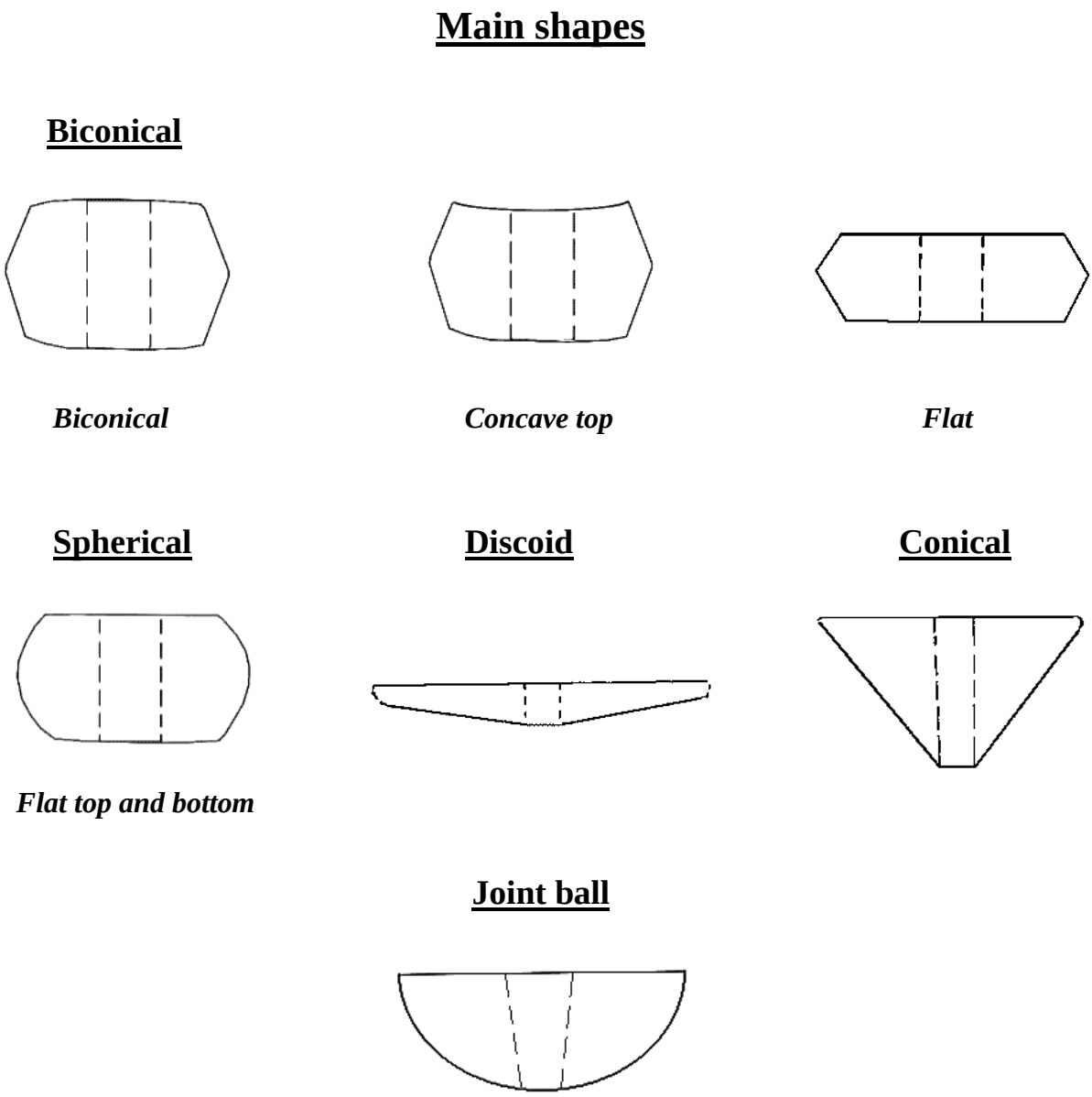


Figure 2. The main shapes of spindle whorls recovered from kv. Trädgårdsmästaren, Sigtuna

Among the spherical with flat top and bottom, there are eight finds which more or less display a slight biconical shape (fig 2). The difference from the biconical spindle whorls is rather distinct, and thus these finds should not be added to this type. A total of 14 spindle whorls of both shapes have a concave surface around the hole (fig 2, chart 4). Whether this feature has contributed to the function of the tool or differs due to various manufacturing workshops, is not possible to determine, at this stage. Nonetheless, it appears to be a common element on the Volhynian spindle whorls.

Only three finds of the spindle whorls made of bone are decorated. The decoration on find nr 13290 consists of concentric circles and three vertical parallel lines from four angles, from the hole outwards (fig 5). Interesting to note is that this is the only spindle whorl with a discoid shape. Another decorated spindle whorl has a cut furrow along the upper part of the

body, and has a conical shape. This is the smallest spindle whorl in the entire collection from kv. Trädgårdsmästaren, and weighs around 1g. The only spherical shaped spindle whorl made of bone, display a circular carving and has a deep furrow in one side. Among the Volhynian spindle whorls, there are eight finds decorated with small diagonal lines or marks around the body (fig 6). Five of these are flat spherical, and three have a biconical shape. A functional interpretation can't be ruled out, since this pattern perhaps may have facilitated the grip, and the marks are not very visible. Five spindle whorls, one biconical and four flat spherical, display a ridged, or lathed surface on the inside of the hole (fig 3). The ridges are probably a result from the manufacture, and could reflect a specific technique used when drilling the hole. One spindle whorl is marked or cut around the entire surface, but it is not possible to interpret any inscription (fig 4).

When comparing the material groups it is evident that there is a clear distinction between material and shape. In fact, the two material categories do not display any similarities in terms of shape at all. The decorative elements are interesting to notice, and it could be argued that some of the patterns have been made for functional purposes, as markers weight for example, or it may also be viewed as an artistic expression, a way for the individual artisan to separate her or his possession from others and accentuate the identity as an artisan (Zagal-Mach Wolfe 2013:176). Either way, the decoration could imply that some spindle whorls may have been considered as objects of value for the person using, or creating it, in the past.

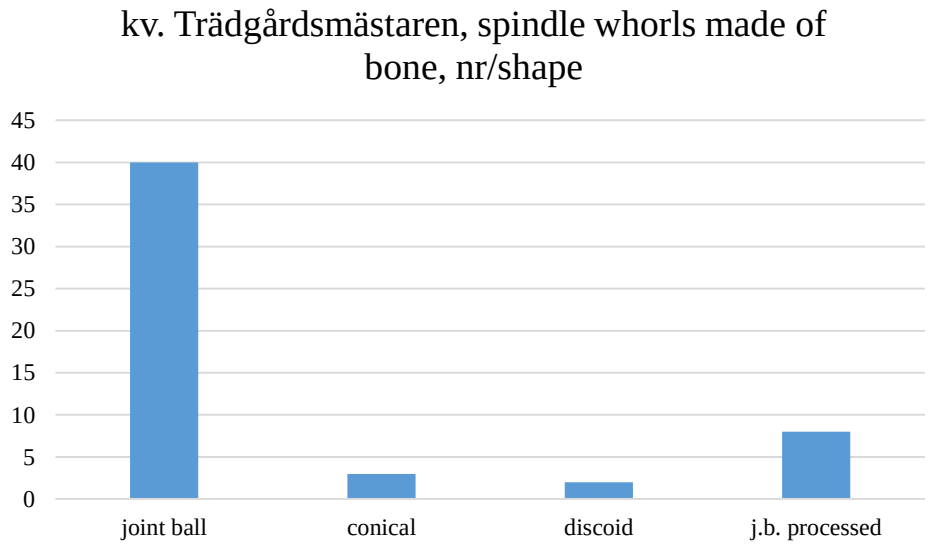


Chart 2. Spindle whorls made of bone divided according to shape.

Figure 3. A biconical spindle whorl made of volhynian slate (find nr 14462), displaying a ridged surface on the inside of the hole. (Photo taken by the author)

Figure 4. Spindle whorl of volhynian slate with cut marks around the surface (find nr 8993). (Photo taken by the author)

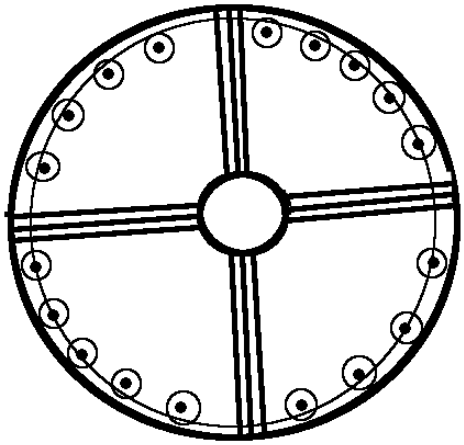


Figure 5. Spindle whorl made of bone, decorated with concentric circles and parallel lines. (Drawing after find nr 13290)

Figure 6. Spindle whorl made of volhynian slate, decorated with small diagonal lines or marks. Find nr 28390. (Photo taken by the author)

spherical shape, find nr 3832

Joint ball processed, find nr 9933

discoid shape, find nr 13290

Joint ball processed, find nr 24774

Conical shape, find nr 19791

Joint ball processed, find nr 13816

Joint ball shape, find nr 12073

Joint ball processed, find nr 19821

Figure 7. Spindle whorls made of bone displaying different shapes and variations (Photos taken by the author).

Spherical flat top and bottom, find nr 4797

Biconical, find nr 28390

Spherical flat top and bottom, concave top, find nr 23656

Biconical, concave top, find nr 9358

Biconical, flat, find nr 18517

Figure 8. Spindle whorls made of Volhynian slate displaying different shapes and variations (Photos taken by the author).

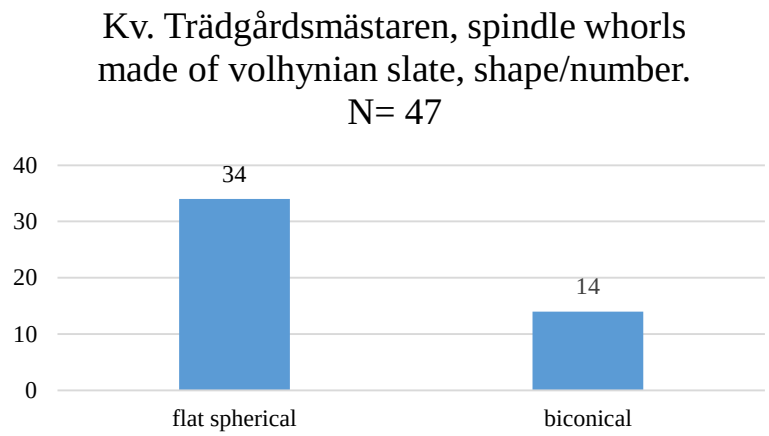


Chart 3. Spindle whorls made of Volhynian slate divided according to shape.

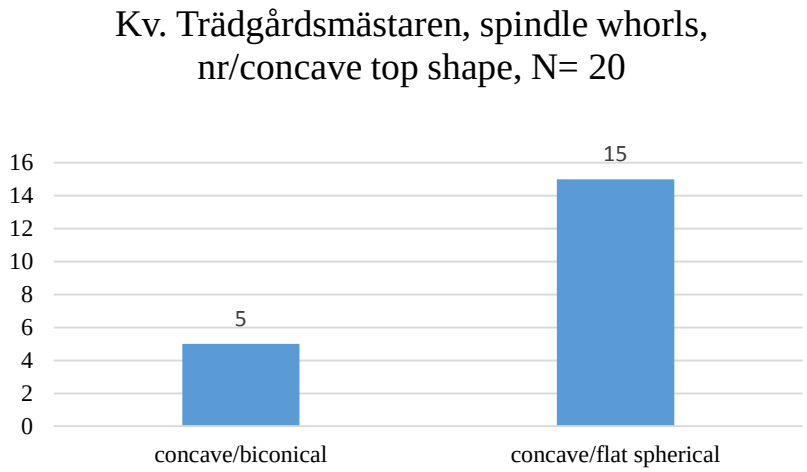


Chart 4. Spindle whorls made of Volhynian slate with a concave top

3.4.2 Weight and diameter

Out of 60 spindle whorls of bone the weight could be calculated for 60. Two of these are fragmented. The weight of the spindle whorls range from 1g to 32 g, where the highest percentage is within the weight categories 1 to 4g and 10 to 14g (chart 5). The large number of very light spindle whorls is particularly interesting to notice. A comparison of the shape and the weight, demonstrates that the shape has little importance for the weight in this material group. Spindle whorls of joint ball type predominate in all the weight categories. As the weight distribution, the diameter of the spindle whorls seem to cover a wide range, from 16 to 44 mm, where sizes between 35 and 44 mm predominates (chart 6).

Out of the 49 spindle whorls of Volhynian slate, the weight could be calculated for 48. This material group seem to have a more restricted weight distribution, ranging from 5g to 24 g, with a concentration between 10g and 19g (chart 5). The diameter ranges between 19 and 31mm, with a concentration around 20 to 24 mm (chart 6). The diameter of the tools also display

a rather small variation, similar to the weight distribution. This may suggest a standardised manufacture of the tools, and that they have been intended for a certain kind of thread production. The shape of the tool does not seem to be of any importance for the weight within this material group. It can be concluded that a variety of thread qualities has been possible to spin with the tools from both material groups.

When comparing the weight and size distribution, there are both similarities and differences to consider. One of the main difference is that spindle whorls made of bone have been manufactured to be used to produce several different thread qualities, while the Volhynian spindle whorls seem to be standardised to fit a certain thread production, or perhaps, raw material. Weights under 15 g is considered to be suited to spin fine quality threads, and several finds from both categories should be given attention in this regard (Andersson 1999a:53). In addition, the Volhynian- and bone spindle whorls with the same diameter, differ in weight quite substantially. For instance, spindle whorls of bone with the diameter between 16 and 26 mm, weigh between 1 and 8g, with a clear concentration around 2g. The Volhynian spindle whorls with same diameters, weigh between 5 and 15g, with a concentration around 8 to 13g, which is quite a remarkable difference.

As these parameters are crucial for the thread thickness and density, it becomes even more evident that we are dealing with different kinds of tools, in the sense that they must have been utilised for different types of thread production. The relationship between the diameter and weight analysed in previous studies, demonstrates that lighter spindle whorls often have a relatively small diameter, and that these parameters are accompanied (Andersson 1999a:51). The Volhynian slate spindle whorls thus have a high density and are more compact than the ones made from bone. There are groups of between 2-6 Spindle whorls that have the same weight and diameter, which clearly demonstrates the standardised nature of the tools from this material group.

In general, the thread possible to spin with the lighter Volhynain spindle whorls (5-15g), which is a majority of the material, are thin or very thin. The biconical and spherical shaped spindle whorls facilitate the ability to spin with a higher rate of speed and thus, a thin and tight thread could possibly be the outcome when these factors are taken into consideration (Deutgen 1990:112).

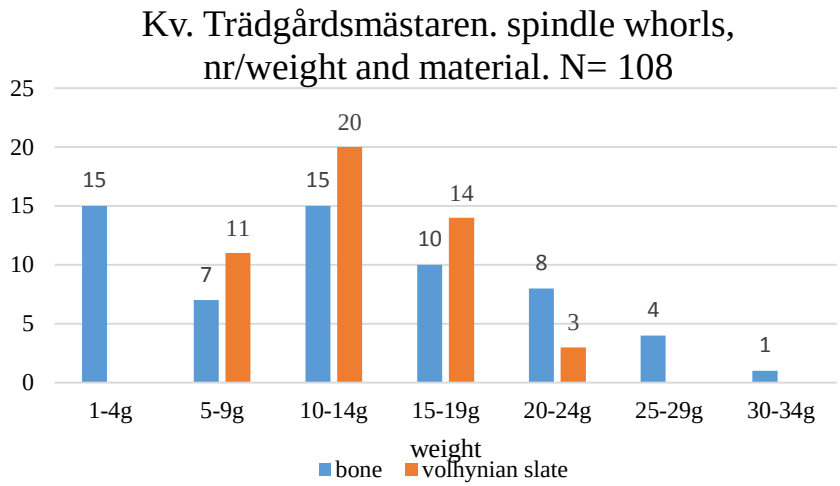


Chart 5. Registered spindle whorls of bone and Volhynian slate, number/weight in mm.

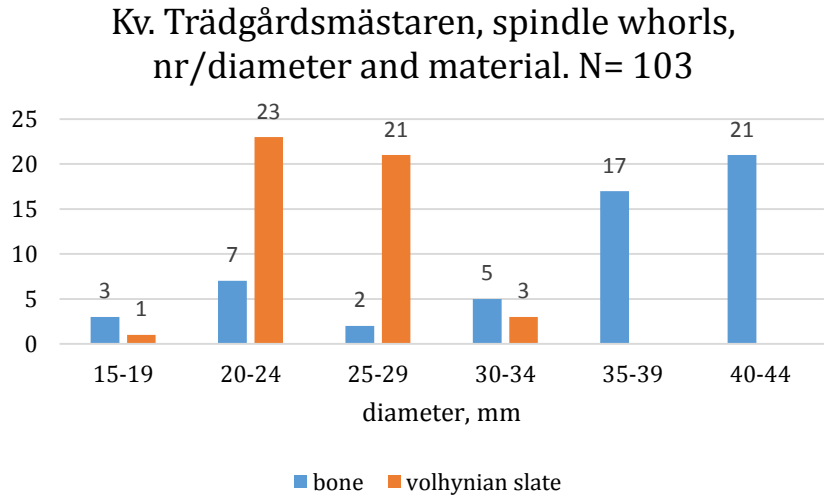


Chart 6. Registered spindle whorls of bone and Volhynian slate, number/diameter in mm

3.4.3 Height

The maximum height can be measured for 55 of the 60 finds made of bone. The height ranges from 6 to 31mm, with a concentration between 10 and 24 mm (chart 7). When comparing the relationship between the shape of the spindle whorl and the height, it appears as the measurements over 17 mm are exclusively corresponding with the finds of joint ball type. Out of 48 spindle whorls of Volhynian slate, the maximum height can be established for 48. Within this material group, the height rages between 9 and 19 mm, with a concentration between 10 and 19 mm. It is evident, in this case, that the height is influenced by the choice of material. The two material groups seem to follow a pattern, regarding the ratio between weight, diameter and height. In contrast to the spindle whorls made from bone, the shape does not seem to affect the height of the spindle whorls made of Volhynian slate.

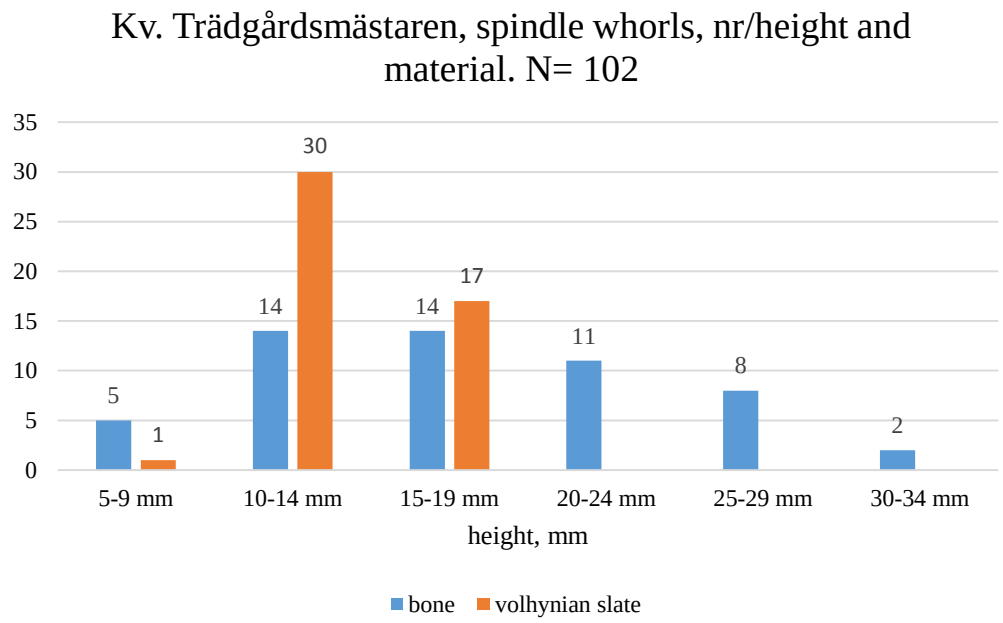


Chart 7. Registered spindle whorls of bone and Volhynian slate, number/height in mm.

3.4.4 The diameter and shape of the spindle hole

Out of 55 registered spindle whorls made of bone, the maximum diameter of the hole can be measured for 52. The three finds missing from this analysis are intermediates and do not have any finished hole to measure. The sizes range from 5 to 12 mm, with a concentration between 7 and 10 mm (chart 8). The shape of the hole determines the shape of the spindle-rod, and the similar hole-shape and diameter suggest that the same type of spindle-rod can have been used (Zagal-Mach Wolfe 2013:179). A majority of the joint ball shaped whorls have slightly cone shaped holes, while the other types display holes with a plain shape (fig 9).

The diameter of the hole can be measured for 48 of the 48 spindle whorls made of Volhynian slate. The sizes for this material group range between 6 and 11 mm, with a concentration between 7 and 10 mm. Although both material groups display similar measurements, the majority of the Volhynian spindle whorls have slightly smaller hole-diameter than the ones made of bone. The shape of the hole is plain for a majority of the spindle whorls.

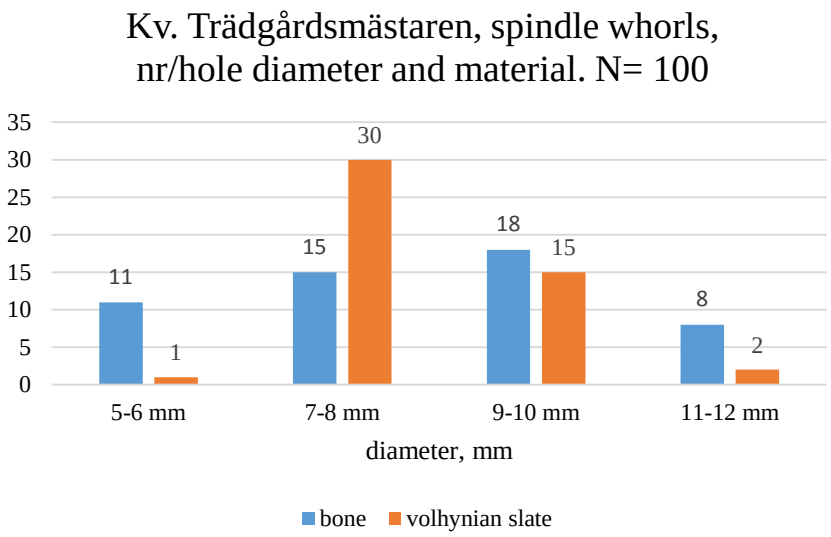
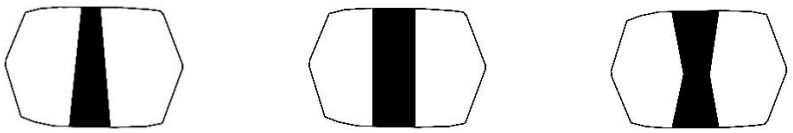


Chart 8. Registered spindle whorls of bone and Volhynian slate, number/spindle-hole diameter in mm.



a) Cone b) Plain c) Double cone

Figure 9. Common shapes of the spindle-hole

3.4.5 Summary

The results from the analysis suggests that there have been tools available to produce several different thread qualities, in kv. Trädgårdsmästaren in Sigtuna. It can be stated that there is a difference between the characteristics of the tools from the two material groups regarding provenance, appearance and function. The choice of material in this case, seems to be of importance for the shape, weight, diameter and height, when comparing the two materials categories. There are a few basic shapes in both categories which predominate. In the bone category, the joint ball type is clearly the most common, followed by the processed joint ball category, and the conical shaped spindle whorls. The Volhynian spindle whorls display two main shapes, biconical and spherical with flat top and bottom, and the latter predominates. In addition, many finds of both types display a concave top.

When observing the spindle whorls made of Volhynian slate it is noticeable that the category display a distinct *standardisation*, with several small groups of finds which have the same weight and very similar measurements. In contrast, the spindle whorls of bone with the

same weight do not display this kind of uniformity. Perhaps this could be associated with the accessibility of the material, as joint balls from cattle probably have been easier to obtain. The intermediates can indicate the manufacturing of spindle whorls from bone, and most likely, that is the reason for the great variation of tools from that material group. This category of spindle whorls thus may be said to represent tools that could be produced if necessary, and at least some of the artisans had the knowledge of how to do so, in this context.

The 48 finds of spindle whorls made of Volhynian slate recovered in kv. Trädgårdsmästaren could definitely be seen as unique. There are no finds with inscriptions in the material from kv. Trädgårdsmästaren, only a few spindle whorls with marks which can be interpreted as decorative or/and functional elements. In the contemporary town of Lund, 18 finds of Volhynian slate spindle whorls has been recovered (Kulturen database). In Birka, only one find can be seen in the material from Hjalmar Stolpes excavations in the 1870s (Andersson 1999a:49). In Bergen, no finds made of Volhynian slate are known (Øye 1988). This may imply that the material can be associated with early medieval urban contexts in Scandinavia, which had frequent contacts with the Eastern European area during this period. Since the occurrence of Volhynian spindle whorls in Novgorod are most prominent during the 12th century, the increase may also be due to an intensified production in Ovruch and Kiev (Rybina 1992:114). Both a production increase and more intensive trade connections between Kiev Rus and the Lake Mälaren area could thus explain the relatively large quantity of Volhynian spindle whorls during this period. However, further studies on textile tools from both urban and rural contexts may change this picture.

The functional parameters of the spindle whorls made of Volhynian slate demonstrate that the general diameter is relatively small, in relation to the weight. The bone spindle whorls with the similar diameter are much lighter, and the relationship between the weight and diameter is particularly interesting in the case of the Volhynian spindle whorls. This may suggest that the two categories of tools made in different areas, not only differ quite substantially in their general appearance but also in function. The thread quality possible to produce with a majority of these spindle whorls could be rather thin, however, the quality of the raw material would have been of great significance. Spinning threads from flax fibres would have required a heavier whorl than when using wool in order to spin a tight thread (Sherman 2008:10). With this in mind, it may be reasonable to assume that the Volhynian spindle whorls could have been suitable for spinning threads from flax, although this has to be further investigated. The great differences between an 8g and 18g spindle whorl, observed during the spinning experiments, confirm that there is also a variation of tools in this material group (Mårtensson et al. 2006).

Even with a spindle whorl weighing 25g, it would be possible to spin a fairly thin thread using the appropriate wool quality (Andersson 1999a:19). It would demand specialist knowledge, good quality raw materials and be time consuming to spin threads with these tools. This thread quality could have been used for fabrics with a high thread count, i.e. textiles which were densely composed (Andersson 2007:150). Thread qualities possible to spin with the spindle whorls made of bone are more varied than the previous category, with both very light and heavy spindle whorls.

The diameter of the spindle-hole is very similar in regard to tools made of both materials, and it have determined the thickness of the spindle-rod (Zagal-Mach Wolfe 2013:180). It is possible to observe that there has not been any greater variation in diameter of the hole, and that a large majority of both Volhynian slate- and bone spindle whorls have very similar measurements. Thus, this parameter is not as much affected by the choice of material, the shape and the weight of the spindle whorl, and it can also indicate that a small variation of spindle-rods were used in the context.

3.5 Spatial distribution

3.5.1 Context description and chronology

The ability to relate the material culture to a context is crucial for an understanding of the craft activities in time and space. The context studied here, allows for a good insight into where the textile production potentially could have been performed, when observing the distribution of spindle whorls, but also another category of textile implements, the loom weights. In several phases, the distribution of textile fragments correlate with the textile implements, and thus I have incorporated information on the material when it has been relevant. It can testify to the kind of raw material available for the artisans and used for textile production in the context. The performance of craft may not correlate with the archaeological remains, as the mobility of people and objects is always a factor which must be considered. It is important to consider the circumstances in which the houses are abandoned or reconstructed. In some cases, the buildings have burnt and the findings in the burnt layers can probably be more representative of the activity areas (Øye 1988:117). Heavier objects that might be easy to manufacture, such as loom weights, may not have been taken away when a new construction was built (Milek 2012:105f). Thus, it is reasonable to assume that the loom weights within the buildings represent stationary textile activities. Textile craft in particular, is difficult to grasp completely, as the different levels of production may not always be demonstrated on the basis of a separation of the craft activities. Thus, searching for workshops or areas only devoted to textile craft, may not be the most relevant point of entry, as production beyond the household's own needs often has been carried out in the domestic environment. What actually would constitute a textile workshop in Sigtuna during the early Middle Ages, is also a question which is difficult to determine. Instead, the quantity and quality of the data combined, should be the main interest. Some areas may be distinguished due to different reasons, and it is important to recognise several aspects of the relationship between the material culture and the context.

A focus on the context itself is essential for the discussion on organisation, and the functional aspects of the tools and their distribution may suggest certain areas, or time periods when the production may differ or remain stationary. The number of tools connected to buildings could testify to the general demand, and if there are any indications of specific toolkits. Zagal-Mach Wolfe describes toolkits as the remains associated with the structures of

production, and in this study this may be observed through the weight distribution of the spindle whorls in relation to the buildings (Zagal-Mach Wolfe 2013:48f). In other words, it is of interest to observe if the relationship between the weights of the spindle whorls are similar in all buildings. Thus, what is referred to as toolkits in this study is specifically focused on the composition of spindle whorls in certain structured spaces. The number of tools in the different phases are also of relevance, if there are other factors indicating changes in the production. Due to source critical aspects, one may not assume that a difference of a few textile implements would be a reflection of the real situation in the past.

The excavation covered an area of 1140 m^2 in the early medieval town centre, and was divided according to a grid of 2 x 2 m large units and was conducted using a method where the structures were in focus, and thus every building layer was the smallest stratigraphic unit (Roslund 1997:38; Wikström 2011:9). In contrast, the single context method should be considered more accurate, as each cultural layer is recorded resulting in several smaller and contexts. The most important aspects of the spatial analysis is to study the chronology and chorology of the finds, that is, to investigate whether they relate to other activities and buildings in various *phases, zones* and *plots*. The chronology of the structures and activities within the block was established during and after the excavations in 1988-1990 (Söderberg 2011:31). In an analysis of stratigraphy, Roslund argued by use of pottery sherd-links that the re-distribution between deposits in time and space was minimal. Thus, the artefact assemblage can be used for spatial studies as well as chronology (Roslund 1997). This contribution has been of great significance for other excavations in the town area. In this study, the source critical aspects should be taken into consideration when analysing the spatial distribution of the finds, however, the correlation of spindle whorls and loom weights can show trends that may suggest something about where the craft was mainly performed within the area and buildings in the different farm plots.

The archaeological remains have been divided into three main phases according to similar building structures and functionality within the farms (Söderberg 2011:23). The three main phases have been divided into several shorter phases, which are represented by contemporary structures within the farm plots (table 1). Distributions maps of all plots in every phase has been established, based on the spatial information for all the finds in the units of 2 x 2 m, in order to observe different trends in textile production over time (fig 11, appendix 2). The marked finds consists of both spindle whorls and loom weights. Both find categories occurs in nearly all the phases presented below.

Main phase I	Main phase II	Main phase III
Phase 1 985-1000	Phase2 1000-1020	Phase 7 1125-1175
	Phase 3 1020-1050	Phase 8 1175-1200
	Phase 4 1050-1075	Phase 9 1200-1230
	Phase 5 1075-1100	Phase 10 1230-1260
	Phase 6 1100-1125	

Table 1. The chronological division from the excavations in kv. Trädgårdsmästaren. (After Söderberg 2011)

The context consist of five farm plots which henceforth is referred to as plot I, II, III, IV and V. The buildings within the different plots display prominent functional areas throughout most of the period, and have been divided accordingly into five zones (fig 10). The buildings have been categorised due to their characteristic features as follows: Zone **I**- *Workshops and buildings associated with craft production,* Zone **II**- *Multifunctional buildings,* Zone **III**- *Buildings with corner hearths,* and *Zone **IV**- Buildings with center hearths.* The main phase **I** is characterised by smaller houses, mainly of residential character with hearths in the centre, and of broad passages. Three to five houses can be observed within the single farm plots, throughout the main phase. There are a few indications of animal husbandry in a few buildings. The craft

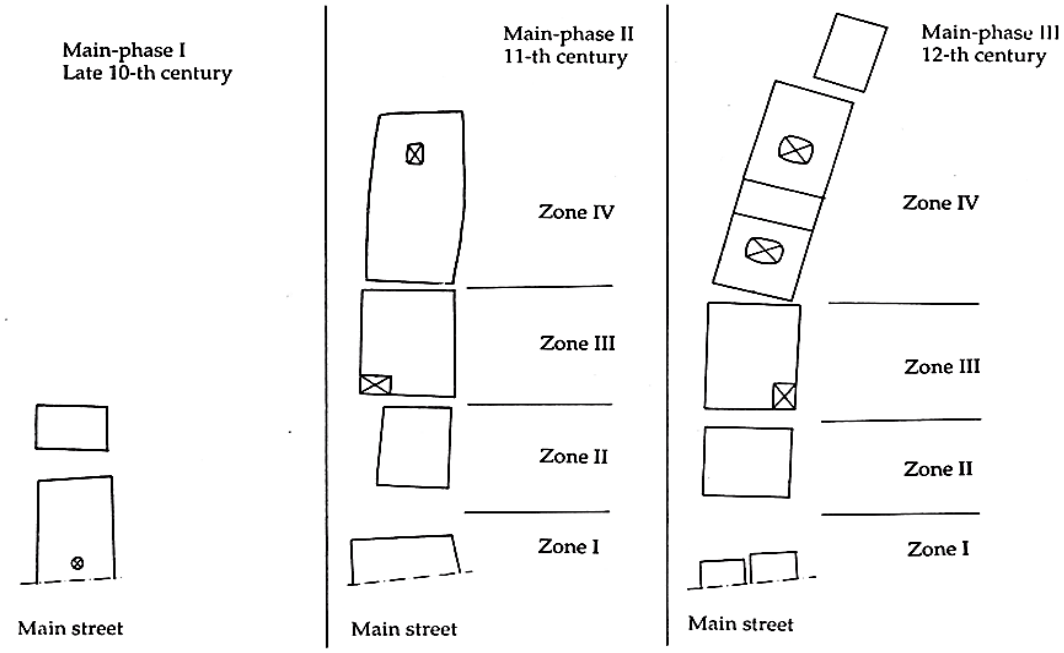


Figure 10. The farm plots in Kv. Trädgårdsmästaren, divided in zones (Söderberg 2011:27)

during this phase, does not seem to have been extensive and is interpreted as mostly related to the supply of the own household (Söderberg 2011:23). In main phase **II** the zone along the main street "Stora gatan" begin to emerge as a workshop area, associated with an increasingly intensive craft production. The craft activities in these areas are represented by metal crafts, comb making, and textile craft which in several cases have been performed in the same building. The distribution of debris connected to comb making suggest a shift in the later part of the phase, from a relatively small scale production attached to residential buildings in zone III and IV, to an intensive craft production beginning in the end of main phase **II**, associated with zone I. In main phase **III**, the zone close to the main street was characterised by intensive craft activities, of specialised character. The buildings once again, became smaller in size and the passageways were broadened. The activities related to comb working was further intensified and moved to the front of the plots, and the craft production seems to have become more varied, and of a more complex nature (Söderberg 2011:24). During this time period, the craft production is viewed upon as stationary, in that a specialised activities was established along the main street, has been interpreted to be due to that they also should have served as distribution points for an external market. In the end of this phase, the craft production decreases gradually.

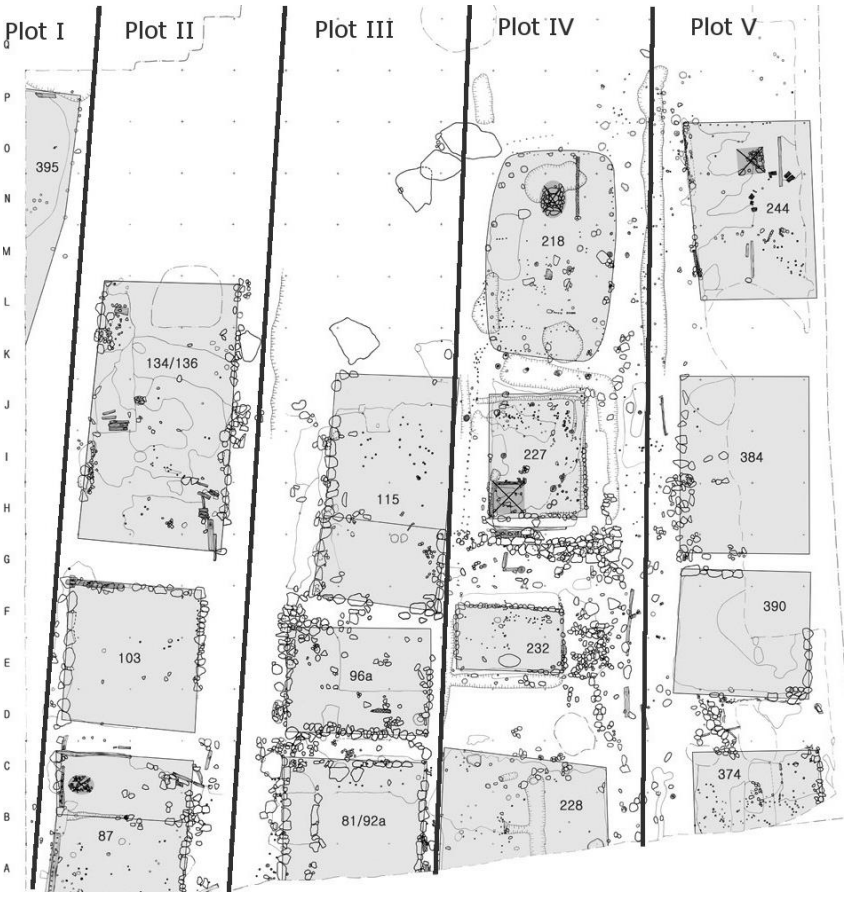


Figure 11. The five town plots in Kv. Trädgårdsmästaren that constitute the context for the study (After Söderberg 2011:46)

3.5.2. Textile tools and activity areas

Out of 214 spindle whorls, 206 are possible to connect to a datable structure and 599 loom weights out of 605, are possible to study chronologically and spatially. The included finds are determined as loom weights in the find lists from the excavation, and all the uncertain finds have been excluded. Due to this, the number of loom weights deriving from this context ought to be higher.

Phase 1 (985-1000)

In phase 1, the number of spindle whorls recovered are 7 and the number of loom weights are 53. The textile production can be associated with several buildings, although most prominent in this regard is the building nr 104/377 in plot II, where a total of 18 loom weights were recovered in a pit in the northwestern corner. This has been interpreted as the remains of a warp weighted loom (nr A 400) (Söderberg 2011:40). Three finds of spindle whorls was recovered within and around this building; 1 of bone weighing 25g, one of burnt clay weighing 31g and one of limestone weighing 50g. One find of a bone needle was also recovered within this structure. In building nr 88/89 in plot III two spindle whorls made of bone and clay were found. The find made of bone has a conical shape, weighs 1g and measures 16 mm in diameter. This imply that a production of very fine threads has been available in Sigtuna already in the 10th century. Other finds connected to the building are associated with iron work, antler-and leather working. The building nr 365 in plot V contained 10 loom weights, of which 5 was found in the same square unit, and in the passage in connection to the building, one smoothing stone made of quartzite, which is used to process the surface of linen fabrics, was recovered. In connection to this building, the planking from a ship was found with traces of wool or hemp.

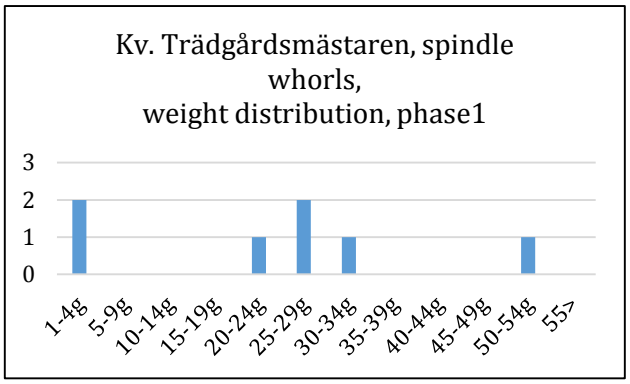


Chart 9. Weight distribution in phase 1. All Spindle whorls from Kv. Trädgårdsmästaren.

The distribution of spindle whorls are connected to plot II and III in this phase while the loom weights are concentrated in the plots II and V. A majority of the spindle whorls weigh between 1 to 4g and 25 to 29g, which implies that there was a need for both coarse and very fine threads in the context during the late 10th century (chart 9). The small number of spindle whorls may be due to the poor preservation of organic materials, and since spindle whorls made of wood may have been used in this period, it is difficult to assess whether the source material can be truly representative for an interpretation on the textile activities in the context. The weight distribution suggest that the very light and rather heavy spindle whorls dominate, and it can thus be concluded that there has been tools to produce both very fine and coarse thread qualities, already in this early period.

The remains of the possible warp weighted loom in plot II, and the loom weights in plot V, contribute to a suggestion that the stationary textile production in this phase was carried out in mainly two buildings, nr 104/377 and 365. How the textile production was organised is difficult to assess in this phase, due to the lack of buildings and other crafts to compare with however, there are clear evidence for both spinning and weaving activities in this phase.

Phase 2 (1000-1020)

There are quite substantial changes to the structure of the town plots and buildings in phase 2, and more distinct functional spaces begin to emerge (Söderberg 2011:47). The buildings become larger and increase in number, and various craft activities such as iron working and glass and- comb working, can be discerned (Söderberg 2011:25). Spindle whorls have been uncovered in almost every building in this phase, although with a slight concentration around plot III, IV and V. This concentration is much more distinct for the distribution of loom weights in the same plots. The number of spindle whorls and loom weights have increased in this period to 18 and 62 finds. In building nr 96a in plot III, 5 finds of loom weights and one spindle whorl made of stone, were recovered. In connection to a building in plot V, (nr 244) with a center hearth in the northwestern part of the trench, 12 loom weights and 2 spindle whorls were found. The spindle whorls are made of Volhynian slate and sandstone, and they weigh 24 and 26 g. The building is placed within zone IV, and has been interpreted as a residential/hall building. In building nr 218 in plot IV, zone IV, several finds of loom weights and one spindle whorl made of burnt clay was recovered. Waste from comb-working is also associated with this building during the early 11th century (Pettersson 2007:8).

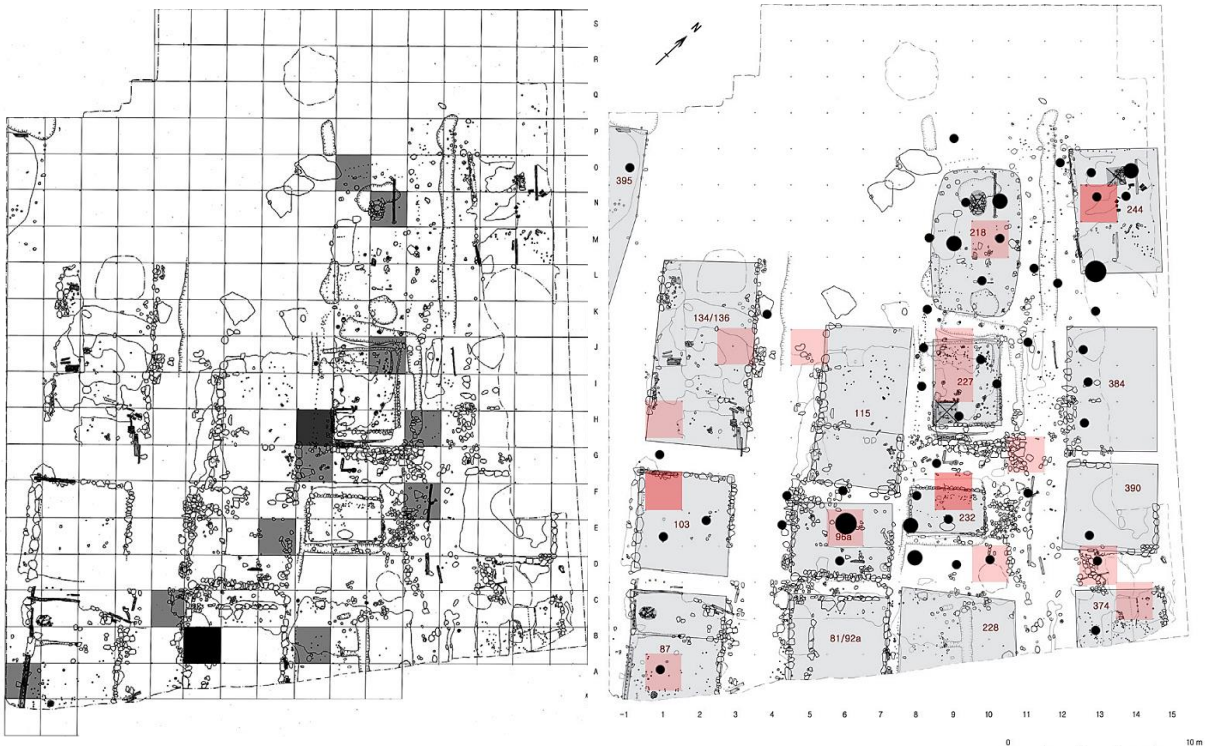


Fig 12. In phase 2, Kv. Trädgårdsmästaren. The distribution of crucibles connected to metal craft (left) (Söderberg & Gustavsson 2007:30), and the distribution of spindle whorls and loom weights (right).

The distribution of spindle whorls are connected to buildings while loom weights are scattered within and around the buildings. Two finds of Volhynian spindle whorls was found in this phase, one of which is connected to the building nr 244 in plot V. Two intermediates of bone (joint balls with the same diameter and height), were found in building nr 103, which may suggest that some spindle whorls were manufactured in the building. A majority of the spindle whorls from phase 2 weigh between 15 and 19 g and 25 and 29 g (chart 10), and the variation of weights are greater than in phase 1, which may suggest that the artisans in kv. Trädgårdsmästaren had begun to produce a greater variety of fabrics in the early 11th century. As the number of buildings increased, one can assume that the population did as well. If production was intended merely for household needs during this period, it is not so strange that we also see a small increase of textile tools. Several of the buildings contain two or three spindle whorls, with different weights, which may indicate a kind of toolkit which was intended for a production of a variety of textiles. It is also noticeable that the activities of spinning and weaving are performed in the same building in some cases but not in others. Perhaps this may be due to that the craftsmanship was organised in different ways within the context, and therefore social differences between the different plots can reasonably be expected. The activities can be connected to buildings with a multifunctional character in zone II, the residential buildings in zone III, and the residential/hall buildings in zone IV. The distribution of metal craft related finds demonstrate a pattern which seems to follow the distribution of loom weights, concentrated in plot IV (fig 12). Debris associated with comb working has been found in the end section of plot IV, however, the amounts are not substantial. The craft activities within the farm yards thus does not seem to be separated at this stage, and there are no clear buildings for only one type of production.

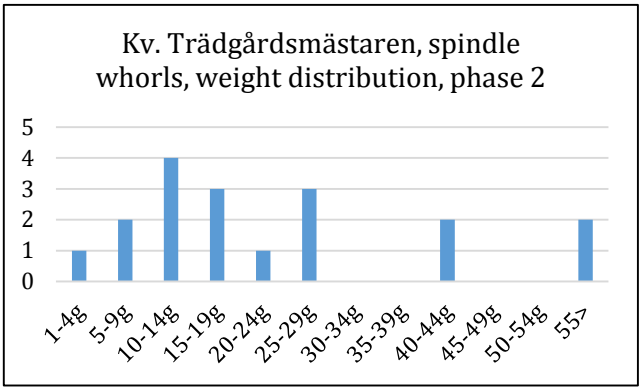


Chart 10. Weight distribution in phase 2. All spindle whorls from kv. Trädgårdsmästaren.

Phase 3 (1020-1050)

Further changes to the structure of the farm yards and the buildings can be seen in phase 3, with extended buildings and more specifically evident buildings for craft production along the main street (Söderberg 2011:55). This production is associated with metal- and comb working, and an intensified textile production. A house in plot V can testify to some degree of animal husbandry, although it is not known what kind of animals.

In phase 3, the textile implements consists of 24 spindle whorls and 116 loom weights, distributed around the entire block. The weights of the spindle whorls ranges between 1 and 50g, with a concentration between 1 and 14g (chart 11). In building nr 388 in plot I, remains of 5 loom weights in the northern part have been interpreted as a warp weighted loom (Söderberg 2011:55f). In this building, spindle whorls of clay and soapstone, weighing 12 and 37g, was also recovered. 7 loom weights and 5 spindle whorls was located outside, in connection to this

structure which reinforces the image of a quite significant textile production in this context. A 50 mm long spindle rod of wood with a thread still wrapped around, a rather unusual find, was also recovered in this building. The thread thickness and raw material is not described however, the spindle whorl made of clay (12g) was found in the same unit.

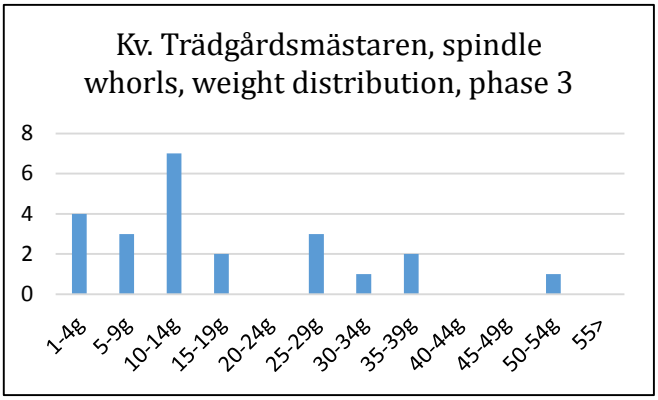


Chart 11. Weight distribution in phase 3. All spindle whorls from kv. Trädgårdsmästaren.

Another possible warp weighted loom was found in building nr 225a in plot IV, zone II, with 8 loom weights assembled in the same square unit. The finding of a smoothing stone can suggest that linen fabrics were woven and prepared (Andersson 1999a:19). A spindle whorl made of Volhynian slate, weighing 8g and with a diameter of 22mm, was found in the same unit. In the same building, 4 spindle whorls of glass (4g), Volhynian slate (11g) and limestone (31g), were located. The two Volhynian slate spindle whorls are both flat biconical however, the diameter of the hole differs. Given that the majority of spindle whorls found is very light, it may indicate that finer quality fabrics were manufactured here. This is the only building interpreted as a weaving workshop "vävstuga", in the excavation report (Söderberg 2011:58). I believe that the interpretation is justified by the assemblage of findings, although this may not be the only space for organised textile production in this phase. The findings in this building are rather special, as most of them are imported to Sigtuna from places outside of Scandinavia. A find of auripigment, which is a mineral used to dye fabrics and sealing wax, among other things, and a ring treasure which consists of 51 tin rings, can demonstrate the uniqueness of the building in relation to others (Söderberg 2011:55). In plot V, zone II, the building nr 334a display several finds of both textile tools and textiles fragments. The tool material consist of 2 spindle whorls of Volhynian slate and soapstone, and 7 finds of loom weights. Several loom weights are scattered around the area outside the structure as well. The textile fragments consist of one densely woven linen fabric and one woolen fabric made of plain weave. The finds of textiles correlate with the distribution of both spindle whorls and loom weights in this phase, which can further imply performances of textile artisans in these contexts. A large concentration of loom weights can also be seen in buildings nr 364/396 in plot II, 236 in plot V and 96b in plot III. A building in plot IV, in zone I, is interpreted as an early workshop with a distinct specialisation in metal crafting, although one find of a wood has been interpreted as a hypothetical part of a loom. The lack of other textile related finds in this building contribute to difficulties in the interpretation.

The textile related activities appear to have increased in phase 3, demonstrating a more intensive production with at least two buildings with remains of warp weighted looms in plot I and IV. Given the large number of accumulated loom weights in several of the buildings, I believe that the existence of other such constructions can not be excluded. In fact, the increase of finds from this category can testify to a fairly large increase in weaving activities.

Considering that the number of buildings in the town yards are almost the same as in previous the phase, it could suggest that the number of artisans have increased. The general changes from previous phases is that the textile related activities now also occur in the zone closer to the main street and in plot I and II. The weight distribution of the spindle whorls is quite diverse and does not suggest any specific type of production (chart 11). When observing the number spindle whorls within the individual house remains, two or three tools seem to be the most common number, and they are also of different weights. This observation may be important for an understanding of the toolkits.

Phase 4 (1050-1075)

In the second half of the 11th century, the buildings in the farm plots increased in size, which also resulted in narrower passageways. A workshop connected to specialised metal casting was established in the zone close to the main street, in building nr 206 (Söderberg 2011:91).

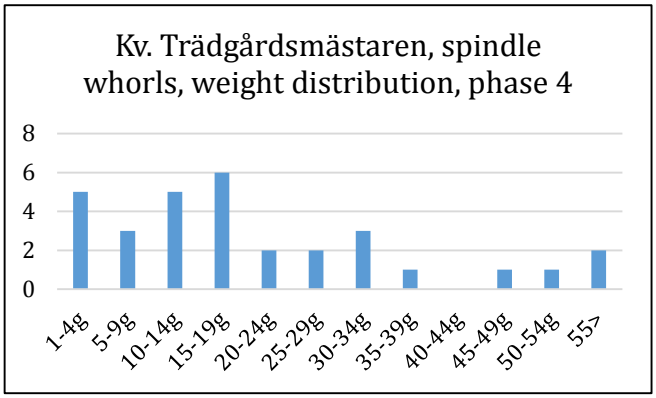


Chart 12. Weight distribution in phase 4. All spindle whorls from kv. Trädgårdsmästaren.

The number of spindle whorls and loom weights originating from phase 4 are 31 and 112. In fact, the number of spindle whorls is larger than in any other phase, which could imply a higher demand for textiles during the second half of the 11th century. The spindle whorls weigh between 1 and 70g, of which a majority weighs between 10 and 19g (chart 12). Both spindle whorls and loom weights are concentrated around plot II and III, although loom weights are found quite frequently within the entire area. Several remains of warp weighted looms can be interpreted on the basis of accumulations of loom weights.

During this time period, the largest number of heavy (30g>) spindle whorls can be observed. In regard to this and the increased number of textile tools from this phase, it is relevant to observe the distribution in connection to buildings. In building nr 335 with a corner hearth in plot II, zone III, and 75/131 in plot III, zone IV, the majority of heavier spindle whorls can be discerned. In the former building, the finds of 16 loom weights, of which 7 were recovered in a 0, 1 m deep pit, indicate the location of a warp weighted loom. Several of the finds are marked with circles made with a bone shaft. Within this building, 4 spindle whorls, of which two weigh 30g was found and other textile related finds in this building are two tinblbein, ornamented with crosses and transverse lines, used to manufacture braids for decorative or other purposes (Haltiner 1990:119) and bone needles which may have been used for sewing however, they were also used in other crafts traditions.

In building nr 75/131, a substantial number of both loom weights and spindle whorls was found. The spindle whorls are made of glass (6g), clay (20g), limestone (47g), stone (50g) and clay (16g). As in the previous building, there are two finds of heavier tools that have similar weights, and the other spindle whorls vary. Even more striking is the large number of loom

weights, a total of 23 finds, within this building. This can probably attest to another warp weighted loom, and it testifies to a large production of textiles. The toolkits of spindle whorls in these two buildings are interesting in regard to sail production. The heavier spindle whorls could be used to produce several thread qualities, not only the kind suitable for sails (Andersson & Batzer 1999:19). However, there are several spindle whorls of different weights within the same building, which means that there have been tools better suited for the production of a finer thread quality available, and thus I argue that it is possible that the heavier tools have been customised for a specific production, perhaps for sailcloth and other coarser fabrics. Further analyses of these specific tools, and the loom weights could perhaps contribute to an enhanced understanding of the production.

Another building with several finds of textile implements is nr 194a in plot IV, zone III. 3 loom weights were found on a burnt log, about 20 cm thick at the eastern corner, and a spindle whorl of Volhynian slate was recovered in connection to this structure. This has been interpreted as the remains of a warp weighted loom which have been leaned against the wall, and the log might have been used as support for the warp when the loom was not used (Söderberg 2011:75). A heavy spindle whorl made of clay, weighing 55g, was also found in this building, which further reinforces the notion that this phase is partially characterised by the production of coarser textiles. In buildings nr 319/328, in plot V, zone II, and 20/50 in plot III, zone IV, there are further indications of heavier spindle whorls.

5 spindle whorls of bone, Volhynian slate and clay, with similar weights was recovered in building nr 129a in plot III, zone III. Three of these have the same weight which could imply that a number of craftsmen have been working with the same type of thread production simultaneously. This is interesting to take into account when the scale of the production is concerned. Also 5 finds of needles made of bone and antler was found in this context, and a textile fragment of a dense quality fabric made of silk. Although the silk fabric was most likely imported to Sigtuna, it demonstrates the special nature of this context.

The large number of tools connected to buildings in phase 4, and the remains of at least three warp weighted looms, indicate a larger scale production of textiles within this context. Several of the buildings seem to contain heavier tools which could imply a production of coarser threads used for sail cloth. It is also noticeable that there have been several artisans spinning and weaving simultaneously within many of the buildings, as there are several tools with the same weight. Although the textile implements are distributed widely over the town plots, there are some differences between the buildings indicating more intense activities in plot II and III in this period.

Phase 5 (1075-1100)

In this phase, distinct workshops associated with metal craft are emerging along the main street. Several of the findings point to a more specialised production, such as the traces of silver refinement and a fragment of a casting mold for the production of horse equipment (Edberg 2011:149; Söderberg 2011:79). A seal-like pendant casted in bronze which illustrates churches or towers is unique find, which has been interpreted as an imitation of an older town seal belonging to Sigtuna (Edvardsson 1990:159). A special find category that recur in phase 6 and

7 in the same plot (IV) is ivory combs (Södeberg 2011:79). By observing the distribution of textile implements in phase 5, it is evident that the main areas for textile craft activities has shifted towards the eastern part of the area, in plot III and IV. 30 spindle whorls and 118 loom weights have been recovered in layers dated to phase 5. Spindle whorls and loom weights are found concentrated around plot III and IV in this phase, and the buildings that display most textile implements are situated within zone III and IV. The weights of the spindle whorls ranges between 2 and 32g, of which a majority weighs between 5 and 14g (chart 13). In general, it appears that there is a greater homogeneity in the toolkits in this phase.

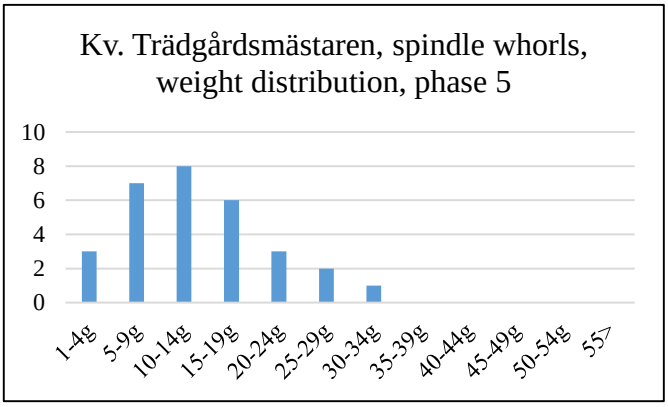


Chart 13. Weight distribution in phase 5. All spindle whorls from kv. Trädgårdsmästaren.

A few of the buildings can be distinguished by the number of textile tools. The building nr 129b in plot III, zone III, is particularly interesting in this regard, since it contained a large number of both spindle whorls, loom weights and other textile implements, such as bone needles and a few textile fragments. A total of 10 spindle whorls was recovered within the building and 28 loom weights, which is quite a remarkable amount. The spindle whorls are made from Volhynian slate, lead, clay, antler, bone and amber, of which several finds have the same weight, even if there is a variation of both lighter and heavier tools in the material. Two spindle whorls of sandstone and glass, weighing 15 and 2g was also found in close connection to the building. 12 to 13 loom weights were found accumulated in the south eastern part of the building, which could be an indication of a warp weighted loom in that area. Interestingly in this phase, the number of Volhynian spindle whorls are high (chart 14). As could be observed based on the analysis of the spindle whorls, the finds made from this material are relatively standardised, with very similar parameters and can perhaps indicate a specific kind of production. Thus, it is particularly important to observe their distribution within the context (fig 13). It is evident that the distribution of the tools is concentrated around the buildings nr 129b, 194b, and 61. The spindle whorls from all these buildings are remarkably similar, in terms of weight and sizes. The finds of spindle whorls in building nr 56 in plot III, zone IV, and nr 194b in plot IV, zone III, also display a similar a weight range.

In the transition between phase 4 and phase 5, it is interesting to notice the relation between light spindle whorls (<10) and heavier spindle whorls (30>) (chart 15). Compared to phase 4, the number of spindle whorls and loom weights in phase 5 are similar however, they differ in certain respects. The weights in phase 4 are comparably heavy, while they in phase 5 are relatively light, i.e. the lighter tools increase in number as the heavier ones decrease. After further observations on the relations between the specific weight groups, it is possible to state that spindle whorls with weights between 5 and 14g correspond to the difference in phase 5 (chart 16). Out of 15 finds in this weight group, 7 are made of Volhynian slate and the other are made of various materials. It is also noticeable that the finds weighing 1 to 4g correlate with

the finds in the weight range of 30 to 34g. It thus seems tempting to connect the demonstrated standardisation of tools with the demands for finer quality textiles, not only intended for supplying the own household during the end of the 11th century. Another interesting observation is the number of spindle whorls with the same weight in this phase, which could imply that there were several artisans producing similar threads intended for a specific kind of textile quality.

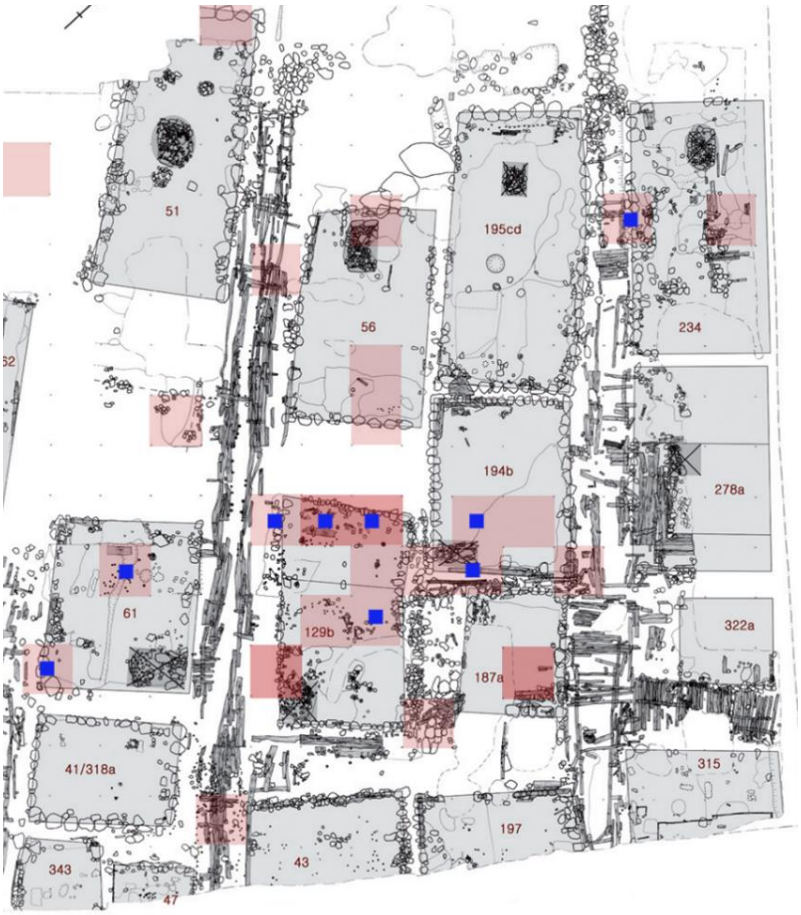


Figure 13. The smaller blue squares represent the distribution of spindle whorls made of Volhynian slate in the end of the 11th century, and the red squares represent all finds of spindle whorls. The finds are concentrated in buildings in zone II.

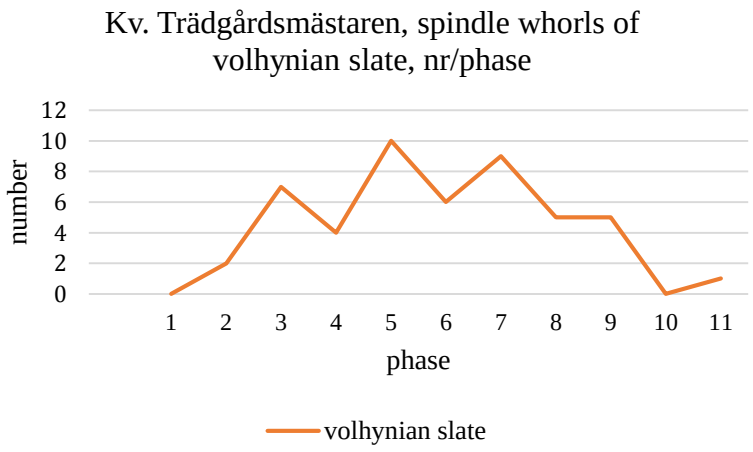


Chart 14. Phase 5. Volhynian spindle whorls, nr/ phase. The largest number of finds occurs in the late 11th century.

Chart 15. A comparison between spindle whorls with weights under 10g and over 30g.

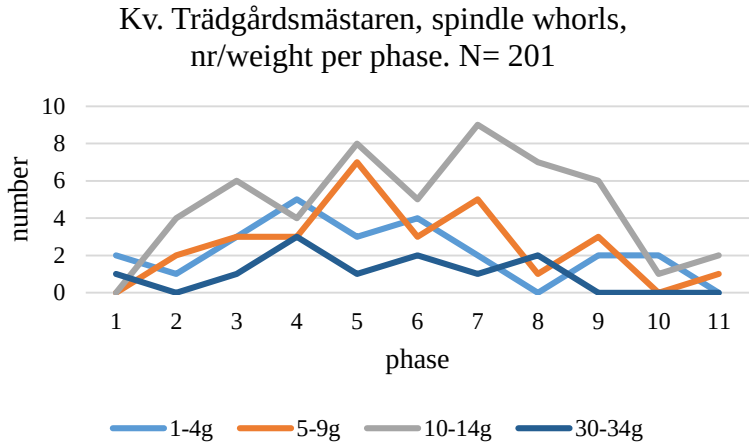


Chart 16. In phase 5. All spindle whorls from kv. Trädgårdsmästaren in weight groups. It is evident that spindle whorls weighing 5 to14g increase, as weights between 1 to 4g and 30 to 34g decrease in number.

Phase 6 (1100-1125)

During the early 12th century, the structure of the farm yards are changing yet again and pairwise workshops are established along the main street, in zone I. In the same zone, debris from comb manufacturing begin to increase (Pettersson 2007:10f). The textile craft does not appear to be entirely separated from the aforementioned activities at this stage (fig 14).

Loom weights and spindle whorls are decreasing in number, and a total of 25 spindle whorls and 59 loom weights derives from this phase. The textile implements are scattered within a smaller area in plots II, III and IV, mainly in zone III. The spindle whorls weigh between 2 and 95g, and the majority weigh between 10 and 14g (chart 17). 14 finds of smoothing stones have been found in the context, of which four can be dated to phase 6. This can suggest that the artisans have used flax as raw material (Andersson 1999a:104).

The buildings nr 48/52 in plot III, zone III, and nr 194c in plot IV, zone III, stand out in regard to the number of tools, and both buildings have possible remains of looms. In the former

building, carbonised remains of wood which may be traces of a loom and 7 wooden sticks, of which 4 have been interpreted as further processed, was recovered.

One of the finds had a thread attached, which most likely should be interpreted as the remains of a spindle-rod. Several textile fragments were found in the same building, such as a roughly tied net made of hemp (Lundwall 2004), and a fragment composed by wool, woven in plain weave with a density of 20/12 cm, which has been interpreted as an imported fabric. I argue that it might be more reasonable to assume that it was locally manufactured, due to the presence of the textile implements within the building.

In the latter building, nr 194c with a corner hearth, the possible remains of a loom have been found in connection to several loom weights. 4 spindle whorls made of stone (95g), bone (both 2g) and lead (13g), can further imply textile activities in the building. Two German silver coins and an ivory comb was found in this building, and are among the most exclusive finds from this phase (Söderberg 2011:91). A clam shell, which has associations with pilgrimage to Santiago de Compostela, was found in connection to the building. The shell can be seen as an

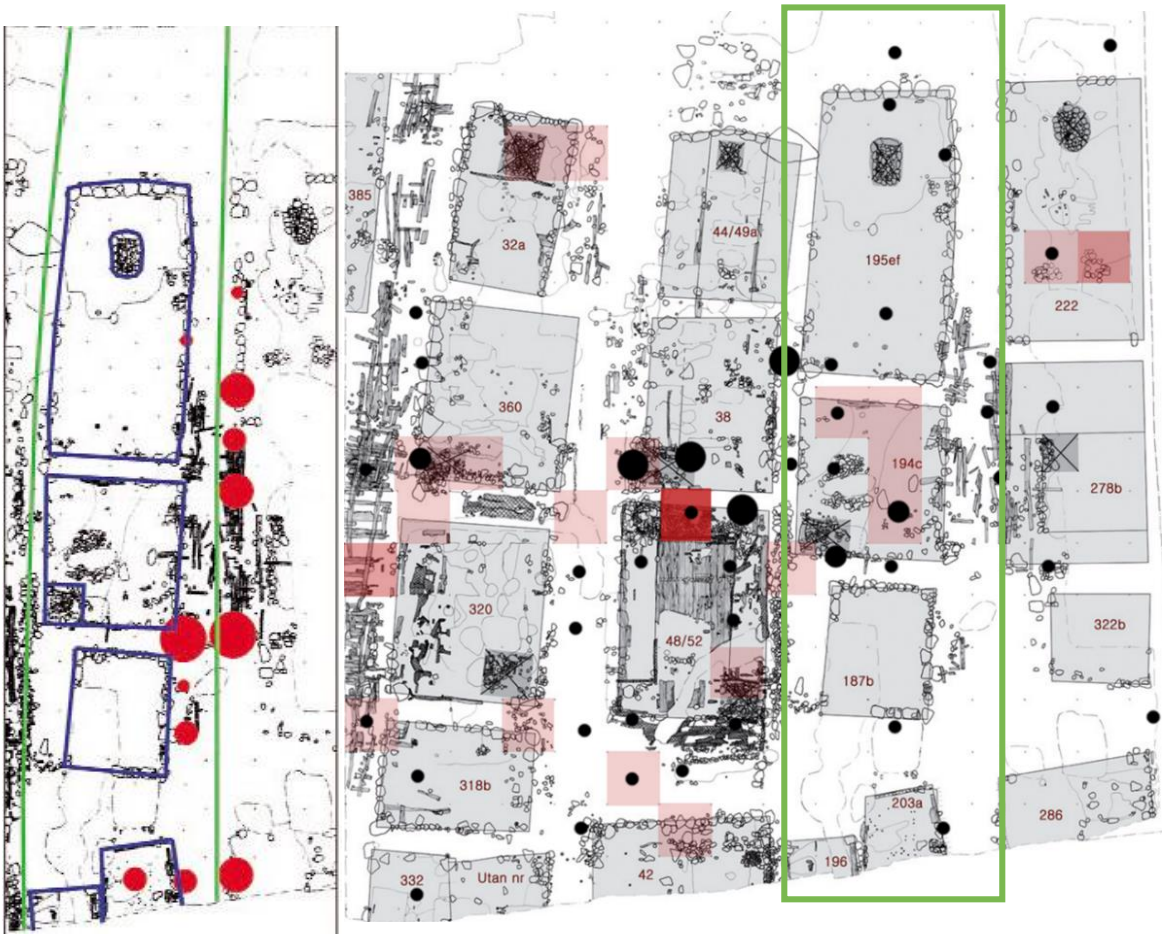


Figure 14. The distribution of debris from comb manufacturing in plot IV (left) (After Pettersson 2007), and spindle whorls and loom weights (right). The craft activities do not appear to be separated at this stage.

early Christian symbol, and similar finds have been recovered in medieval graves in Lund (Edvardsson 1990:146f). Two fragments of casting molds for crucifixes was found in plot III, and according to Söderberg and Gustavsson, their manufacturing may be associated with authorities connected to the church who may have owned the plot, functioning as patrons for the artisans (Söderberg & Gustavsson 2007:37).

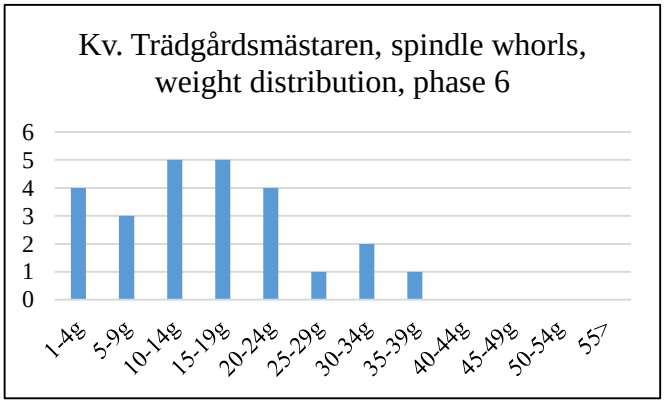


Chart 17. Weight distribution in phase 6. All spindle whorls from kv. Trädgårdsmästaren.

Other buildings in the context can also be connected to textile activities. 2-3 spindle whorls have been recovered in building nr 32a in plot II, zone IV, nr 222 in plot V, zone IV, and building nr 360 in plot II, zone III. The activity areas implied by the textile implements in this phase, appear to be concentrated around plot III, zone III. The decrease in the number of textile finds from this phase is interesting, as this trend seems to turn in phase 7. There are however special finds associated with the buildings, which also contain textile implements. Some are related to a sacred sphere, and could perhaps be associated with individuals with a high social status.

Phase 7 (1125-1175)

In mid-12th century comb manufacturing is at its peak in and occurs mainly in the workshop area in zone I, where it appears to have been a production of larger scale (Pettersson 2007:10). The distribution of textile implements and debris from comb manufacturing can suggest that the two craft activities are separated in this period, in contrast to previous phases when they appear to have been in a closer relationship (fig 15). In addition, a majority of textile tools has been found in plot IV and V, meaning a shift of location even for this craft. Nearly no loom weights can be observed outside this area, and only a few spindle whorls are scattered in and around the buildings. A specific workshop for advanced metal crafting in shed nr A 34 in plot III, where in addition to iron working, the processing of precious metals can reflect the specialised craft environment (Söderberg & Gustavsson 2007:35). The processing of rock

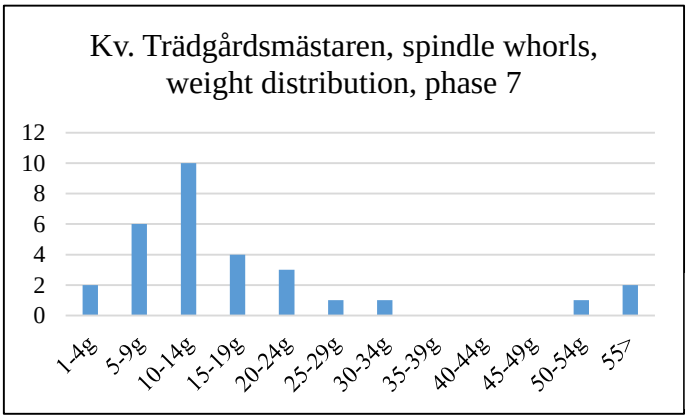


Chart 18. Weight distribution in phase 7. All spindle whorls from kv. Trädgårdsmästaren.

crystals, which also can be considered as a specialised craft, have possibly been carried out in plot II (Dock 1990:89)

A total of 30 spindle whorls and 41 loom weights recovered in this phase. The spindle whorls weigh between 1 and 60g, and a majority weigh between 10 and 19g (chart 18). In building nr 145 in plot IV, zone IV, 6 spindle whorls of unspecified stone (60g), limestone (30g), Volhynian slate (7, 11 and 13g) and clay (18g), was found. Plot IV, excels with finds of a Byzantine ivory comb, and a fragment of amphora pottery in building nr 177 (Söderberg 2011:103). This building also appears to be located within the main area for textile activities, according to the distribution of implements (fig 8) and 3 spindle whorls of bone weighing 3, 15 and 20g and circa 11 loom weights was recovered. 5 more finds were found scattered outside the building in the passageway. A tinblbein, a tool used for twisting cords from yarn, can also be added to the collection of textile finds (Haltiner 1990:119). The distribution of textile implements in this phase testify to a quite radical decrease of loom weights, in particular since this phase is longer than the others and range over 50 years. It is now possible to draw the conclusion that the decline in phase 6 was not a coincidence, however, I do not believe that this

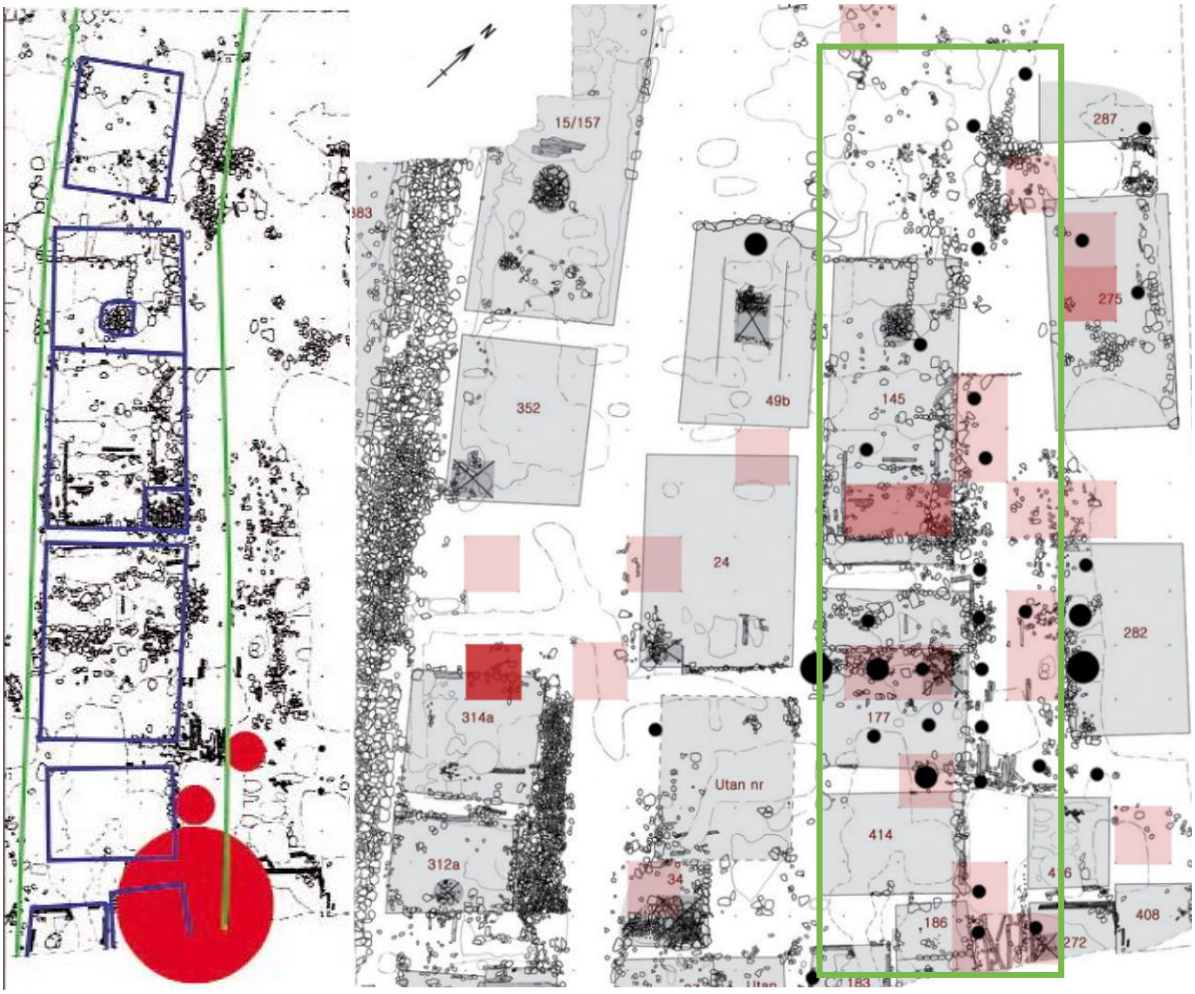


Figure 15. Phase 7. The distribution of debris from comb working in plot IV (left (After Petterson 2007), compared to the distribution of spindle whorls and loom weights, where the marked area display plot IV (right).

is an indication of less frequent weaving activities within the town yards, although it is possible that some activities have been moved to other locations. Other types of looms have been used in the early Middle Ages, which often do not leave any traces behind since they are constructed by organic materials. Thus, weaving and weavers should not be ruled out in this phase (Mårtensson et al. 2009:373). As previously mentioned, the horizontal loom was in many ways revolutionary for the urban textile production, as it improved the efficiency of the process and made it easier for one person to weave (Callmer 2003:346; Walton Rogers 1996:1763). I believe that there is a possibility that the horizontal loom gradually replaced the warp weighted loom in this context, beginning in the early 12th century. Previous finds of parts from a horizontal loom from Sigtuna has been dated to the 12th century, which fits well into the picture (Øye 1988:73). The fact that the number of spindle whorls are still high, may further strengthen this interpretation.

Phase 8 (1175-1200)

During the late 12th century, the buildings in the back of plot IV and V have turned slightly, which contribute to a different appearance of the, until this phase, fairly similar structure of the town yards (Söderberg 2011:117). In general, the finds and the characteristics of the craft activities in this phase display a special character. An important discovery of a coin stamp suggests that the minting by Knut Eriksson was carried out in one of the workshops with debris from metal crafts (Lagerqvist 1990:95).

21 spindle whorls and 24 loom weights have been recovered from the context in this phase and the spindle whorls weigh between 7 and 32g, with a concentration around 10 to 14g (chart 19). The small number of loom weights is noticeable, and although the number of spindle whorls also has decreased, the change is not as drastic. Spinning still appears to be an activity which occupies several people within the town plots, but weaving should as previously mentioned, not be ruled out. On the contrary, one find of a possible pulley-block from a horizontal loom was recovered in building nr 162/178, which may confirm that this technology was used during this time.

The building nr 28 in plot III, zone III, contained a total of 6 spindle whorls, of which 4 are made of Volhynian slate (7g, 13g, 13g and 19g). A majority of finds from this material group was almost exclusively located in this building. In addition, special finds such as rock crystals and a miniature copper alloy axe, an ancient Russian item, was also recovered in the

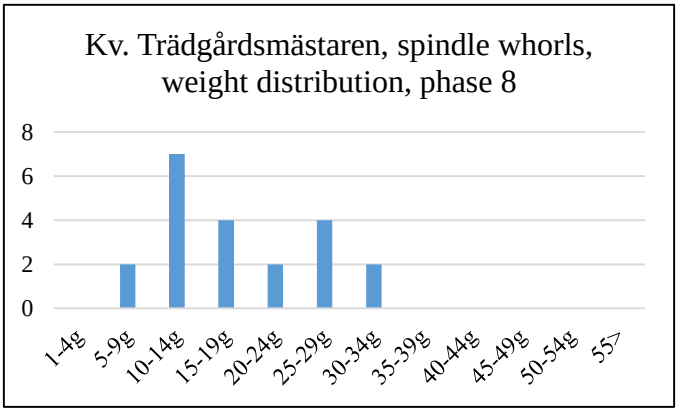


Chart 19. Weight distribution in phase 8. All spindle whorls from kv. Trädgårdsmästaren.

same building (Edberg 2011:154). A total of 14 finds of this type of axe have been found in Sigtuna, which is a very unique phenomenon. In building nr 312b in plot II, zone II, 2 spindle whorls made of stone (10g), and bone (9g), can be observed. In close connection, 3 more finds from this category made of slate (26g), bone (32g) and glass (25g) were recovered. The number of spindle whorls in this building is large in contrast to the others, which contain a one or two spindle whorls.

The spindle whorls are attached to buildings in several plots, although with a concentration around plot III. A majority of the loom weights appear to be scattered in the passageway between plot IV and V, and are thus not connected to any specific buildings. Although the layers from this phase were in less good condition than in the previous phases, it is most likely that the lack of loom weights can be explained by a switch to the horizontal loom, or possibly that weaving was carried out in specific buildings in other areas of the town. An analysis of the textile implements from all the excavations conducted in Sigtuna might clarify this issue.

Phase 9 (1200-1230)

The layers from this phase are in rather poor condition, which may affect the representativeness of the find assemblage, and the craft activities are thus also difficult to fully grasp. Nevertheless, debris from comb manufacturing is still frequent in plot III and IV, and the workshop area along the main street remain. The processing of rock crystal also still occurs in plot II and III. Specific finds from this phase is the so-called "kungabenet" as previously mentioned, whit an inscription that testifies to the generosity of the king.

The textile implements are rather few in comparison to the other phases, and the collection consist of 14 spindle whorls and 10 loom weights. The finds weigh between 1 and 20g, with a concentration around weights between 10 and 14g (chart 20), and there is still a variety of spindle whorls, however, mainly of lighter weights. A majority of them have been recovered within, and in the surroundings of the buildings in plot III in all zones, and one or two tools seem to be the most common number in a single building. In building nr 399, a smoothing stone made of sandstone have been recovered, which usually can indicate the processing of linen fabrics. There are no finds of textile implements close to this building that could further suggest an activity area. The few finds of loom weights are scattered around the passageways in zone IV, and as in previous phases it may be explained by a change in weaving technology.

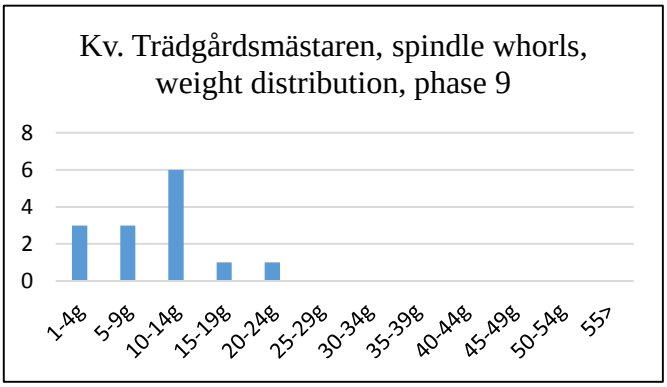


Chart 20. Weight distribution in phase 9. All spindle whorls from kv. Trädgårdsmästaren.

Phase 10 (1230-1260)

As in the previous phase, the textile implements are few and it is difficult to grasp the conditions for the activities. Only 6 spindle whorls and no loom weights were recovered in phase, and majority of the spindle whorls are associated with buildings. The finds weigh between 2 and 100g, with a concentration around 1-4g and 20 to 24 g (chart 21). Due to the poorly preserved layers from the 13th century, the source critical aspects are many however, it can be concluded that there are not any traces of the large scale production of textiles seen in previous phases, during this period.

A few of the buildings still contain finds of spindle whorls. 2 of them were recovered in a building in the center of the excavated area, nr 6/23, which also contained glass rings possibly manufactured in Slavic areas, a fragment of a glass beaker, and a figure of Christ made of antler, which may have been part of a crucifix (Roslund 1991:56). The spindle whorls are made of clay and bone, and weigh 10 and 3g. The workshop area along the main street appears to have gradually disappeared, however, comb manufacturing is still quite extensive (Söderberg 2011:135).

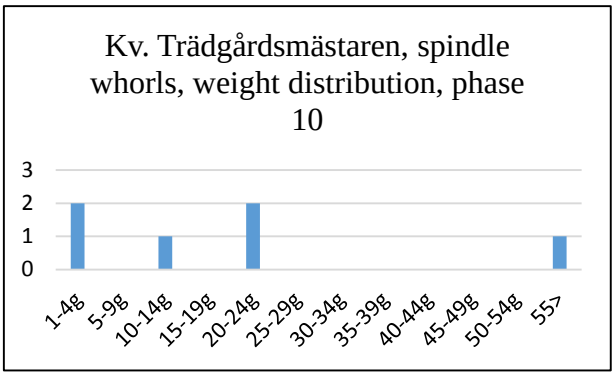


Chart 21. Weight distribution in phase 10. All spindle whorls from kv. Trädgårdsmästaren.

3.5.3. Summary

To sum up this chapter, I will briefly describe the general tendencies I have been able to observe from the distribution of textile tools in time and space. It is possible to highlight different stages in the production of textiles in kv. Trädgårdsmästaren during the period 985 to 1260.

985-1000: Previous interpretations on craft production in this context have stressed the very sparse nature of the activities in the 10th century (Söderberg 2011:23). What can be inferred from the number and the distribution of textile implements in phase 1, is that the textile craft appears to constitute a relatively large part of the activities in at least two or possibly buildings with hearths in the center. Both very light and heavier spindle whorls occur, which indicates that there have been tools to spin several different types of thread qualities. The presence of warp weighted looms can imply that both spinning and weaving was carried out in more than one building and this also testifies to established households already in the 10th century in Sigtuna.

1000-1020: In the early 11th century, in phase 2, the structure of the town yards have changed substantially with the addition of several buildings and more defined activity zones. There number of both spindle whorls and loom weights has increased slightly, which may indicate a population growth. Nearly all textile implements under study have been recovered in, or in very close connection to buildings over the entire area, but mainly in zone II, III and IV. The various craft activities do not appear to be separated at this stage, which could suggest that the production has not been organised to a greater extent.

1020-1075: In phase 3 the textile implements have increased, and loom weights in particular, indicating a more intensive stationary textile production than in previous phases. In phase 4, the second half of the 11th century, both light and heavy spindle whorls occur, although comparing to the other phases, the heavier tools predominate. The number of tools increase during this time period and the number of warp weighted looms can indicate an intensified textile production. Perhaps, the heavier spindle whorls were used to produce sailcloth, and other coarser fabrics. It is not possible to determine only by studying the spindle whorls, however, if we consider the context, the probability for sail production is high. From what we know about the trade connections and the imported goods, it is quite possible to assume that there has been production of sails in Sigtuna.

1057-1100: In phase 5, in the end of the 11th century, there seem to be a change in the production, as both the heavier and very light spindle whorls decrease in number, and the weight group 5 to 14 g increase. During the same time, a large number of Volhynian spindle whorls are brought into Sigtuna and their distribution are restricted to an area around plot II, III and IV in kv. Trädgårdsmästaren. Considering that the number of spindle whorls are almost equal to the number in phase 4, I would suggest that there may have been a qualitative change in the textile production during this time, and the Volhynian spindle whorls may have played a significant role. The finds of ivory combs in phase 5 to 8 in plot IV is also interesting, as the textile activities seem to be linked to the same buildings in all phases.

1100-1175: In phase 6 and 7, in the early and mid-12th century, the impressive number of loom weights present in previous phases are decreasing rather significantly (table 2). The development continues throughout the century, and loom weights are entirely absent during the mid-13th century. Such a drastic decrease in number of loom weights, may be due to the introduction of the horizontal loom, which made the process of weaving more efficient when the demand for textiles was great (Good 2001:210), and since the number of spindle whorls are the same as in the previous three phases, this interpretation may be likely. The possible pulley-blocks connected to horizontal looms, recovered in the end of the 12th century and in the 13th century, could perhaps confirm that this technology was in use during this time. In the contemporary town of Bergen in Norway, remains possibly connected to horizontal looms have been recovered in layers dated to before 1170 and 1413 which demonstrates that the technology was not only used in northwestern Europe during this time (Øye 1988:77).

The production seems to have been reorganised since the debris from comb manufacturing now are separated from the textile crafts. The textile production also seems to have shifted location, and is concentrated mainly in the eastern plots, where comb manufacturing had previously dominated.

1175-1260: During the end of the 12th –and beginning of the 13th century, there is a decline of both spindle whorls and loom weights. We must take into consideration that the cultural layers have been disturbed by more recent activities, and therefore the find material can not be considered as representative as in previous phases. The possible pulley block connected to the horizontal loom, in phase 8, could be an indicator for the use of this technology during the 12th and 13th century.

The zones where the textile implements occur most frequently are II, III, and IV, which are buildings of multifunctional character, buildings with corner hearths and the residential/hall buildings. In other words, in buildings mainly used as dwellings. Like the other crafts, textile production also appear to shift location during the centuries, and is kept separated from metal crafts, and comb manufacturing when they occur in the zone close to the main street.

Phase	Spindle whorls	Loom weights
Phase 1 (985-1000)	7	53
Phase 2 (1000-1020)	18	62
Phase 3 (1020-1050)	24	116
Phase 4 (1050-1075)	31	112
Phase 5 (1075-1100)	30	118
Phase 6 (1100-1125)	25	59
Phase 7 (1125-1175)	30	41
Phase 8 (1175-1200)	21	24
Phase 9 (1200-1230)	14	10
Phase 10 (1230-1260)	6	0

Table 2. A summation of number spindle whorls and loom weights in each phase. The drastic reduction of loom weights in phase 6 and onwards is noticeable, and likewise the continuity of spindle whorls. The correlation between the number of spindle whorls and loom weights from phase 3 to 5 is also worth paying attention to.

4. Textile tools and production in Birka

In this chapter, a comparison between the textile craft in Birka and the results from the analysis of the material from kv. Trädgårdsmästaren in Sigtuna, will be conducted. All textile implements recovered in Birka have been analysed by Andersson, and the finds relevant for this study are mainly spindle whorls (Andersson 1999a). Although, for a general picture of the nature of the production, other tools may be relevant to incorporate. There are source critical aspects to consider since the analyses have been conducted on different scales. In Birka, all tools from the excavations have been analysed, although only 6 to 7 % of the settlement area have been excavated, while the current study only covers a block in Sigtuna (. However, I do believe that with this in mind, certain qualitative aspects can be compared, which allows for reflections on the differences and similarities and can be useful for an understanding of the organisation of the production in kv. Trädgårdsmästaren.

It is not necessarily the number of tools that should be in focus, rather the ratio between the parameters of the tools from the two sites. Since only one spindle whorl of Volhynian slate has been found in Birka, the finds made of bone are in focus for a comparison of functional parameters. By comparing these spindle whorls from both contexts, the function and characteristics of the locally manufactured tools can display similarities or differences in the craft-tradition. Other aspects relevant to compare are the weight and material between all the spindle whorls from both contexts. Where the implements have been recovered is also relevant to consider, and if the distribution can imply a different situation than in Sigtuna during the following centuries, and the interpretations on nature of the textile production will also be highlighted.

4.1. Birka- a brief historical account

During the Vendel- and Viking age, around 7th to 9th century, specific places for craft production and trade/exchange, so called *emporias*, began to emerge in northern Europe. Birka, located on the island of Björkö, is a well-known site in these contexts and has functioned as a node between the east-western and north-southern routes in the Lake Mälaren and played an important part in long-distance trade in the Baltic Sea during the Viking age (Ambrosiani 2008:94; Gustin 2004:16). Birka has long been regarded as the predecessor of Sigtuna, since the establishment of the latter coincided with the decline of the site, however, the two urban sites had various functions and should be viewed as different phenomena which have emerged in specific contexts. Imported objects testify mainly to contacts with Western Europe, northern Germany and Poland during the 8th- and 9th century. During later parts of the 9th century Birka, had frequent connections with Eastern Europe and Byzantium, as well as for Sigtuna during the following centuries (Ambrosiani 2008:97; Gustin 2004:195). There are clear evidence for specialised craft production, and as in Sigtuna, bronze casting, gold smithing and comb

manufacturing occurred, and the distant location have required a supply of raw materials from the surrounding area to support the artisans (Ambrosiani 2008:97).

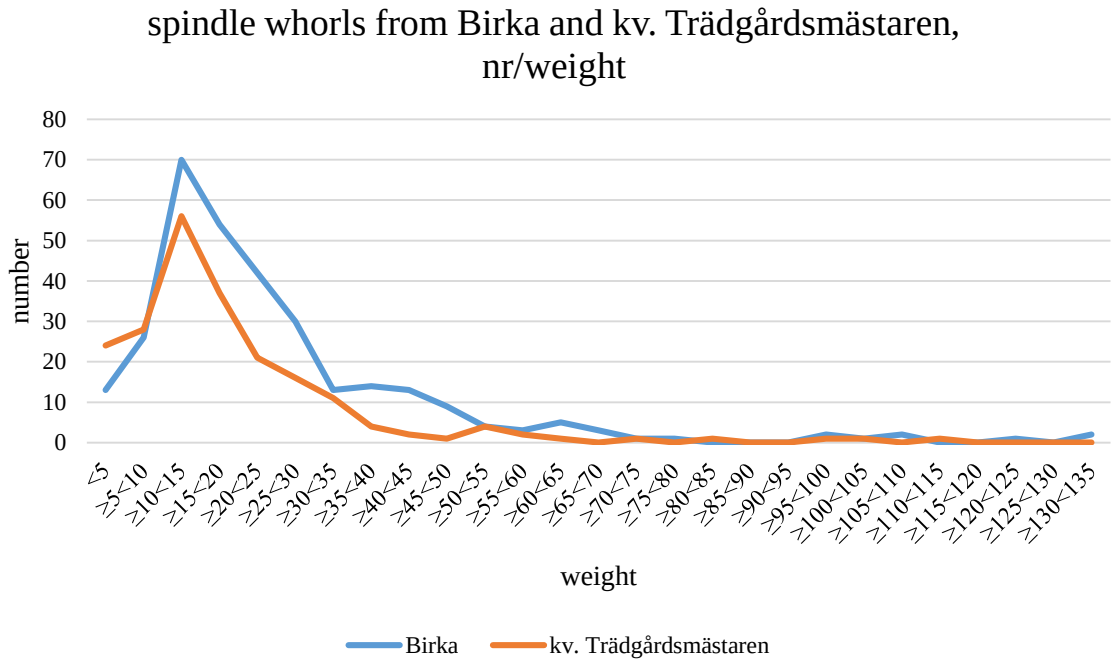


Chart 22. Weight distribution. All spindle whorls from Birka and kv, Trädgårdsmästaren

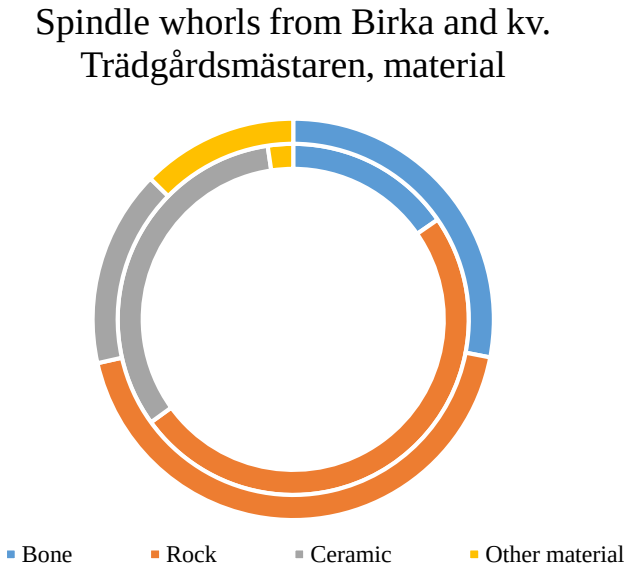


Figure 16. The inner circle display the material distribution in Birka, and the outer circle represent the material from kv. Trädgårdsmästaren in Sigtuna.

4.2. Textile tools

Andersson Strand conducted the analysis of textile tools from Birka and her observations and results are used here to compare with the material from kv. Trädgårdsmästaren in Sigtuna (Andersson 1999a). A total of 429 spindle whorls have been recovered in Birka from excavations conducted between the years 1870 to 1996. As in Sigtuna, the finds are made from various materials such as stone (50%), bone (15%), ceramic (33%) and other materials (2%) (fig 16). The stone spindle whorls are made from of gray sandstone, limestone, red and gray slate, soapstone and quartz, which all are imported materials (Andersson 1999a:49). In the Sigtuna material, spindle whorls of sandstone, limestone, slate and soapstone also occurs, however, one significant difference is the large number finds made from Volhynian slate. Only one find made from this kind of material can be seen in the Birka material, which is quite remarkable, and it should be added that it is the only stone spindle whorl with a biconical shape (Andersson 1999a:49).

The weight could be calculated for 309 spindle whorls, and the most common weights are in the range between 5 and 29g (chart 22). The weight distribution demonstrate a varied picture, although with a quite noticeable number of light spindle whorls, but also relatively heavy ones (Andersson 1999a:50). The spindle whorls weighing more 24g or more, are almost exclusively made of stone, which is not the case in Sigtuna, where the material is rather varied. It is evident that there is quite a large number of light spindle whorls in kv.Trädgårdsmästaren, when comparing with the material from Birka, and it further strengthens an interpretation that a production of fine quality textiles have been possible in Sigtuna. The most common weight range, between 10 and 14g, is equal for the material from both sites. The weight distribution demonstrate that there have been tools possible to spin threads of many different qualities in Birka, and the number of lighter spindle whorls are relatively large.

4.2.1. Loom weights

Since the study does not cover a detailed analysis of the loom weights from kv. Trädgårdsmästaren, their functional parameters cannot be compared, however, the number of finds may be interesting to consider. In Birka, 649 loom weights were found and a majority weigh between 400 and 800g. The number of loom weights from kv. Trädgårdsmästaren is 605, but in both cases, the number is assumed to have been greater since most are fragmentary and, in addition, not all the loom weights were retained from the very earliest excavations at Birka by Hjalmar Stolpe (Andersson 1999a:54). Nevertheless, it can highlight that the number of loom weights found in kv. Trädgårdsmästaren is relatively large.

4.2.2. Spindle whorls of bone

Out of the 429 spindle whorls recovered in Birka, 66 (15%) are made of bone. Out of the 429 finds, the shape could be determined on 386, of which the dominating shapes are joint ball type

(35 finds) discoid and flat convex (Andersson 1999a:49). Same situation can be observed in Sigtuna, where the Joint ball type is the most common. The weight ranges between <5 to 44g, with a concentration around 10 to 24g (chart 23). The spindle whorls from kv. Trädgårdsmästaren, display a slightly different pattern with a larger number of very light spindle whorls. The majority of diameters range between 35 and 44mm (chart 24) which is wider than other material groups, since the majority have been manufactured out of joint balls (Andersson 1999a:50). Another important observation is that these tools does not seem to have been further processed, in contrast to the finds recovered in Sigtuna. From the analysis of the spindle whorls from kv. Trädgårdsmästaren, it was evident that several finds made of joint balls displayed some alterations to the shape, and this may be individual expressions of adaptions to a different kind of production or raw material. The maximum height ranges between 5 and 30mm, and the majority of finds measure between 10 to 14 mm, and 15 to 19mm (chart 24). The most common diameters of the spindle-hole range between 7 and 10mm (chart 26), which are the same measurements as for the material from Sigtuna. The comparison between spindle whorls made of bone from Birka and kv. Trädgårdsmästaren demonstrate that these tools are rather similar in shape, weight, and in diameter of the spindle whorls and of the hole. The height is the only parameter which appears to be slightly different. However, in general, the comparison demonstrate that there have been a similar manufacturing of spindle whorls made of bone at both sites.

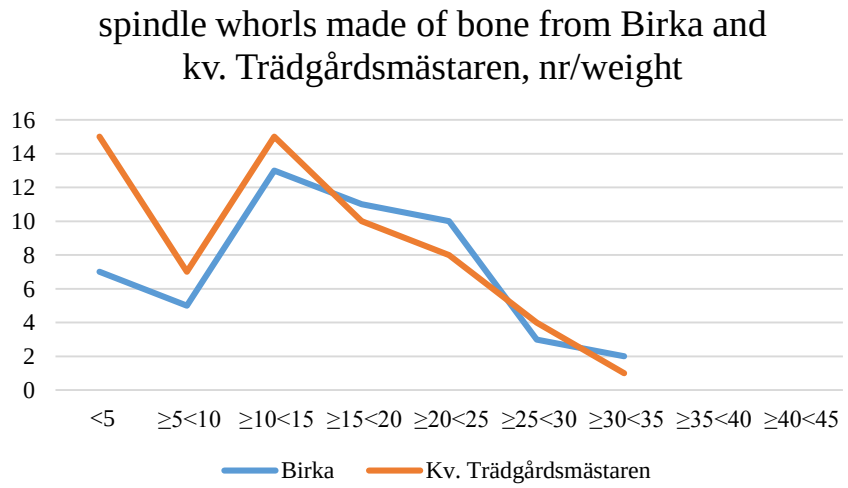


Chart 23. Weight distribution. Spindle whorls made of bone from Birka and kv. Trädgårdsmästaren in Sigtuna.

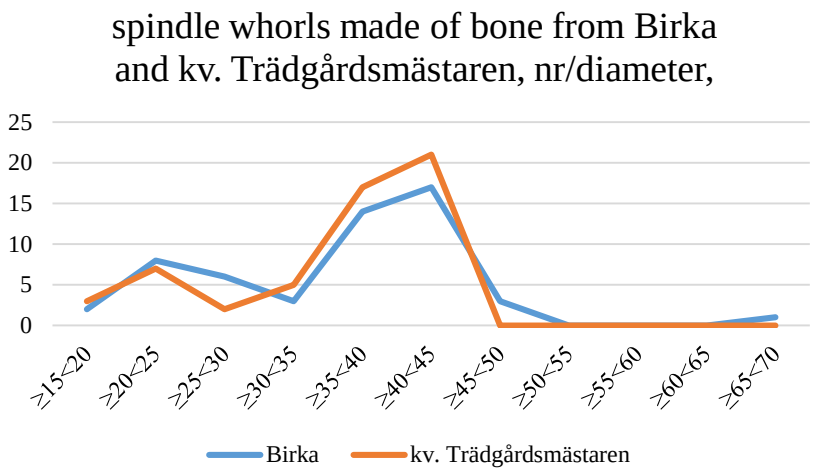


Chart 24. Diameter. Spindle whorls made of bone from Birka and kv. Trädgårdsmästaren in Sigtuna.

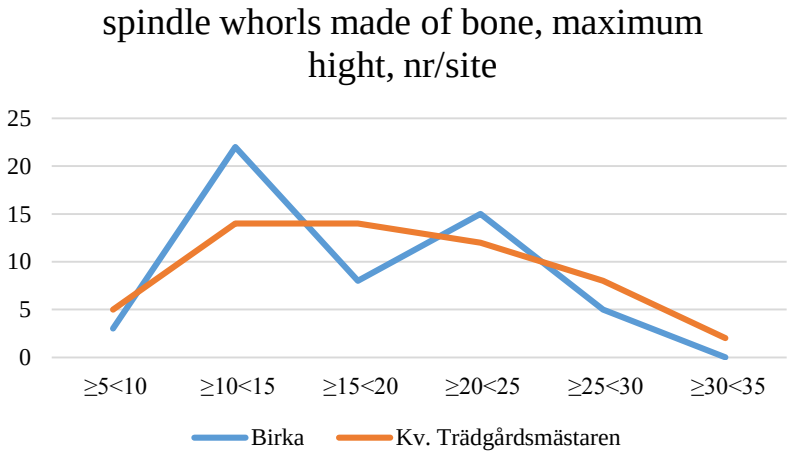


Chart 25. Height. Spindle whorls made of bone from Birka and kv. Trädgårdsmästaren in Sigtuna.

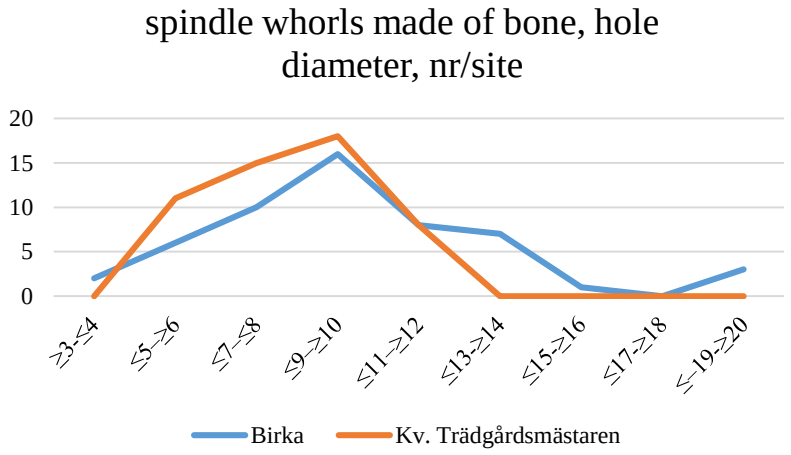


Chart 26. Diameter of the spindle hole. Spindle whorls made of bone from Birka and kv. Trädgårdsmästaren in Sigtuna.

4.3. Activity areas and chronology

The results from the analysis imply that both spindle whorls and loom weights are increasing in number in the 10th century, which is the youngest period of the town's history. This could be due to an increasing population during this time period, but it is also difficult to assess if the excavations have covered equally large areas from all time periods, to make the interpretation valid (Andersson 1999a:67). Andersson could not connect any specific type of thread production to a certain time period (Andersson 1999a:61). The textiles tools were found scattered over the entire excavation area, and was mainly concentrated in deposits for household- and metal waste. A majority of the tools were thus not found not in buildings (Andersson 1999a:65).There are no clear concentrations of loom weights or spindle whorls that could suggest specific workshops, however this does not mean that the production have not been organised and intended for consumers other than solely the members of the household (Andersson 1999a:66; 2009:14) Nor can specific workshops for textile production in Birka be ruled out.

4.4. The organisation of the production in Birka

To cover the need for textiles of the household would have demanded many people and taken a great deal of time (Andersson 2009:2). From the results from the analyses of both spindle whorls and loom weights, Andersson argues that the nature of the textile production in Birka probably was varied, but there are no indications of any significant change in the textile production between the mid-8th century and the second half of the 10th century, in Birka (Andersson 1999a:108). As the textiles from Birka have been analysed, Andersson has endeavored to try to demonstrate whether these fabrics have been possible to manufacture in Birka. Textiles in group II, "patterned twill fabrics of high quality", and group III, "ribbed fabrics and other tabby weaves of fine quality", are both of very fine quality, which would demand specialist knowledge and skills to manufacture. In addition, it would also be a very time-consuming activity and the time spent on producing textiles would have demanded that the artisans were provided with raw materials, which must have been of very high quality for this type of production (Andersson 2009:13f). Andersson argues, based on the analysis of textile tools, that it is possible that an *attached specialised production* have existed in Birka, although a majority of these high quality fabrics recovered in the graves have probably been imported to the site (Andersson 2009:13). This kind of fine quality textile could have been used as gifts or be intended for exchange.

What Andersson refers to as group IV, "diagonal twills", are textiles composed by a simpler kind of weave, and a majority of these has most likely been produced in Birka. This production have been large scale, and was most likely organised in a *household industry mode*, or a *putting out mode/Workshop production mode*. The textile analysis have showed that the weaves of these fabrics are rather standardised, and also the large number of tools suitable for this kind of textiles, imply that several people have been working simultaneously. Production

for the members of the household must also be considered to have been on a larger scale, and must have been very time consuming. Thus, many people were involved in the manufacturing of textiles, from raw material to finished products. It is also evident that different kinds of organisations could have existed simultaneously, and involved artisans with different levels of knowledge and skills (Andersson 1999a:66). The raw material must have been imported from the surrounding area to cover the needs for producing a sufficient amount of products, for all levels of organisations.

4.5. Summary

Although a comparison between the two sites can not be considered as entirely representative, it is nonetheless important to emphasize some of the differences and similarities observed. The variation of threads that have been possible to produce in Birka, from very thin to very coarse, can also be observed in kv. Trädgårdsmästaren. There are a relatively large number of lighter spindle whorls in Birka, according to Andersson (Andersson 1999a:67). The spindle whorls in kv. Trädgårdsmästaren demonstrate a larger number of lighter spindle whorls than in Birka. Although, one should be careful to compare the quantities of data in this case, it can highlight the relatively rare occurrence of spindle whorls of this weight. The spindle whorls made of bone from both contexts appear to be very similar in regard to weight and diameter which can suggest a similar craft-tradition (Zagal-Mach Wolfe 2013:40).

The textile implements in Birka do not occur frequently in connection to buildings, in contrast to Sigtuna, which may imply a difference in production organisation. The production of textiles in Birka was varied, and Andersson has promoted a variation of possible organisational modes. Most of the textile production was likely carried out on a *household production* level, as well as on a *household industry* level. The production of fine threads indicate that there may have been artisans with specialised knowledge, producing high quality textiles for a patron or for exchange, in an *attached specialist production* mode. It is interesting to notice that the textile implements increased in the end of Birkas existence, which could be an indication for an increased population (Andersson 1999a:67).

5. The textile production in kv. Trädgårdsmästaren- Discussion and conclusions

In the final chapter I will present my conclusions and discuss the results from the quantitative and qualitative analyses within the frames of the working model introduced. The results, which can not be seen as representative for the entire town area, demonstrate that throughout the early Middle Ages there are differentiations in the production of textiles in the farm yards in kv. Trädgårdsmästaren. This should be expected, since the demands for a variation of textiles must have been great, even when the production merely was carried out to supply the members of the household. Even though there have been a varied production throughout the period it is important to recognise the smaller changes, and I believe this is particularly important when

crafts initially connected to household activities, are concerned. The quantitative and qualitative differences I can observe could be indications for changes in demands, and in the society. Since my source material and timeframe is limited, I can only suggest possibilities and argue for probable interpretations, and I believe that these interpretations could function as a basis for further discussions on craft production in the town and for a further development of the research on textile tools.

5.1. The spindle whorls

What different types of spindle whorls can be seen in the material and what kind of threads can be inferred from the analysis of spindle whorls made of Volhynian slate and bone?

The analysis of the spindle whorls can demonstrate that a variety of thread qualities has been possible to spin, in kv. Trädgårdsmästaren between the late 10th century and the mid-13th century. The spindle whorls made of Volhynian slate and bone, display distinctive differences in function and characteristics. The spindle whorls made of bone do not show any significant standardisation in regard to their function and several types of thread qualities, from very thin to very coarse, have been possible to spin in all the periods. When observing the chronological distribution it is evident that in every phase, there has been a variety of tools from this category. The comparison with the spindle whorls from Birka demonstrate that the ratio between the tools parameters are very similar, which can indicate a similar craft-tradition.

The Volhynian spindle whorls clearly differ from the previous category. A majority display a distinct standardised design, and have been possible to use for a production of finer threads with the proper quality of raw material. Since only a few textiles have been analysed, it is not possible to tie the spindle whorls to a specific type of fabric, however perhaps they were most suitable to use when spinning flax. An analysis of the loom weights from the context could indicate the potential of various types for weaves, and thereby clarify the situation further. An important aspect to further look into, is the pattern displayed by the weight distribution of the spindle whorls which may indicate tendencies for toolkits. Even though we can assume that a not all spindle whorls have survived *in situ* and other parameters should be added, some observations can be made. Based on the spatial distribution of the material remains, there seems to be a large variation in weights between spindle whorls within several buildings where two or more are present. If this can be considered representative is a source critical issue, but it is a frequent pattern that may indicate that there has been possibilities to spin a variety of thread thicknesses in the same buildings.

The raw material available for the textile artisans has most likely been wool, flax and hemp. The cultivation of hemp in the Viking age around Lake Mälaren, and the indications from the analysis of a textile fragment found in the context, suggest that hemp was used (Andersson 2007:150; Lundwall 2004). The occurrence of smoothing stones in several phases, suggest that flax probably was processed in context as well and used for spinning threads. What can be assumed is that the textile fragments composed of wool and hemp, analysed by Lundwall may have been manufactured at the site, according to the analysis of spindle whorls (Lundwall

2004). Further analyses of the textile remains from the site could shed a light on the kind of materials and techniques that were used, and be compared with the tool analysis.

5.2. Reflections on function and provenance

What can the results imply, when provenance is considered?

The imported tools, the Volhynian spindle whorls, should be seen as a part of the textile production in Sigtuna during most of the early medieval period. They should also be recognized as imported objects which have entered an already established craft tradition (Sørensen 1987:95f; Zagal-Mach Wolfe 2013:40). Since these tools can not be considered as single imported objects occurring only in a few periods, they can be assumed to have influenced the local craft production and the artisans. There is an inflow of the spindle whorls in the end of the 11th century when most of them appear gathered in the buildings in one zone, and there is a general increase in the occurrence of lighter spindle whorls and a decrease of heavier. During the same period, the influences from Rus are most prominent, which is visible in the material culture recovered in Sigtuna (Roslund 2001:518). The affinity between the imported- and local objects is a question which would be discussed more thoroughly if all the tools from the excavation had been thoroughly analyzed. These tools do display functional differences when comparing with the locally manufactured spindle whorls of bone, however, to draw further conclusions all spindle whorls must be analysed and the provenance of the material should be determined.

An interesting phenomenon is the standardised nature of the Volhynian spindle whorls. The inflow of imported Slavic pottery also display a similar proceeding, where only a restricted assemblage of vessels with a similar function, is brought in to Sigtuna (Roslund 2001:521). Analyses of the spindle whorls recovered in Kiev Rus could provide information on if there is a greater variety of Volhynian spindle whorls, in terms of function, but this information has not been available for this study. Since the inflow of Volhynian spindle whorls occur during nearly the entire period I believe that they may have had an impact on the craft-tradition and the textile artisans, but not merely as functional objects. I have discussed the Volhynian spindle whorls and their function, but the main importance of these objects for the artisans in Sigtuna may have been their provenance and their rareness. These objects have not been recovered outside of the medieval town, and their restricted distribution must have meant that they were regarded as fairly exclusive in the area. The red slate from Ovruch had a symbolic value in Kiev Rus, meaning that the spindle whorls were desirable items with a significance beyond function as tools for thread production. They may not have been valued in the same manner in Sigtuna, however, the unusual material and origin has probably been of great value to the artisans in Sigtuna who had access to these tools, and had an impact on their identity as textile producers handling high quality tools from a distant area to produce fine quality threads.

5.3. The scale, concentration and production context

Can the distribution of the textile finds implicate specific areas for the production of textiles? How can this pattern be interpreted?

The ***context*** where the production is performed is defined by Costin as the nature of the administration of the production (Costin 1991:8). Were the artisans working with textile production within the town yards in kv. Trädgårdsmästaren attached to an elite or royal authority? Or were they independent, and produced for a wider market? Or was it merely a production for the household during the whole period? I believe that the situation during the early Middle Ages in Sigtuna was varied and more dynamic than what each of the explanatory models suggest. I also believe that the situation may have differed between households in certain periods, as the results from the spatial analysis suggests. In kv. Trädgårdsmästaren there are clear evidence of the performances of textile artisans, however, it is not known from any written sources what kind of textiles that were produced, nor whether they were used as payment of taxes, involved in trade/exchange or as gifts providing elites with the power to maintain their social status and create social bonds (Roslund 1990a:54).

The royal presence is evident in form of coinage, the manufacturing of weights and the king's residence in the center of the town. The material culture testifies to the close trade links with mainly Kiev Rus, but also to Western Europe, and these connections should not solely be understood on the basis of financial aspects. Sigtuna in the early Middle Ages was a town in large part built on an ideological and royal foundation, where the craft should be seen as a crucial part of the changes and maintenances of the existing social structure. We should consider the other crafts occurring in the context simultaneously in order to obtain a more complete picture. The organisation of comb manufacturing have been studied by Pettersson, who proposes a development similar to the situation in Lund, influenced by Christophersen's stages of organisation, from "husflid" to "markedsproduksjon" (Pettersson 2007:13). Söderberg & Gustavsson propose a similar development for the metal craft, with a sparsely household bound production in the 10th-and early 11th century, administered by nobles who is believed to have owned the town yards (Söderberg & Gustavsson 2007:36). The nature of the craft changes into a larger scale production during the mid to late 11th century, which workshops and production of bolt locks suggest (Söderberg & Gustavsson 2007:33). Possibly there has also been attached specialists working for patrons connected to the church in the early 12th century. The context in which the textile production was carried out could thus be connected to political authorities and *attached* specialists, at least from the 11th century and onwards. The textile production could have followed a similar development, but was perhaps organised differently. It should not be understood as a straightforward development where the domestic production is replaced gradually, rather as a production carried out on many levels simultaneously which also adapt to the prevailing needs of different types of textiles. I argue that this variation is possible to discern from the results of the analyses, and it may also be the most important aspects to consider in regard to the organisation of the production.

The ***scale*** of the production is related to the number of artisans working and the level of products produced (Costin 1991:15). The number of tools in this context appear to be relatively high, when comparing with the total number from other sites. For example in Birka, a total of 429 spindle whorls were found, and at Coppergate in York the 236 finds of spindle whorls represent one of the largest collections ever recovered from a British site, and from the excavations in the contemporary town of Bergen in Norway, 206 spindle whorls were recovered (Andersson 1999a; Walton Rogers 1996:1731; Øye 1998). We must remember that the finds were found within an area with remains of only five town plots in Sigtuna, and that the total number of textile implements from town is much higher. We also need to take into consideration that the total number of spindle whorls were probably higher, since many of the finds made from organic materials might not have been preserved. Tesch calculated the number of inhabitants living within the different farm plots to be between 5 and 10 people (Tesch 1990:35). Considering this and the number of tools, the production of textiles should have involved many of the inhabitants in the town yards. A production covering domestic needs certainly appeared to have required a lot of time and effort, primarily the process of spinning, however, the number of textile tools required should be only a few per farm (Andersson 2003a:113). Thus, between phase 3 and 7 (1020-1175), it is a possibility that the production covered more than household needs. A comparison with the production in contemporary rural environments would be interesting in this regard, however, this does not fit within the scope of this paper. It is important to consider the source critical aspects in regard to the increase and decrease of textile implements, since many different factors may affect the situation. In order to cover the needs of a growing population the production for the domestic unit would have to increase. However, considering the relatively high number of textile implements in this context, I argue that it is possible to suggest that the textile production was intended for consumers outside of the domestic unit during this time period.

The ***concentration*** of the production is what Costin refer to as the spatial arrangement of the production activities, and this aspect have been available to observe in this context at some level (Costin 1991:13). Although the situation can not be summarised in a simple manner, some occurrences can be noted. The textile implements in kv. Trädgårdsmästaren are mainly distributed within, or in close connection to buildings described as multifunctional and residential, in the zones II, III and IV. Even though the spatial distribution may not be strict evidence for activity areas, it does provide a pattern which could be used as a basis to argue for the division of spaces and the organisation of the crafts. One important observation is that the loom weights and the spindle whorls often have been recovered in the same buildings or in close connection to one another. This phenomenon is more prominent in some time periods, when a few buildings appear to have been the main areas for spinning and weaving, and where several artisans may have been working simultaneously. One building has previously been interpreted as a weaving workshop, namely the nr 225a, where several textile implements and the remains of a warp weighted loom were recovered (Söderberg 2011:58). There are no explanation for the interpretation in the excavation report, which makes it difficult to ensure on what grounds the interpretation was made. This building was relatively small, and did not

contain any visible evidence for other craft activities. With this in mind, this could be seen as a building intended mainly for weaving and perhaps spinning. However, a majority of the buildings, in which textile implements were recovered, contained remains of other craft activities.

I have brought forward a few buildings which have the most prominent evidence for stationary and mobile textile activities, however, several other buildings contain one or two spindle whorls in nearly all phases (Appendix 2). I can observe a pattern where the spindle whorls correlate with the occurrence of loom weights, which could suggest that the activities have mainly been carried out in the same area, although spinning was most likely performed in a majority of the buildings while weaving was more restricted to buildings with more favorable conditions. Whether these buildings can be defined as workshops for textile production is difficult to say, since the question of how a workshop for textile production in Sigtuna during the early Middle Ages would appear, is difficult to answer. However, this may not be the proper way to approach textile craft during this time period. Too much emphasis is put on the space where the activities have been carried out, but the space is often defined by the occurrences of textile implements, and thus both the space and the production is regarded as domestic. I believe that household may have been the main areas for textile craft during the period under study, however, as previously discussed it is important to not confuse the concept of the household and the household unit with the modern view of its associated activities, since the space most likely have been used and divided differently. The crafts carried out in this sphere could have had economic and social value, and most importantly, the household has not been an immutable space.

When observing the distribution of textile implements in relation to other crafts, the division of the activities in space does not appear very clear since in most cases there are traces of a variety of crafts in the same building (fig 11, 13, 14). Most prominent is the relation between comb manufacturing and textile production, which seem to change during the 12th century when debris from the former craft increase drastically and shift location to zone I. Simultaneously, both spindle whorls and loom weights appear concentrated in plot IV and V, meaning that the textile activities have been relocated. In Birka, a majority of textile implements were not found in buildings, which may imply differences in the organisation of the production between the two sites. The space for textile production on Viking Age Iceland was restricted to pit-houses, and separated from other activities. This changed in the 12th- and 13th century when the cloth became important as a valuable export commodity, and the production took place in the household (Malek 2012:123). Most likely, the textile production in kv. Trädgårdsmästaren during this time could be understood as a craft most prominent in household environments organised within the domestic unit where a production of textiles have extended beyond the households needs during the late 11th and onwards, but has also been carried out to support the needs required by the own household. The indications for relocation and change provided by the spatial analysis are interesting since it shows that the textile activities have influenced and been influenced by other craft activities and their spatial organisation.

5.4. The production organisation

What was the nature of the textile production in kv. Trädgårdsmästaren during the early Middle Ages, and is it possible to see changes in the textile production over time?

How can we make sense of the relation between the material culture, the actors and the context? It is difficult to draw definitive conclusions on the organisation from the material, and I would again like to stress that the development may not have been linear, from simple to complex. In some periods the production was most likely carried out on different levels, as the results may suggest. The variations demonstrated by the results suggest that in nearly all phases, a production of both fine quality - and coarser threads have been possible. This in turn can be traced to the need for a variety of textiles.

The period under study is difficult to understand, but it is nonetheless intriguing. It is often seen as a transition period when everything takes off, and the minor changes and processes are important for understanding this transition. The political actors, the kings and bishops, have certainly been of great importance for Sigtuna, and also the contacts that were formed and maintained with other locations outside the Scandinavian area. As I have previously discussed, textile production should be viewed upon as an important part of the society and can certainly be connected to urban development, and the question of how the craft production was organised is definitely relevant in this respect. Both quantitative and qualitative changes can be suggested, and it is also possible to draw some conclusions from the comparison with Birka.

From the observations on the function of the spindle whorls and spatial distribution of textile implements, I suggest that there have been an intensive period of textile production from 1020 to 1175, and it is within this period it is possible to discern possibilities for production on different levels. Just an increase of textile tool is interesting, as it can be linked to a greater need for raw materials. Since there have been very few indications of animal husbandry within the context under study, this was probably supplied by farms in the surrounding countryside, and perhaps even further away. It may also have contributed to changes in the landscape associated with an increased political control.

The general perception of the crafts in Sigtuna during the late 10th century is that it was mainly performed to cover the needs of the household. The textile implements can confirm that there were spinners and weavers producing textiles in the town yards during this time, but since there are very few buildings in this phase, it is difficult to determine the extent of textile production. The craft was most likely carried out at a ***household production*** mode, where artisans belonging to the domestic unit were producing textiles for its members. We need to consider the large amount of threads needed, not only for clothes but for utilitarian textiles. The result is important because it demonstrates that there was established households already at an early stage in Sigtuna, with both weavers and spinners that provided a variety of different of textiles.

During the second half of the 11th century, specialised artisans associated with metal crafts and comb manufacturing are present in the workshop area close to the main street. During this period, I can also observe an increase of textile implements and discern some changes which

may indicate production of different types of textiles at various levels. The number of textile implements testify to a large demand of products, and this means that the provision of raw materials must have been extensive and required organisation, since the households is not likely to have been self-sufficient. In the mid-11th century, there are a large number of heavier spindle whorls in nearly all buildings. Heavier spindle whorls are suitable for producing coarser threads intended for sailcloth for example. The need for sails in this period would have been quite great, in respect to the increased mobility overseas and the large number of imported objects recovered in the context. There should also have been a possibility to repair sails. I cannot state whether there was a production of sails during this time period solely based on the data available, however, I can conclude that there have been a relatively large number of tools possible to spin the kind of threads suitable for this kind of coarser textiles and if so, the production had to be organised and the provision of raw material had to increase.

In the third quarter of the 11th century, the lighter spindle whorls have increased significantly, at the expense of heavier ones. This appear to be partially due to the relatively large number of Volhynian spindle whorls, which are brought in to Sigtuna during a period when trade connections with Kiev Rus may have been intensified and these kind of spindle whorls was desirable objects in Kiev Rus, not only due to their function as tools. Based on observations made in experimental archeology, skills and experience would have been very important it would demand specialised knowledge and be very time consuming to spin a thread with the lighter spindle whorls. The kind of thread possible to spin with the lighter spindle whorls are very thin, and there is not a possibility to spin a coarser thread. The large number of light spindle whorls could suggest that several of the textile artisans active during this period had this kind of specialised knowledge. The time spent on manufacturing and the specialist knowledge may suggest that the artisans were ***attached specialists***, who produced high quality textiles for an elite patron or as a commodity intended for trade/exchange. The quality of raw material would have a large impact on the spinning process, and thus the artisans must have been very aware, and have a great knowledge of all the steps in the production process.

I have promoted the possibility that the weaving technology gradually began to change during the mid-12th century which could suggest a further professionalisation, and may imply that the demand for textiles increased during this period. The horizontal loom was introduced in towns in North-western Europe in the 11th and 12th century and the artisans in Sigtuna was seemingly keeping up with the technological development (Walton Rogers 1996:1815). There is thus, according to the model, a possibility that the artisans were producing textiles for a wider market at ***Household industry*** level or in a ***Workshop production*** mode during the 12th century. The textiles could thus have been an important part of the economy of the households. The professionalisation could have contributed to a liberation from reliance on an administrator at some extent and enabled independent specialists to produce and acquire goods (Andrén 1985:84)

The extent of the textile production in later periods is difficult to determine. The presence of textile tools decrease, but the cultural layers have also been disturbed by later activities, and therefore the conditions for preservation have not been ideal. There are still a considerable

number of spindle whorls occurring in the late 12th- and early 13th century, which can be seen as an indication for continuous textile activities during 13th century.

The period under study is vague, in the sense that there are not many historical sources that can testify to the everyday activities performed by artisans, and to the products they were creating. The demands for different kinds of textiles would surely have affected how the production was organised, and most importantly in this regard, the provision of a sufficient amount and the proper quality of raw material would require changes in the landscape, trading connections and the social organisations. Thus, these trends I have proposed could have had a large impact on the society, and the artisans performing textile craft.

5.5. Craft, agency and identity

The results of a variety of choices and performances are what we study as archaeologists, since the material culture have been created and used in the past. The variation and complexity of the craft production has been brought forward, and through the analyses of both the textile tools and their distribution, the great variation in both function, time and space contribute to enhance this. The possible choices have been many, and there have been several ways to perform and alter any of the steps in the process. There are changes over time, although not always in an in linear development. If we view the artisans as actors with different abilities and skills, multiple identities, capable of making the technological choices reflected by the context they find themselves in and the actors who they interact with, the multiple dimensions of the production and the performances can be highlighted.

The material culture can be seen as concepts which contain all these aspects. Since textile production on all levels have required experience and knowledge of the whole production process, the artisans must have had the ability to influence and make decisions about alterations, particularly regarding raw materials and technology which the non-producing population were not. The group of spindle whorls made of bone that have been altered in shape are interesting to consider in this regard, as it may be visible traces of technological choices affecting the performance as well as the final product. This can also demonstrate the individual adaptions of artisans to the demands from the society, testify to the capability and knowledge of making these technological choices to suit specific conditions. The artisans were driven by the standards and requirements from the society, but could control the creation of material culture in their own way.

The large number of lighter spindle whorls, suitable for a production of very fine threads, is evident particularly in the end of the 11th century. This suggest that the artisans using these tools had a great knowledge of the technique, and had gained a lot of experience. As Costin and Brumfiel have proposed, there may have been a connection between the production of high quality textiles and the creation and manipulation of identity (Brumfiel 1998:150; Costin 1998a, 1998b). The artisans producing for a patron may have gained a certain social status associated with their skills and specialist knowledge. It is the social relationships between the producers, the artisans and the consumers that shape these identities.

6. Summary

In this thesis, textile tools and urban production in early Middle Ages in Sigtuna have been in focus. Textile production is a field within archeology that often have received vague attention in many contexts. The reason may be due its association with the household sphere, which has often been perceived as immutable and the activities have thus not been recognized as important for society at large. It is also rare that textiles are found in archaeological contexts as they are often not preserved. Much research has been carried out on textiles and dress styles, however, tools such as spindle whorls and loom weights have not been given equal attention. My aim with this thesis has been to give special attention to the tools for textile production in an early medieval urban context and examine the function of the spindle whorls and the nature of the textile craft. I give particular attention to the Volhynian slate spindle whorls brought in from Kiev Rus, and the locally produced spindle whorls made of bone. By measuring and weighing the spindle whorls I have been able to draw conclusions on the thread quality possible to spin. By examining the spatial and chronological distribution of spindle whorls and loom weights in the context I have also been able to reach new interpretations on the nature and organisation of the textile production. A comparison with Birka is conducted in order to study the regional changes over time between the two sites.

My conclusions are that the artisans in kv. Trädgårdsmästaren had the possibility to produce a variety of thread qualities throughout the early Middle Ages both with the Volhynian spindle whorls and the bone spindle whorls. The Volhynian spindle whorl are evidently standardised and may have been used for a certain kind of thread production, or intended for a specific type of raw material. Through a comparison of the spindle whorls made of bone from Birka and kv. Trädgårdsmästaren I can draw the conclusion that the tools are very resembling which may indicate a similar craft-tradition. I argue that the most intensive period for textile production in the context was between the mid-11th- and the 13th century, and that there have been different levels of production during this period. I have suggested that the horizontal loom was introduced during the mid-12th century, contributing to making weaving more efficient and a production of textiles intended for an external market could have been possible. The textiles can thus have been both socially and economically valued, and the different ways in which the craft have been organised can be viewed as important aspects of changes in society.

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Appendix 1- List of finds of spindle whorls made from bone and Volhynian slate in kv. Trädgårdsmästaren, Sigtuna.

1.1. Spindle whorls made of bone

5 finds were in poor condition and have therefore not been available to include in the qualitative analysis. All finds are included in the spatial analysis.

Find nr.	phase	weight	plot	diameter	height	Hole diameter	shape	Hole shape	Remarks
231	11	17		44	23	10	joint ball	cone	
406	11	22		41	26	11	joint ball	cone	
2086	9	10	III	37	16	6	j.b. processed	plain	carved
2121	8	9	II	35	13	7	joint ball	cone	
2187	10	3	III	34	12	11	fragment		Fragmented, antler?
2281	8	32	II	44	31	10	joint ball	cone	
3832	7	14	II	31	13	9	discoid	plain	cut in one side, circle decoration
4736	8	23	IV	42	22	11	joint ball	cone	
5239	8	25	III	42	31	9	joint ball	cone	
6284	7	5	III	39	14	8	fragment		fragment, two cut marks
6395	9	16	III	40	20	9	joint ball	cone	
6435	8	19	III	-	-	-	-	-	-
7638	4	10	III	36	14	11	j.b. processed	Cone?	carved
7716	4	2	II	23	12	9	joint ball	plain	
7717	4	3	II	-	-	-	-	-	
7813	6	11	III	38	14	9	joint ball	plain	
8750	5	14	III	-	-	-	-	-	
8830	7	12	III	38	17	9	joint ball	cone	
9111	5	27	III	43	27	9	joint ball	cone	
9133	4	2	III	36	18	9	joint ball	cone	Hollow top?
9514	3	2	II	22	11	7	joint ball	Double cone?	
9747	5	3	III	23	10	6	j.b. processed	plain	flattened at the bottom
9902	4	1	III	19	7	6	joint ball	cone	
9933	5	10	III	38	15	8	j.b. processed	plain	uneven hole, carved and flattened at the bottom
10118	3	15	II	40	18	9	joint ball	cone	
10557	3	1	III	20	8	8	joint ball	plain	

10642	1	1	III	16	6	6	conical	plain	decorated with a cut furrow, lathed
11219	4	18	III	41	20		joint ball		intermediate
11448	1	25	II	40	26	9	joint ball	cone	
12073	5	20	II	40	28	10	joint ball	cone	Hollow top?
13201	2	5	III	27	12	6	joint ball	cone	
13290	9	11	IV	39	8	6	discoid	plain	slightly convex, decorated with concentric circles and cut vertical lines
13816	8	22	IV	42	23	8	joint ball	plain	
14628	7	13	IV	39	23	8	joint ball	cone	
14704	7	3	IV	39	19	6	joint ball	cone	
15339	6	2	IV	21	10	6	joint ball	Plain?	hole not centred
15754	6	2	IV	19	7	5	joint ball	cone	slightly cone shaped hole
15941	5	3	IV	26	13	8	joint ball	plain	
18970	7	15	IV	36	28	8	joint ball	cone	in bad condition
19191	7	20	IV						
19366	11	18		39	25	9	joint ball	cone	
19791	7	8	V	24	17	7	conical	plain	lathed
19821	2	2	IV	20	11	6	j.b. processed	cone	cut into a cylindrical shape, convex bottom
20698	7	13	V	37	21	8	joint ball	cone	clear hollow top
20943	8	18	V	40	24	8	joint ball	plain	
20944	8	11	V	40	15	7	j.b. processed	plain	cut to become more conical
21059	9	11	V	35	16	10	joint ball	cone	
21112	8	11	IV	34	15	6	conical	cone	
22027	7	7	V	33	16	11	j.b. processed	cone	cut into a lenticular shape, bad condition
22339	11	12		40	17	8	joint ball	plain	
23044	5	13	V	37	19	9	joint ball	plain	
23335	6	23	II	40	26	11	joint ball	cone	
24774	4	7	II	35	16	10	j.b. processed	cone	almost biconical or lenticular, processed
24952	6	4	V	30	11	12	joint ball	plain	bad condition, hole not centred
25163	6	17	V	42	21	12	joint ball	cone	
26017	4	24	I	42	26	10	joint ball	plain	
26396	2	19	II	41	20	-	joint ball		intermediate
26397	2	27	II	41	20	-	joint ball		intermediate, sign of hole
27523	6	8	I	-	-	-	-	-	-
28120	5	20	I	43	20	8	joint ball	cone	Hollow top?

1.2. Spindle whorls made of Volhynian slate

Find nr.	Phase	Weight	Plot	Diameter	Height	Hole diameter	Shape	Hole shape	remarks
1 No ID		21		29	17	8	flat spherical	plain	concave top
2 No ID		22		30	16	8	flat spherical	plain	
3 No ID		13		24	14	9	biconical	plain	slightly concave top
4 No ID		24		31	17	10	flat spherical	plain	ridges inside
5 No ID		17		27	15	8	flat spherical	plain	decorated with diagonal cuts
6 No ID		10		24	13	8	flat spherical	plain	small raised edge around the hole
7 No ID		15		26	14	8	biconical	plain	
8 No ID		11		23	13	8	flat spherical	plain	
9 No ID		17		27	15	9	flat spherical	plain	
10 No ID		17		27	16	9	flat spherical	plain	concave top
11 No ID		17		29	15	9	flat spherical	plain	
12 No ID		11		23	13	6	flat spherical	plain	concave top
3984	8	11	III	24	12	7	flat spherical	plain	concave top, slightly biconical shape, decorated with cut marks
4797	8	19	III	27	16	7	flat spherical	plain	slightly cone shaped hole
4846	9	8	III	22	10	7	flat spherical	plain	flatter in the shape
5034	8	13	III	24	13	7	flat spherical	plain	
5035	8	13	III	25	13	8	flat spherical	plain	concave top
6473	7	12	III	24	13	8	flat spherical	plain	slight concave top
7641	4	19	III	27	19	9	biconical	plain	
7662	6	10	III	24	13	9	flat spherical	cone	grey in colour
8567	5	14	II	26	14	8	flat spherical	plain	concave top
8598	6	5	III	19	12	7	biconical	plain	concave top
8680	6	15	III	27	12	8	flat spherical	plain	decorated with cut marks
8972	5	16	III	28	13	8	flat spherical	Cone ?	slight cone shaped hole, concave top, ridges inside

8993	4	17	II	28	15	8	flat spherical	plain	slight biconical shape, cut marks over the whole surface
9089	5	13	III	24	16	8	biconical	plain	hollow top
9358	5	8	III	21	13	8	biconical	plain	concave top
9535	5	19	III	30	16	9	flat spherical	plain	slight biconical shape, dark grey in colour
10450	3	17	III	27	16	8	flat spherical	plain	
11951	3	8	II	22	13	7	flat spherical	plain	
13292	9	14	IV	26	14	10	flat spherical	plain	several cut marks around the hole
14418	9	13	II	25	13	7	flat spherical	plain	small raised edge around the hole, concave top, slight biconical shape
14462	5	8	IV	22	12	8	biconical	plain	ridges inside
15102	7	13	IV	26	13	9	flat spherical	plain	ridges inside, concave top
15231	7	7	IV	21	10	8	Biconical, flat	plain	flatter in shape
17115	7	12	V	24	14	8	flat spherical	plain	concave top
17615	3	11	IV	27	11	11	biconical	plain	flatter in shape, hole slightly uneven
17965	3	8	IV	22	11	8	Biconical, flat	plain	flatter in shape
18517	5	9	V	27	9	11	Biconical, flat	plain	flatter in shape
19312	5	8	IV	22	12	9	Biconical,	plain	concave top
20196	7	11	IV	24	12	8	flat spherical	Cone ?	slightly cone shaped hole, concave top
23067	9	6	II	20	11	8	biconical	plain	concave top, decorated with cut marks
23656	5	12	II	25	13	9	flat spherical	plain	concave top
25346	6	11	II	23	13	8	flat spherical	plain	slight concave top
25430	6	19	II	28	18	10	flat spherical	plain	hollow top?, rounded
26918	11	13		24	15	9	flat spherical	plain	concave top, cut mark next to hole
27143	7	15	V	24	16	9	flat spherical	plain	rounded
28390	7	9	V	20	15	8	biconical	plain	Hollow top? Decorated with cut marks

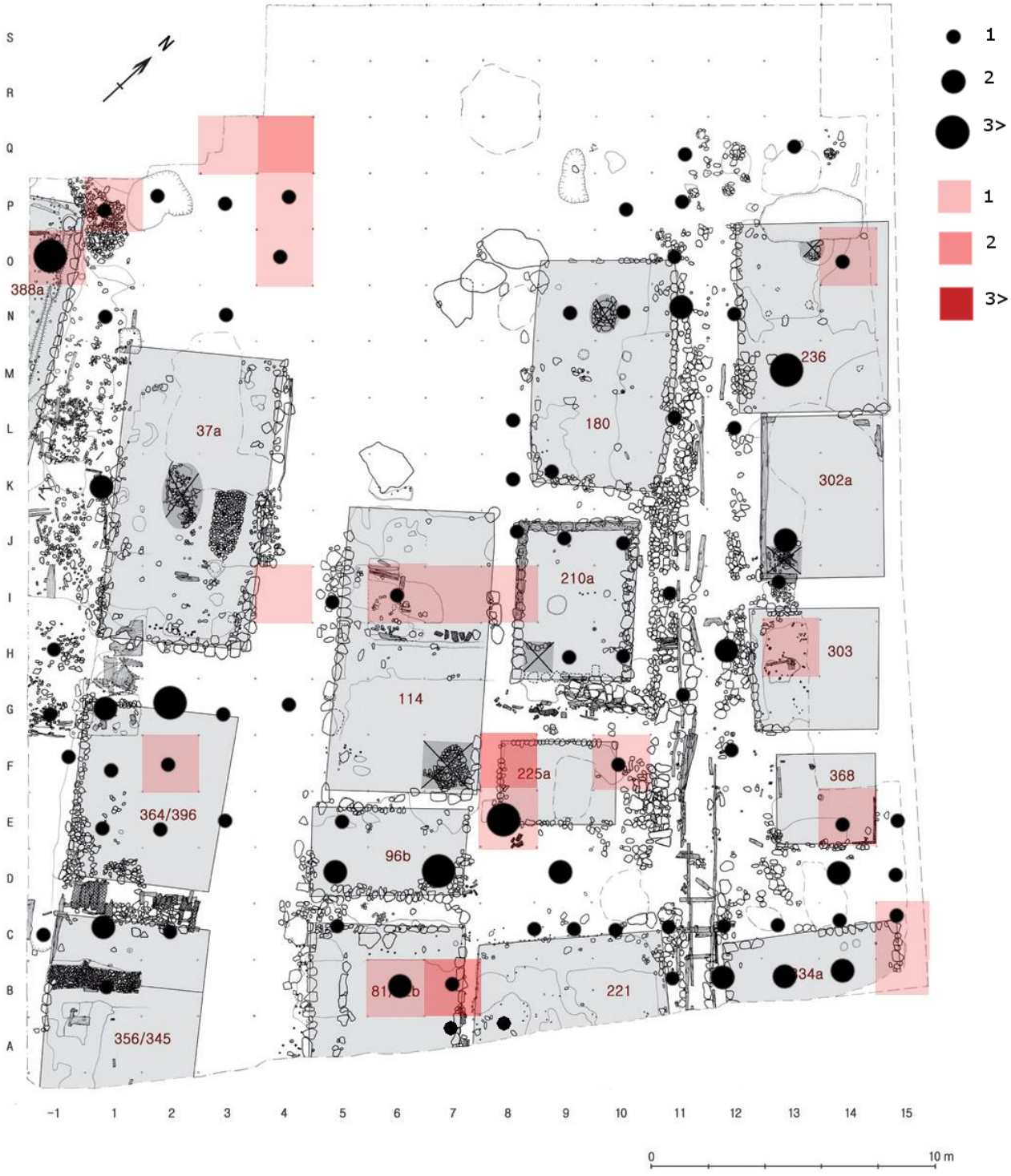
Appendix 2- Maps displaying the distribution of spindle whorls and loom weights in kv. Trädgårdsmästaren, Sigtuna

Red squares represent the distribution of spindle whorls according to unit (2x2 m), and black circles represent finds of loom weights.

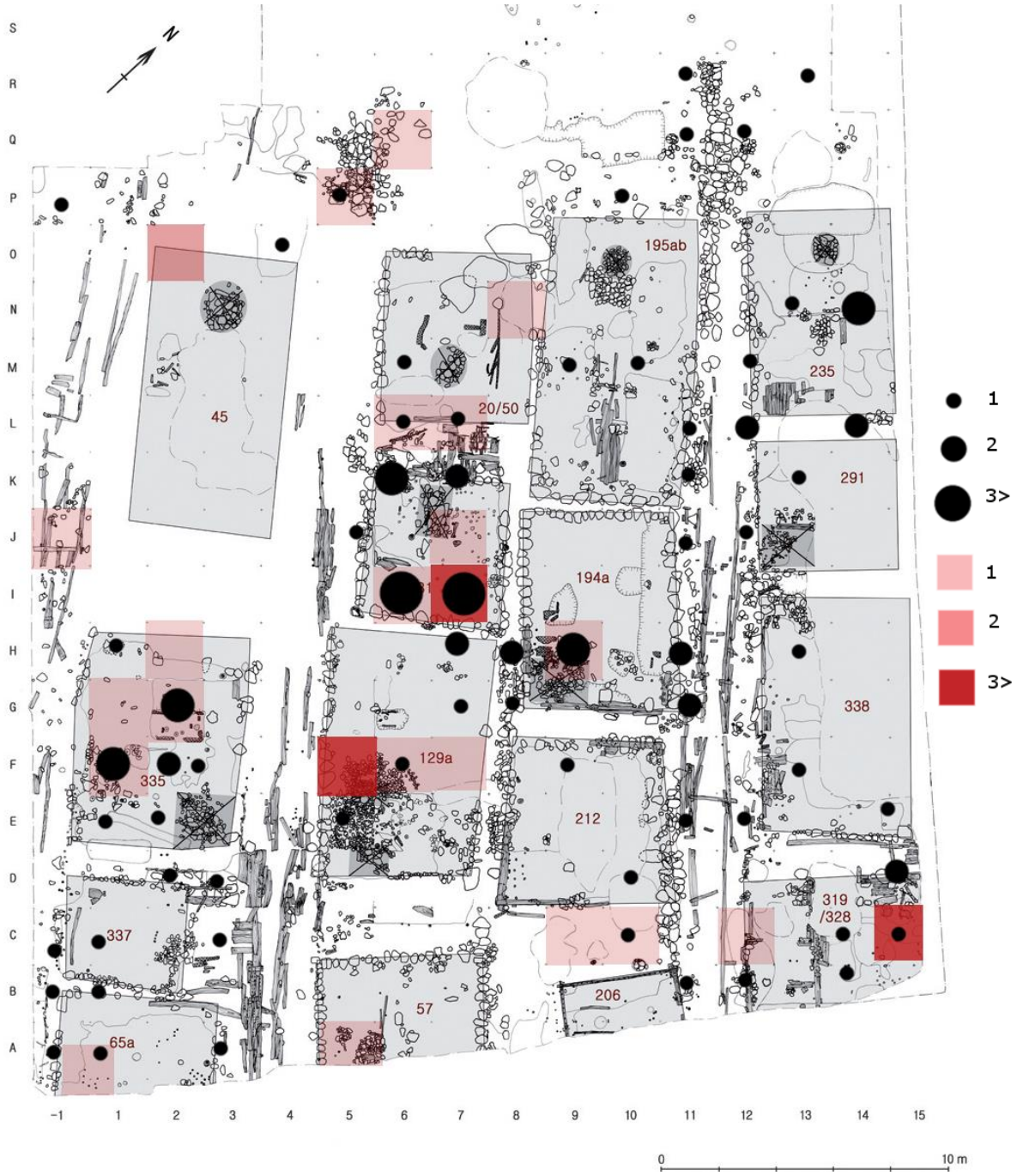
Phase 1 (985-1000)

Phase 2 (1000-1020)

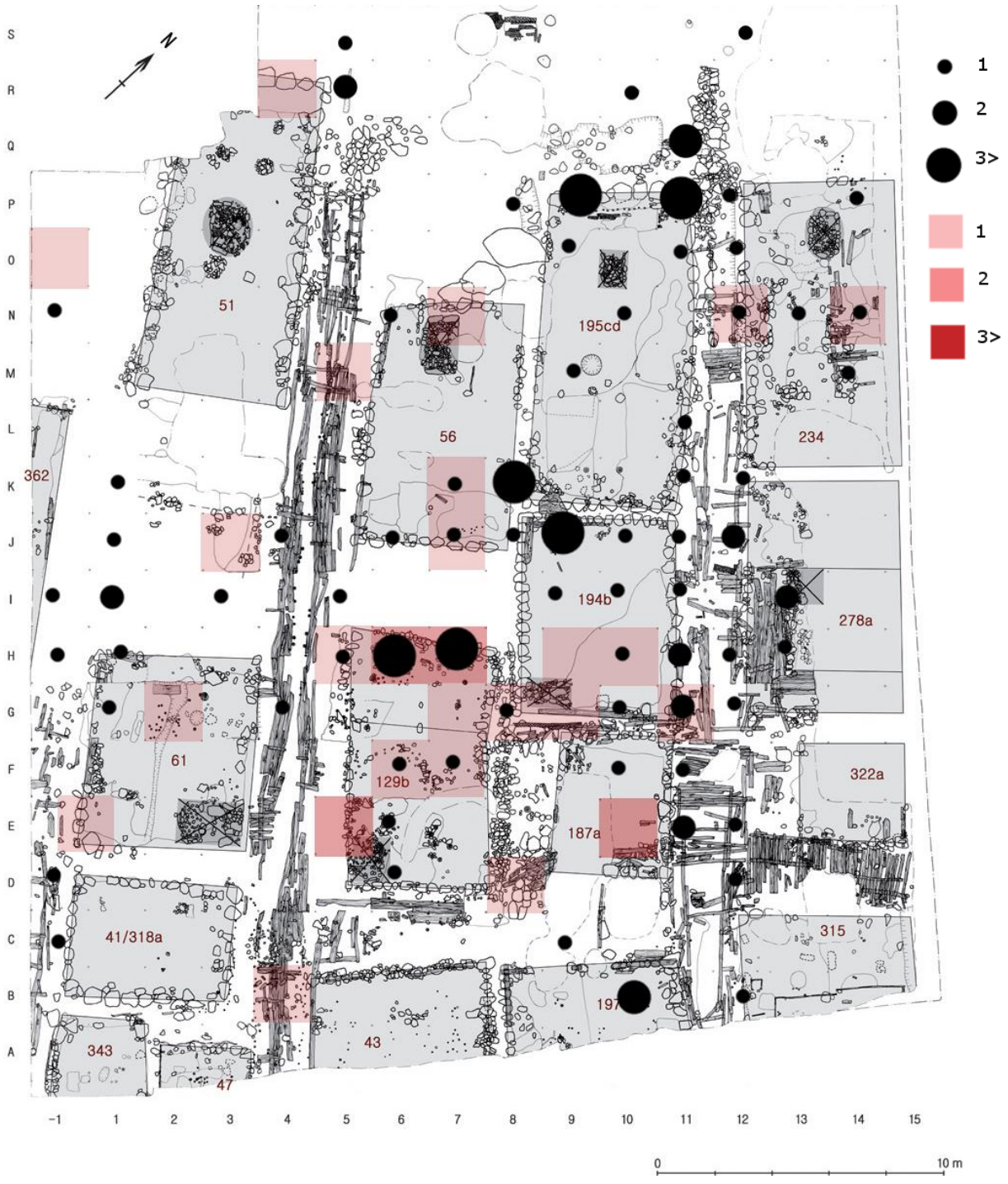
Phase 3 (1020-1050)



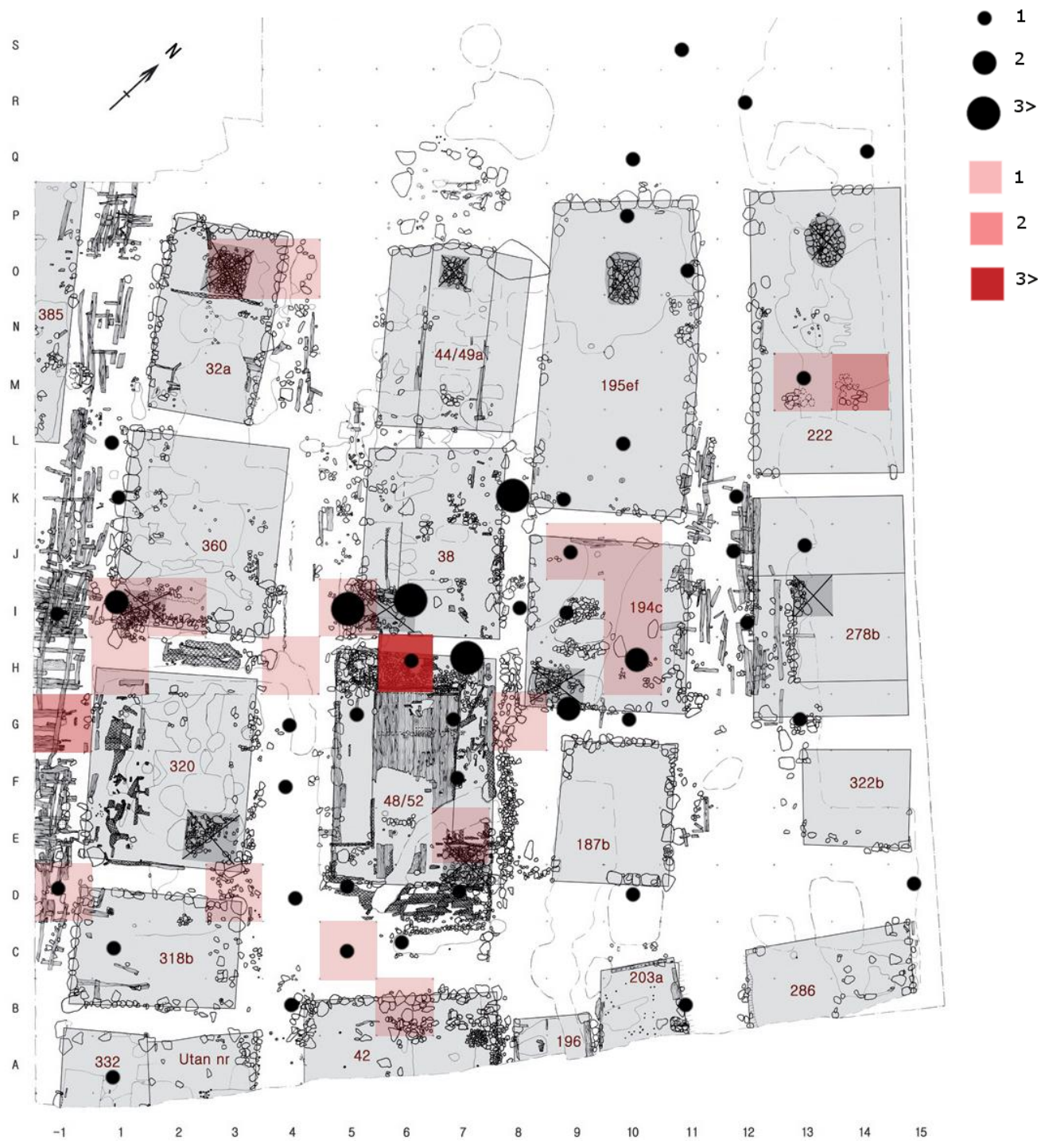
Phase 4 (1050-1075)



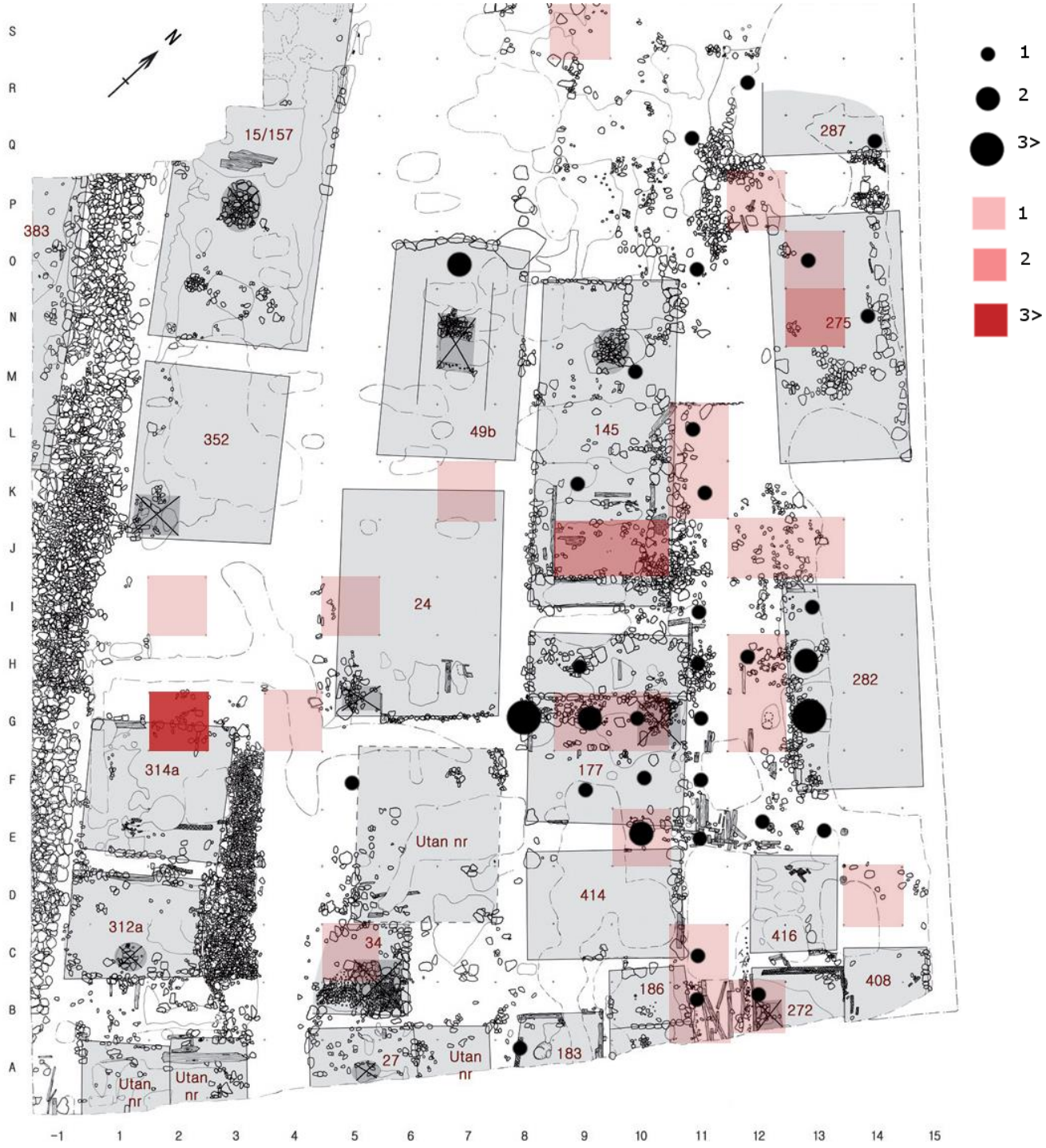
Phase 5 (1075-1100)



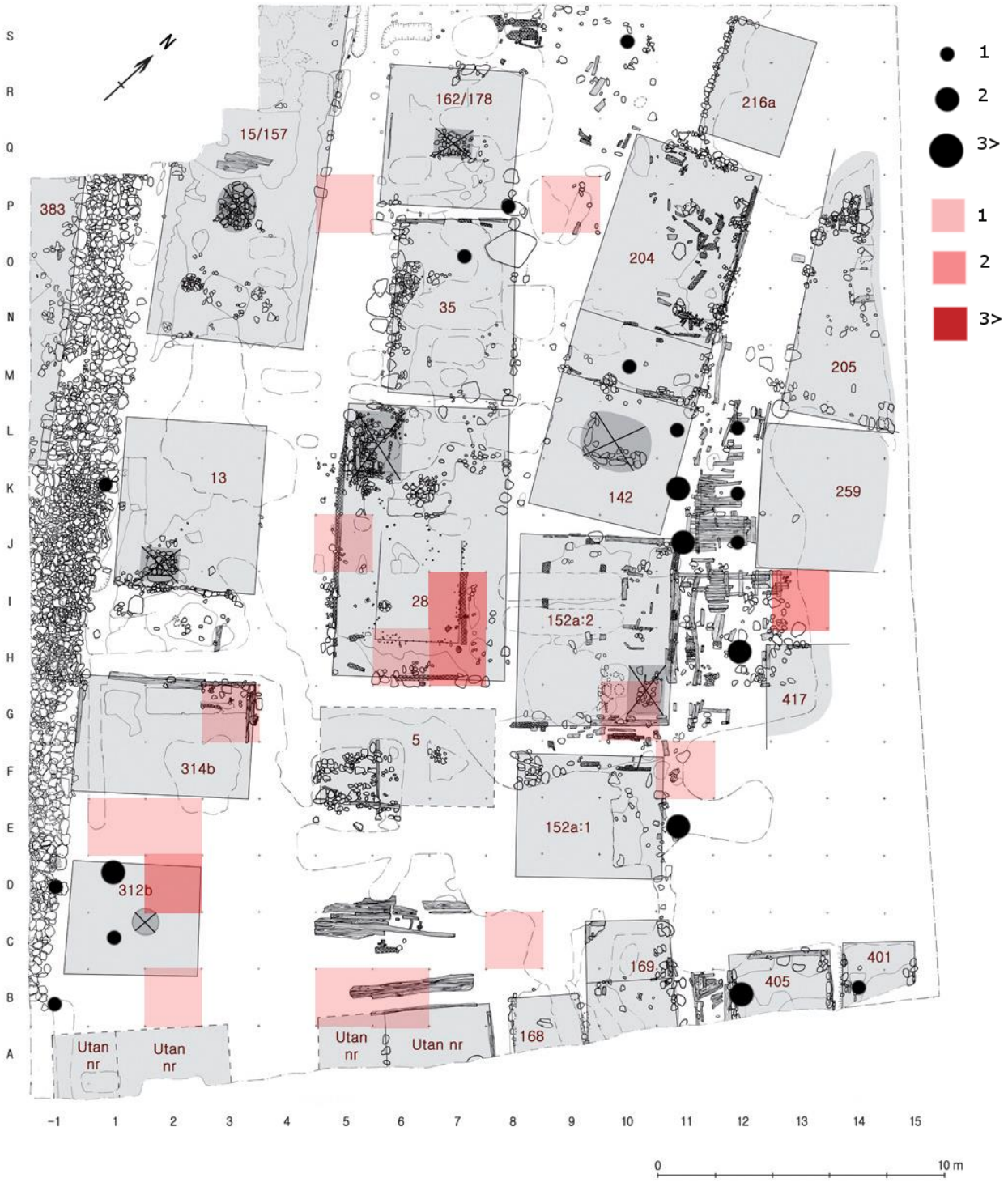
Phase 6 (1100-1025)



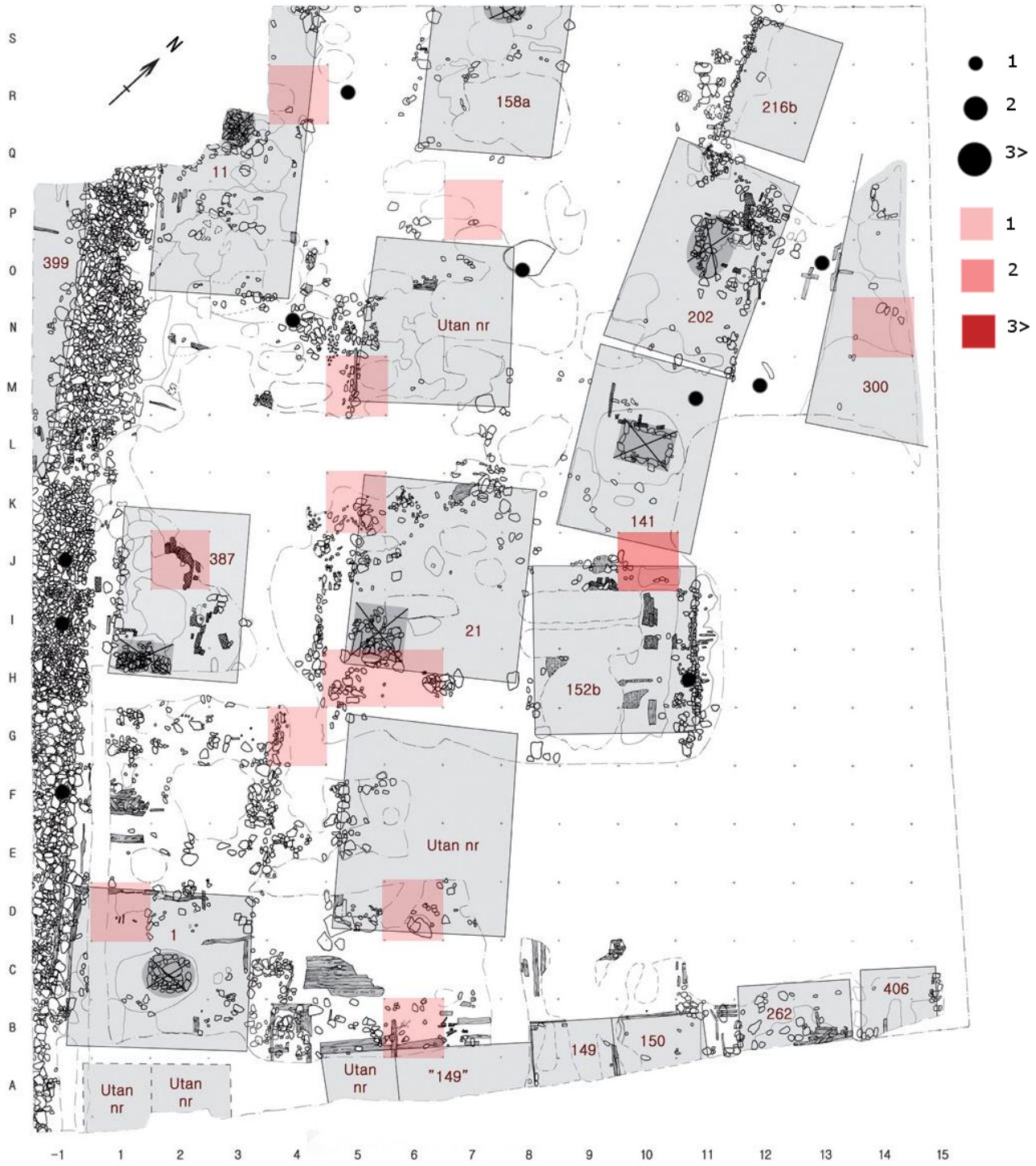
Phase 7 (1125-1175)



Phase 8 (1175-1200)



Phase 9 (1200-1230)



Phase 10 (1230-1260)