

Chapter 6

Tools, Textile Production and Society in Viking Age Birka

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Investigation of textiles is important when we discuss costume practice, gender and social status. Studying raw materials, tools and techniques used in textile production provides valuable knowledge of the organisation of textile craftsmanship as well as the economic and cultural role of textiles in a society. While there are textile finds from this period, most of them are fragmentary. Thanks to textile scholars, however, we have acquired information, not only on raw materials, but also on the techniques used to manufacture textiles. In contrast, textile tools are ubiquitous in settlements and some prehistoric textile techniques, such as spinning and weaving on a warp-weighted loom, have a tradition lasting to this day and we can therefore understand how and for what purposes they were used. With all this information woven together we have a good opportunity to elucidate textile production and its importance in society. This chapter focuses on textile production in the Viking Age port of trade Birka, where Sweden's largest assemblages of Viking Age textile tools and textiles have been found.

Keywords: tools, Birka, Viking Age, handicraft, women, production, society.

The Viking Age trading port of Birka is situated on Björkö, a small island in Lake Mälaren (see Map 4) in east Sweden. The region is rich in antiquities from the Iron Age and Viking period. During the Viking Age, settlements expanded rapidly in this region. Based on the amount of graves and cemeteries, the number of settlements has been estimated at about 1000 farms in 800 AD and 4000 farms in 1100 AD (Ambrosiani 1985, 103).

Birka is famous because it is the earliest known 'town' in Sweden with evidence of both international trade and specialised craftsmanship. It consisted of a settlement area of around 7 ha, the so-called Black Earth area, of which only 6–7% has been excavated, and graves (Ambrosiani and Eriksson 1996, 43). Birka has been dated principally on the basis of grave finds. According to the latest results, the main period of Birka spanned a period of just 220 years (750–970 AD). The population of Birka has been estimated at 700–1000 individuals in the early period and around 1500 in the late phase (Ambrosiani and Clark 1991, 157).

Of the estimated 3000 graves, around 1160 have been excavated. Of these, 551 are cremation burials, 94 are so-called chamber graves and the rest are inhumations. The chamber graves are very rich in preserved textiles, jewellery and other valuable items. The social structure of the Birka population has been discussed by several scholars (e.g. Arbman 1955; Gräslund 1980; Hägg 1983). They have compared the grave finds in relation to Rimbert's *Vita anskarii* that states that there were chieftains, rich merchants, craftsmen, ordinary people and slaves in Birka. Gräslund sums up her analysis of the graves by observing that:

The grave goods in some inhumation and cremation burials indicate great wealth, others (some chamber-graves) demonstrate by their construction that the deceased belonged to a high social stratum despite the absence of rich grave goods. It is likely that all these were the burials of chieftains and their families as well as merchants, either local or from other Scandinavian areas or from countries outside Scandinavia (Gräslund 1980, 86).

The people of Birka could not have existed in a place as isolated as Björkö without any connection to the mainland. A precondition for the existence of the place is that it attracted merchants and craftsmen on the one hand and the population of the mainland on the other. Although the inhabitants of the site were in contact with contemporary North European towns, they would have been highly dependent on the mainland to satisfy their basic needs for food, timber, firewood and raw materials. In particular, there was a great need for raw materials for textile production. Large quantities of wool and, possibly, flax and hemp were required in order to cover production for household requirements (Andersson 2003, 63).

THE TEXTILES FROM BIRKA

The textile finds from Birka are of great importance for our knowledge of Viking Age textiles. In the 1930s, Swedish textile scholar Agnes Geijer did pioneering work with her systematic analysis of these finds. While the textile material from the graves is very fragmentary, it gives a good picture of different types of costumes; there is also evidence for cushions and carpets or hangings used to furnish the graves (Geijer 1938).

Geijer divided the fabrics into four groups: (1) coarser fabrics mostly woven in tabby; (2) patterned twill fabrics of high quality; (3) ribbed fabrics and other tabby weaves of fine quality and (4) simple twills. She was convinced that most of the fabrics of high quality were imported to Birka because of their uniformity. Geijer assumed that it was impossible to produce these types of textiles locally especially with wool from the Scandinavian sheep (Geijer 1938). Later, Inga Hägg suggested that the linen fabrics were also imports (Hägg 1974, 100). According to Geijer and Hägg, the only types of fabric that were produced in Scandinavia at this time were of the coarser qualities. This assumption has been accepted by most textile scholars although the origin of these textiles has been widely discussed over the years (e.g. Geijer 1938; 1965; 1994; Hoffmann 1964; Ingstad 1980; 2006; Bender Jørgensen 1986; Hägg 1987).

We know from the textile finds and written sources like the Icelandic sagas that textiles, tapestry and sails were of great importance for the Vikings. In the Sagas, we read about men and women wearing different types of garments such as shirts, cloaks, trousers, shoes and gloves. Costumes are differentiated and specified as high-status, military costumes, simple clothing, dresses that were worn out, magic garments, textiles given as gifts, and textiles for exchange and trade. Most of the textiles were found in the very rich chamber graves, therefore, the finds of textiles do not represent the general needs of the people of Birka. Even if the many archaeological textile finds in Birka are unique, they do not give a complete picture of all the textiles the inhabitants needed and produced.

RAW MATERIAL, TEXTILE TOOLS AND TECHNIQUES IN BIRKA

It must be acknowledged from the outset, that when working with the interpretation of raw material and tools, there are several problematic issues to contend with, in regard to our sources. Analyses of archaeological textiles confirm that different raw materials were used, yet there is no exact knowledge of for instance, the varieties of sheep that existed at the time. It is uncertain when the cultivation of a plant like flax was introduced to Scandinavia, and we do not know for certain what the flax looked like, or how it was grown.

Textile tools made of organic material are usually not preserved, so we do not know to what extent they were used. Spindle rods, looms, but also shuttles, reels, and swifts have vanished, and even objects made of other materials like iron can rust away and perish. What we have are tools made of stone and clay such as spindle whorls and loom weights. However, even if some information is missing, we can still obtain a great deal of knowledge from the preserved tools and textiles.

Raw material

The major raw materials used in textile production in Birka, as in the rest of Scandinavia, were wool and flax. Wool seems to have been the most important, but at the same time, it must be borne in mind that linen rarely survives, and its lack is perhaps above all a problem of preservation. The latter is also the case for nettle and hemp fibres.

Forests and heaths could be used as sheep pastures; the islands in the archipelago would also have been good for grazing. In the medieval provincial laws there are detailed rules on grazing rights and customs on the islands in Lake Mälaren (Szabó 1970, 70). In the osteological material, one can see that sheep rearing increased in Sweden and, above all, on the islands in the Baltic Sea in the 1st millennium AD, in contrast to the development in the rest of Northern Europe, where the relative proportions of bones of cattle and sheep remained the same as before (Pedersen *et al.* 1998, 367).

The osteological analysis of animal bones from Birka and the hinterland shows that sheep products such as wool and mutton were imported there from the mainland.

Both flax and hemp were cultivated in the Iron and Viking Age in the Mälaren valley. Most pollen diagrams also show a great expansion of hemp cultivation in the period AD

600–1000 (Hansson and Dickson 1997; Pedersen *et al.* 1998, 382).

Wool and wool preparation

Sheep in the Viking Age were probably smaller than today's sheep, and it is difficult to determine how much wool could be obtained from one animal. Icelandic sources from the early 19th century state that an ewe could yield 1–1.25 kg of washed wool and a wether between 1.75 and 2.5 kg of wool (Adalsteinsson 1990, 286).

The wool was plucked or cut from the sheep. There are around 100 archaeological finds of shears from the Birka burials, and knives are one of the most common items in the Birka graves. Not all of these finds, however, would have been suitable for wool shearing.

A sheep has different kinds of wool: the fine-fibred and curly wool nearest the skin; the hair, which is longer, coarser, and stronger than the wool; and kemp, which is coarse and stiff and easily broken. The fibre properties of wool can vary greatly within the same type of sheep (Andersson 1999; 2003). The difference may be due to factors such as the food available to the sheep, but there can also be individual differences within one and the same group. There is also a great difference in the coarseness of wool fibres depending on which part of the sheep the wool comes from. Wool from the thighs, for example, is much coarser and longer than wool from the sides and shoulders. This differing structure of the wool was utilized in textile production. The long hairs were used when strong thread was needed, for example, in the warp.

The sorting of wool into different groups of fibre and the preparation of the wool for spinning are two important stages if the work is to proceed as easily as possible and if the yarn is to be evenly spun.

The wool can be spun immediately after it has been shorn or plucked from the sheep, but usually it is first teased by hand or combed with the aid of wool combs. In Birka several comb teeth have been found, but there are no finds of complete wool combs (Andersson 2003, 89).

When the long hairs are to be separated from the wool, two wool combs are used (Fig. 6.1). First, one of the wool combs is filled three-quarters full with wool. The wool is then combed with the other comb from the top and the sides until all the long fibres are well combed and lie parallel, sticking out beyond the sides of the tool. The long hairs are then drawn out of the wool comb by hand in a long strip of fibres, the hairs then lying parallel and ready for spinning. It is virtually impossible to achieve 100% separation between hair and underwool, and there is always a certain amount of underwool left in the yarn, just as there is always a certain amount of hair left in the wool. The underwool that remains in the combs can, of course, be used for spinning as well, but with this wool one spins a different type of thread since the fibres are much shorter.

After combing, the fibres are rolled into a rolag and during the spinning this is either held in the hand or attached to a stick, known as a distaff. The distaff can be held under the arm or attached to the lining of the skirt.

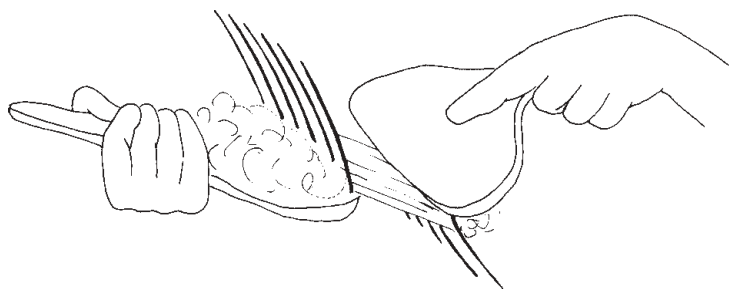


Fig. 6.1: Combing wool.
(©Eva B. Andersson)

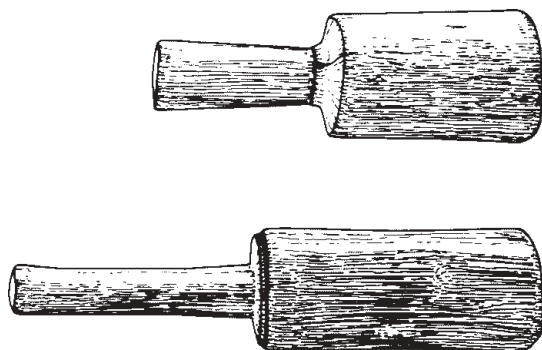


Fig. 6.2: Flax clubs from Oseberg,
Norway. (After Grieg 1928)

Flax and its preparation

When flax is ripe it is pulled up by the roots and the seeds are rippled. The flax then has to be retted. The stems can either be placed in water or spread on a dewy ground. The moisture assists in the process of dissolving the pectin found between the bunches of fibre in the bark and the stem. The next stage is breaking, when a wooden club is used to break up the stem and the bark which are to be separated from the fibres (Fig. 6.2). After that, at least in historic times, the flax was scutched with a broad wooden knife, which scraped away the last remains of stem and bark. Finally the fibres are hackled, or combed, with the aid of a tool which, like a wool comb, has long iron teeth.

No flax preparation tools in Birka or its surroundings are preserved, which is not surprising since they were mainly made of wood. On the other hand, there are some finds, from both the burials and the settlement area, of smoothing stones and even three smoothing boards. These items have been interpreted as tools to make fine linen fabrics smooth and shiny. They are made of glass or stone but a smoothing tool made of bone could also have been used. To smooth a fabric, it was stretched on a hard surface, known as a smoothing board, and then rubbed with the bone or the stone. The finds of smoothing stones in Birka are mainly made of glass and there are also many bone finds that could have been used for the same purpose. These tools do not constitute direct evidence for the manufacture of linen on the site. But as mentioned before, there are several finds of linen

textiles and also evidence that flax was cultivated in the region, so it is most likely that people produced linen for textile production in the Mälär area and in Birka.

Other textile raw material

Another raw material that could have been used in Birka is hemp. Hemp is related to flax but its fibres are coarser. In the analysis of plant remains found in sediment just outside the Black Earth at Birka, vestiges of hemp were discovered (Hansson and Dickson 1997, 209). Written sources from the Middle Ages state that the production of hemp was important, for instance, for the manufacture of coarse hangings and rope. The nettle is another plant that has been used for fibre. Nettle fibres are finer and shorter than flax and are less durable. To make the hemp and nettle fibres spinnable, they are prepared in the same way as flax.

Other fibres, which could be used, come from the bast of lime, willow and poplar. There are several finds of silk textiles in Viking Age Birka, but both yarn and cloth must have been imported (Geijer 1994, 134).

Metal thread

Metal thread has also been used for the production of certain textiles, above all the tablet-woven bands and *passementerie* (see below). In the manufacture of metal thread, a special wire-drawing instrument was used; one of these has been found in the Black Earth at Birka (Arrhenius 1968, 288–293). In this case the starting material was a 3–4 mm thick wire of gold or silver, and the finished product was 0.1–0.5 mm thick. This ‘drawn thread’ is solid, with a round cross-section. This type of thread was the most common metal thread in Birka.

Another type of metal thread was *lamella*, a thin strip of metal which has been rolled or hammered from a wire or a small strip of gold foil, silver foil, or other metal (Strömberg *et al.* 1979, 15, 48). The *lamella* can be spun round a core of organic material, such as silk but only a few of the tablet woven bands from Birka were made with this type of thread.

DYEING

The analysis of archaeological textile material shows, that people in the Viking Age dyed textiles. Not only were garments entirely or partly dyed, but also other textiles, such as hangings, were made of yarn dyed in different colours and shades (Franzén and Nockert 1992, 20). However, it is difficult to determine how common this practice was, since the colour of textiles has either not been preserved or has changed while in the soil. Numerous plants give a lasting colour, and there may have been widespread knowledge about their use. Analyses of dyed textiles have shown that blue was obtained from woad, while red could be produced with madder or plants such as hedge bedstraw or northern bedstraw. Yellow colours could be obtained from plants like weld (Dyer’s Rocket) and alpine bearberry.

Wool is simpler to dye than flax since the dye adheres better to wool fibres than to flax fibres. Furthermore, different sheep have various shades of brown and grey, and there can even be several natural shades in the fleece of the animal. These various natural colours were also utilized in textile manufacture. Sometimes these different colours were sorted and spun separately, taking advantage of the shades in the weave. Flax fibres could be bleached by various methods.

TEXTILE TOOLS AND TOOL MANUFACTURE

Iron Age people knew and used several types of textile tools for different techniques. Several of the tools used during the Viking Age remained in use well into historic times, and there is sufficient knowledge about how they were employed. Even if the textile tools that have developed in more recent times, such as the spinning wheel and the treadle loom, are more efficient and make it possible to produce more complex textiles, we should not underestimate the Viking Age implements and above all the different ways in which they were used. Just because the tools look simple, it does not mean that what was made using them was simple or coarse. Thus, complex tablet-woven bands can be produced with the aid of simple tablets of wood or leather. Even though the tools are simple, the bands can in some cases withstand comparison with modern applied textile art.

Another example is the fabric known as 2/1 twill, which most scholars assumed was impossible to weave on a warp-weighted loom (e.g. Hoffmann 1964). Finds of textiles in this weave were even cited as evidence for the use of treadle looms. Experiments carried out at Lejre Experimental Centre in Denmark in the 1980s and 1990s demonstrated clearly that it was no more difficult to weave a 2/1 twill than a 2/2 twill on a warp-weighted loom (Andersson 2000, 174).

The following account of the different tools and techniques is a broad survey of the textile techniques used and the function and potential of the tools.

SPINNING TOOLS

The most frequently found spinning tool from the Viking Age is the spindle. A spindle consists of a rod and a whorl (Fig. 6.3). There are no finds of spindle rods from Birka. However, since wooden rods have been found on other Viking Age settlements, we can assume that the rods used in Birka too had been made of wood.

The spindle whorls uncovered in archaeological excavations vary in regard to material, shape and size. They were usually made of stones such as sandstone, fired clay or bone, but whorls of other, more exotic materials, such as glass and amber, have also been found. At Birka, there are many archaeological finds of spindle whorls made in different shapes and sizes.

The spindle whorl can be placed at different heights on the spindle. The whorl is

usually placed on the lower part of the rod, giving a low whorl spindle, or on the upper part, giving a high whorl spindle. The placing of the whorl affects how the spindle is rotated. If the whorl is at the bottom, the whorl is activated by twisting the upper part of the stick. If the whorl is at the top, the spindle can be rotated either by moving it against the thigh or by twisting the lower part of the spindle. In archaeological digs it is rare to find a whole spindle with the whorl still attached to the rod. It is nevertheless likely that both low whorl and high whorl spindles were used in Scandinavia during the Viking Age.

After the preparation of the rolag, the wool is twisted by hand into a short thread which is attached to the rod. The spindle can then hang freely. Thereafter the rod is rotated while the spinner simultaneously draws out the fibres, and it is the twisting of the fibres around their own axis that forms the thread. When a certain length has been spun, the thread is wound up on the spindle and it is then possible to continue spinning. The process is repeated until the spindle rod is filled with thread.

When the rod is full, the spun yarn is wound onto a reel or niddy noddy (Fig. 6.4). None have been found in Birka but they are known from other places, for instance, the Oseberg grave in Norway (Hoffmann 1991, 164). When the yarn is removed from the spindle rod it is 'alive' and can easily get tangled, which can cause problems when setting up the warp threads on a loom. A solution to this problem is to let the thread stay stretched on a reel for a while.

The parameters that affect the quality of the spun thread are the fibre material and the weight and diameter of the whorl. Experiments have demonstrated that a very thin thread can be spun with a light small spindle whorl, and a much coarser thread with a spindle whorl that is heavy and large (Holm 1996; Andersson 1999, 2003).

The quality of the wool affects above all the manufacture of the finer threads. Experiments have shown that with very light whorls weighing under 10 g one can spin

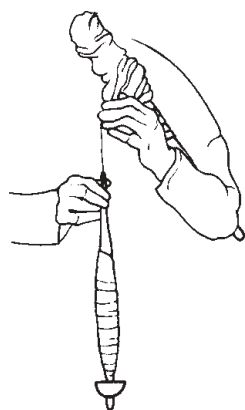


Fig. 6.3: Low-whorl spindle with rod and whorl. A distaff is used when spinning. (©Eva B. Andersson)

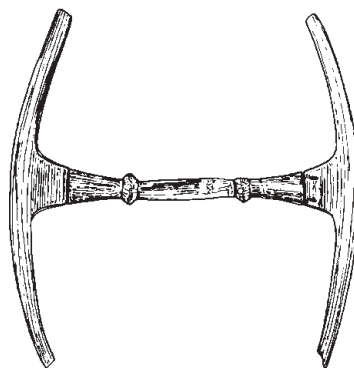


Fig. 6.4: Reel, width approx. 30 cm. (After Grieg 1928)

yarn of a very fine quality, comparable to the Viking Age yarns found in the Birka burials. The same spindle cannot be used to spin a coarser thread. It was also demonstrated that rods of less than 15 cm in length could have been used as spindles; when spinning with a very light whorl, a shorter rod is necessary to achieve balance in the spindle (Andersson 1999, 2003).

The study of the spindle whorls from Birka showed that the whorl weight varied from 2 g to 134 g, but weights between 5 g and 40 g were the most common. Altogether the result indicates that the yarn produced at Birka included both finely spun thread for luxury fabrics, and coarser yarn, for instance for sailcloth (Andersson 2003, 73).

LOOMS AND WEAVING

Cloth is a result of weaving two thread systems crossing each other at right angles. One of these systems, the warp, is kept stretched during the weaving. The other thread system, the weft, runs alternately over and under the warp threads. The warp must be strong if it is to hold when the threads are stretched, so it is often more tightly spun than the weft. The appearance of the fabric depends on (1) the weaving technique that is used, (2) whether the yarn is fine or coarse and (3) whether the thread is tightly or loosely spun.

The thread count shows the number of warp and weft threads per cm. A well-balanced fabric has an equal number of warp and weft threads.

The system in which the warp and weft are interwoven to make a fabric is called the weave or binding. It is always the warp that binds the weft. To achieve a weave, some warp threads must be raised or lowered between each new pick. This action in weaving is called changing the shed (a space between the warp threads into which the weft can be inserted). By varying how many warp threads are raised or lowered between the picks, different weaves can be obtained. The basic weaving techniques are tabby, twill, and satin. Twill weave can be varied by alternating the binding points in several different variants, for example, 2/2 twill, 2/1 twill, diamond twill, and chevron twill (Fig. 6.5). To weave a non-continuous pattern, for example, a tapestry, one uses weaving techniques such as brocade (*e.g.* soumak and brocaded tabby) and tapestry weave (see *e.g.* Strömberg *et al.* 1979; Franzén and Nockert 1992, 15; Geijer 1994, 58).

The warp-weighted loom

Weaving is accomplished on a loom. The loom that has left its traces in the Scandinavian Viking Age archaeological record is the warp-weighted loom (Fig. 6.6). This loom is upright and the warp is kept stretched by loom weights. Loom weights are the main archaeological evidence for this type of loom. The weights found in Birka were made of clay, as was common during the Viking Age in this region. The weights vary in size and shape. Generally speaking, lighter weights are suitable for fabrics with thin warp threads, while heavier weights are more useful for fabrics with thick warp threads.

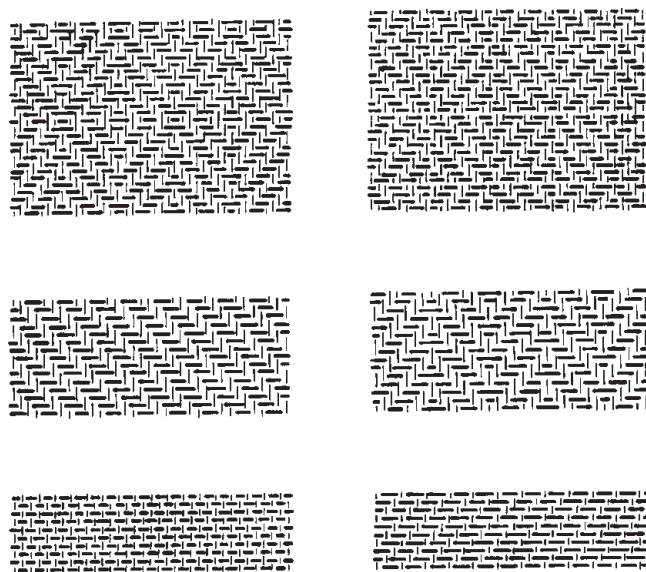


Fig. 6.5: Different types of weave. Top left: diamond (goose eye) twill. Top right: broken lozenge twill. Centre left: 2/2 twill. Centre right: chevron twill; bottom left tabby. Bottom right: 2/1 twill. (©Eva B. Andersson)

The analysis of the loom weights from Birka shows that loom weights of different sizes had been used. The loom weights vary from 200 g to 1900 g in weight, but the results of the study indicate that weights between 400 g and 800 g were the most common (Andersson 2003, 80).

The width and length of the warp is determined above all by the dimensions one wants the finished fabric to have, although, of course, the size of the loom limits the width. Still, data from Iceland show that a piece of cloth woven on a warp-weighted loom could be as much as 12.5 m long (Geijer 1965, 118).

When weaving on a warp-weighted loom one stands in front of it and weaves from the top downwards. The weft is inserted between the warp threads and beaten upwards with the aid of a sword beater. There are no finds of

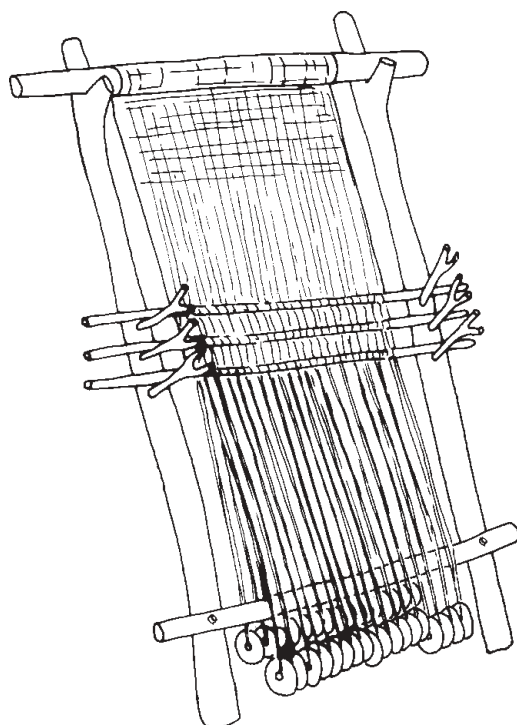


Fig. 6.6: Warp-weighted loom (height approx. 1.7 m). (©Eva B. Andersson)

sword beaters from Birka, but other finds from Viking Age graves suggest that the beaters were made of wood, bone and/or iron. (Hoffmann 1991, 176).

The two-beam loom (Fig. 6.7)

Another type of loom used in prehistoric times was the two-beam vertical loom, but there are few archaeological traces of this since it was made entirely of wood. Like the warp-weighted loom, the two-beam loom stands upright. The length of the warp is limited to the height of the loom, since the warp threads are stretched by being attached to the loom. If a longer piece of cloth is needed, the warp-weighted loom is thus preferable.

It is difficult to see from the surviving textile fragments whether they were woven on a two-beam loom or a warp-weighted loom (Hald 1980, 210). Today, the vertical two-beam loom is still used in certain parts of Norway for weaving coarser pattern-woven textiles, such as bedspreads. Different types of combs are used to beat the weft in the different patterns (Hoffmann 1991, 178).

In Birka a couple of weaving combs have been found, but coarse bone needles may have been used for pattern weaving with the simultaneous use of several weft threads, mostly of different colours. To keep track of these threads and to make it easier to insert the picks, the weft is threaded onto a bigger needle.

OTHER TECHNIQUES AND TOOLS

Tablet weaving (Fig. 6.8)

Bands woven with the aid of thin, squared tablets with holes for the warp are called tablet-woven. The finished result can vary from simple bands woven with four tablets to exclusive bands with silk and metal threads pattern-woven with more than 150 tablets (Hald 1980, 229). The simpler bands were used, among other things, to edge cloths, while the exclusive pattern-woven bands served as costume decoration. Tablets have been found, for instance, at Birka but also at Oseberg in Norway and on the Swedish island of Gotland (Grieg 1928; Geijer 1938; Nockert and Knudsen 1996, 42).

A simple way to make tablet woven bands is to hang the warp from a hook in the ceiling and stretch it with loom weights. Another way, the one most frequently used today, is to stretch the warp horizontally by tying one end of the warp to a hook and attaching the other end to a belt worn round the waist; instead of weights, the warp is stretched by the weaver's own body. To weave the simplest type of band, one then turns all the tablets a quarter-turn to create a shed. The tablets are then turned yet another quarter-turn, and hence the threads too. A new weft thread is then inserted in the new shed that is formed, and so the process continues. In pattern weaving, each tablet can be turned individually.

Tablet bands have been found in about 60 Birka graves. Many of them are woven with gold or silver threads as weft (Geijer 1938; Hägg 1986, 52).

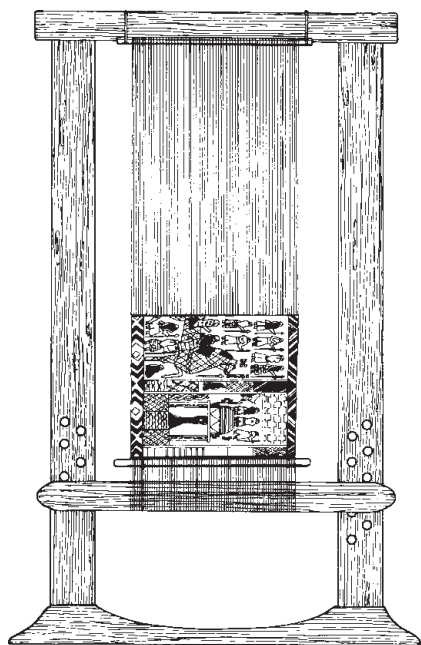


Fig. 6.7: Two beam loom with tapestry (height 1.1 m, width 66–67 cm). (After the Oseberg find)

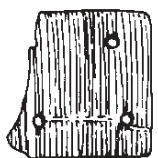
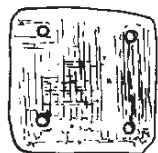


Fig. 6.8: Tablets for tablet weaving, tablets measuring approx. 3.5 by 3.5 cm. (©Eva B. Andersson)

Passementerie and other techniques

Textiles made with the techniques of plaiting, sprang, and *passementerie* have also been found in Birka (Geijer 1938, 99; Hald 1980, 240; Hägg 1983, 208; 1986, 52). Special tools are not usually necessary for plaiting. Among the plaits used for bands and straps are diagonal plaits. Sprang is a technique used for hoods and the like. The work may have been done on a simple wooden frame with the aid of thin sticks or perhaps bones. *Passementerie* is an umbrella term for decorative trimmings (borders, fringes, tassels, and the like) made of gold or silver thread, different colours of yarn, and other materials. Many techniques included here, such as twisting, braiding, lacemaking, band weaving, and embroidery often occur simultaneously (Geijer 1938, 99).

A large number of *passementerie* items of gold and silver thread such as various types of embroideries and brocading have been found in the Birka graves (Geijer 1938). All these textiles are very well made, indicating high professional skill. Several of these *passementerie* items are probably closely related to *macramé*, a complex plaiting technique (de Dillmont 1987, 413). Apart from a device for holding the loose vertical threads, few or no tools are needed. If one works with many long threads, however, it can be an advantage to have the threads rolled up on a bobbin or the like.

FINISHING AND DECORATION OF TEXTILES

Fulling

Fulling is a process involving the preparation of woollen fabric with water and sometimes soap. The result is a very tight fabric. The method has been used, for example, in the manufacture of outer garments and sailcloth. If a fabric is to be fulled, it is important that at least the weft is made of wool.

Needles and single-needle knitting

Textile work requires many needles of different sizes. Analyses of textiles have shown that Viking Age people used several of the sewing techniques that are still used today (Hald 1980, 281). For sewing thin fabrics, fine needles, often made of metal, were used. Thin metal needles, like the sewing needles used today, were also employed for needlework and embroidery. Examples of various embroidery techniques found in the Birka textiles are stem stitch and chain stitch (Geijer 1938, 108). In Birka, there are several archaeological finds of thin, metal needles and many finds of needle boxes. It is interesting to note that the needle boxes found in the graves are usually made of metal such as bronze, while the needle boxes found at the settlement area were made of bone (Andersson 2003).

The needles more commonly found in Birka are made of bone (Andersson 2003). Bone needles may have been used for single-needle knitting, a technique which can be used to make socks and mittens, but no coarse textiles made with this technique have been preserved from the Viking Age. However, there are several medieval finds of textiles made by single-needle knitting (Hald 1980, 299, 302).

Coarse, bone needles may, as mentioned before, have been used for pattern weaving. Big needles may also have been used as shuttles by winding the weft onto the needle and inserting it through the shed. The needles used for these operations did not need to be sharp-pointed since they were not meant to perforate the cloth.

Coarse, pointed bone needles on the other hand may be suitable for sewing or darning thick woollen fabric. It is also likely that people used a bone needle or awl to make holes in very thick, fulled fabrics before sewing.

Other textile tools and techniques

Pleating is a technique that is often mentioned in connection with linen fabrics, but woollen material can also be pleated. Pleating is done by sewing small folds, 2–3 mm deep, with needle and thread. The threads are then pulled so that the cloth is wrinkled, after which it is moistened and put in a press until the folds are made permanent. The threads are then removed from the cloth. This technique forms low, round standing folds. The term pleating also includes pressing a pattern into fabric, so the technique described above is commonly called *plissé* or in Swedish *rynkeveckning* to avoid confusion (Geijer 1980, 214). There are several examples of the use of this technique in the linen textile finds in Birka (Hägg 1974).

TEXTILE PRODUCTION AND ITS IMPACT ON SOCIETY

The textile tools, especially spindle whorls, show that textile production in Birka was extensive and varied. Research has demonstrated that the inhabitants of Birka had all the necessary tools for making the range of qualities of wool and linen cloth found in the graves. Moreover, the tools demonstrate that everything from finer to coarser textiles was produced (Andersson 2003, 99). This clearly contradicts the previous assumption that indigenous textile production in Birka comprised only coarse woollen cloth of poor quality (e.g. Geijer 1938; 1965; Hoffmann 1964; Hägg 1974).

While the loom weights are far too fragmentary to allow any assessment, the spindle whorls, the sewing needles, and the bone needle boxes seem standardized in shape. Spindle whorls of stone were either made in Birka out of imported raw material or were brought to the site ready-made. Some of the tools were probably made by a specialized craftsman and not by the user (Andersson 2003, 148).

Textile tools have been found all over the excavated area, and there is no evidence of specific production at any particular place in the excavated part of the settlement. However, it should be kept in mind that only 6–7% of the settlement area has so far been investigated.

The number of finds of textile tools increases during the 10th century AD. Whether this reflects an actual increase in production is impossible to establish, since there are several aspects to take into consideration. Still, much suggests that the settlement expanded during this period, meaning that more textiles must have been produced to satisfy household requirements. Another factor is that it is difficult today to determine whether equally large areas have been excavated from the 8th, 9th, and 10th centuries AD. The evaluation of the tools likewise does not show that there was any specific type of textile manufacture in any period or that the production changed during the lifetime of Birka.

There are, with some exceptions, few finds of textile tools from the graves. They only occur in about 153 graves. In addition, the finds represent types of textile tools – metal needle boxes, smoothing stones, and scissors – which are not very frequent in the settlement. I do not believe that the tools found in the graves represent specialist textile workers. According to Icelandic sources, wealthy women did not weave cloth for everyday use: they sewed and sometimes spun (Þorláksson 1981, 61). In the graves, there are no finds of loom weights, just a few spindle whorls, and several finds of needle cases and scissors which support this interpretation. The weavers and those who spun most of the thread and combed the wool are so far invisible and the question is: can they and their work ever become visible?

By studying the textile tools, we get a picture of the textiles manufactured at Birka, a picture different from the one suggested by merely studying the textiles themselves. There were many people living in Birka, men, women and children, people with different backgrounds and status. All of them needed clothing and other types of textile. No wonder that so many textile tools have been found.

Textile manufacture just for everyday use must have taken up a great deal of time. Just to produce two costumes, one female and one male, a spinner needed to spin approximately 42,600 m of yarn (Andersson 2003, 47). The knowledge and skill to produce textiles must have been lodged in more than one person. Several people were involved in the production process which included the harvesting of fibres, preparing them for spinning, weaving, various finishing processes and finally sewing them into clothing and other products. Could these textiles have been produced in every household at Birka? I would define the Birka house-hold production of textiles in the following way:

- the production solely covered the household's own needs;
- household members possessed general knowledge and skills;
- raw materials were commonly accessible;
- textile manufacture was not a full time occupation.

Many of the textiles for everyday use could have been produced in this mode, especially by ordinary people; but there is the question of where they got the raw material from. It is quite likely that at least some of it was imported. In order to produce costumes for 300 people, at least 900 kg of raw material would have been needed.

Even if most of the textiles were produced in a household context, another possibility is that spinners and weavers manufactured textiles in their homes in household industry mode or in a putting out mode. This kind of production can be defined as follows:

- the production scale was beyond the needs of the producers;
- it was organised at household level;
- the members of the household possessed general knowledge and skills;
- there was a surplus of raw material and/or the buyers provided them with raw material;
- they did not work full time.

Could some of the sophisticated textiles, despite earlier suggestions, have been manufactured at Birka and, in that case, in what organisational mode? On the basis of the results of the Birka corpus of tools, I believe that at least some of these fine quality textiles were manufactured here, although not in every single household. Neither do I believe that these textiles were manufactured in workshops since there is no archaeological evidence for the latter (yet). The mode I think most credible is an 'Attached specialist production'. For this mode I suggest that:

- high quality products were made;
- production was by craft specialists and their skills were enhanced by full-time occupation;
- craftspeople were supported by and dependent on patrons;
- they worked on a full- time basis;
- the raw materials were of a better and/or higher quality.

To produce such textiles a great deal of time and skills are needed. The wool could have been imported as raw material from some foreign countries, and also some of the

textile craftspeople could have come from abroad. Much of the raw material for different types of crafts, as well as the knowledge and skills to work them, were imported to Birka. It is quite possible that some of the chieftains and/or the rich merchants brought both raw material and even a textile worker or two home from a journey. It is also possible that these specialists in turn taught their techniques to some of the local inhabitants.

I believe that these specialists produced only for their patron, and that the textiles they produced could be given as gifts. It is, of course, also quite possible that the chieftains could support these craftspeople in order to manufacture textiles for their patrons and their families' everyday use.

There is one more group of possible textile workers that should be mentioned, namely, high-ranking women. When women of high status are mentioned in Norse sagas in connection with textile manufacturing, it seems that they are not producing 'every day' textiles but rather more exclusive textiles like tapestries and embroideries. It is consequently possible that elite women in Birka produced sophisticated textiles as the tools from the graves partly suggest.

CONCLUSIONS

This chapter demonstrates how useful it is to combine knowledge of textiles and textile production to gain a better picture of the impact of textile production on society. The textiles and the traces of textile production give us the opportunity to interpret and discuss textile craft in Viking Age Birka. My investigation shows that production at Birka has been more complex and specialised than hitherto thought. It was organized most likely in different modes and both specialists and non-specialists may have been involved in the manufacturing process. There is clear evidence of specialist crafts at Birka, and it is not surprising that some of the textiles also could have been produced by specialists. Some of the raw material has been imported from the Mälars region, but it could also come from more distant places.

The textiles give us one picture and the tools another; by comparing and combining them and the contexts in which they are found we are able to show the importance of textile work in the Viking Age. The high status costumes give us information about the complex techniques and skilled craftsmanship involved in the production of luxury items. The tools, on the other hand, give us a picture of the textiles people needed for every day use and the textiles that were produced locally. At the same time, the tools show us that there existed a highly specialised textile production in Birka in contrast to the situation in the agrarian settlements in the Mälars Region. We know that exclusive textiles often were given as gifts and commanded a high value. We know that sails must have been as valuable as the ship. We know that everybody needed textiles. The investigation of the textiles and the textile tools found in Birka elucidates supports and confirms this.

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