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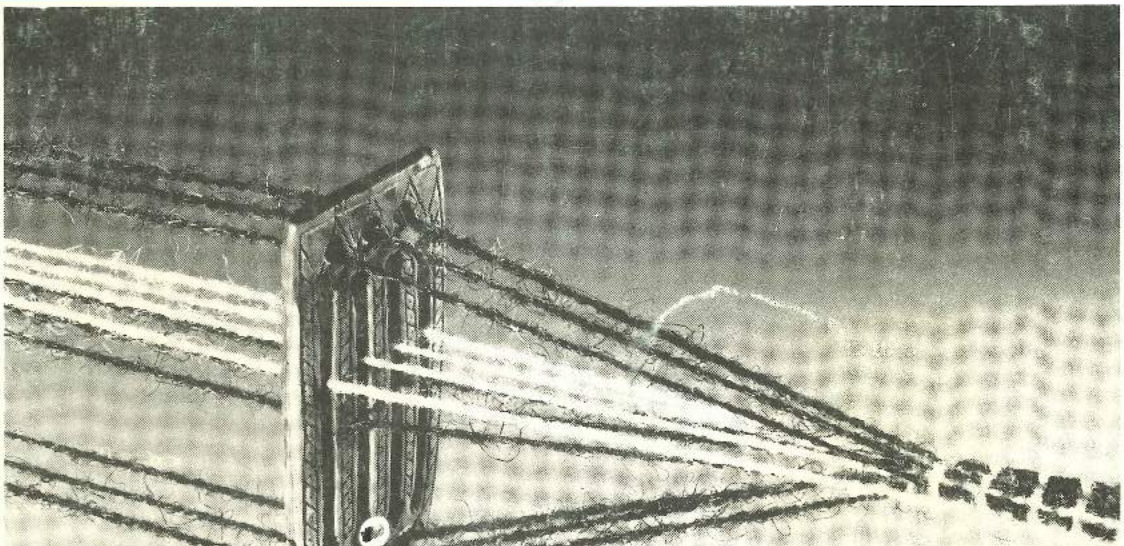

TEXTILE EQUIPMENT AND ITS WORKING ENVIRONMENT, BRYGGEN IN BERGEN c 1150 - 1500

Ingvild Øye

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ISBN 82-00-02537-3

Published with a grant from the Norwegian Rescarch Council for Science and the Humanities

Distribution office:
P.O. Box 2977 Tøyen
N-0608 Oslo 6, Norway

Printed in Norway by
REKLAMETRYKK GRAFISK A.S, BERGEN

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FOREWORD

In this volume of the Bryggen Papers we present the results of a study of the objects associated with textiles which were found during the excavations at Bryggen in Bergen 1955-68. It attempts to throw light on essential questions concerning the development of the textile industry during the period 1150-1500. The significance of this activity at Bryggen is demonstrated by the extensive range and variety of the finds and one of the main aims of the author has been to trace the nature of the textile production at Bryggen by, for example, analysing the various combinations of finds associated with particular buildings in the different phases of the excavation.

The publication of this volume has been financed the Norwegian Research Council for Science and the Humanities (NAVF) and by the University of Bergen through the Olav Kyrre Fund. It has been translated into English by Clifford Long.

The Editorial Committee responsible for the publication of the series consists of Professor Knut Helle, Dept of History, University of Bergen, Senior Curator Asbjørn E. Herteig, Dept of Archaeology, Medieval Section, Historical Museum, University of Bergen, and Senior Curator Svein Indrelid, Dept of Archaeology, Prehistoric Section, Historical Museum, University of Bergen.

Bergen, May 1987

Asbjørn E. Herteig
Chief Editor

ACKNOWLEDGEMENTS

My work on this monograph commenced in 1976/77 when I was employed as research assistant in the Medieval Archaeological Section of the Historical Museum, University of Bergen. But it was not until 1982, when I received a one-year grant from the Norwegian Research Council for Science and the Humanities, that I had the opportunity to concentrate on this task for a longer period. The work was completed by the summer of 1983, but, due to the existing research situation concerning the general chronology of the development at Bryggen, it had to be based on unverified and uncorrelated chronological data. Revised chronological data became available in 1986. The basis for the dating of all the artefacts in this study was now re-examined, and the manuscript was revised accordingly.

I wish to extend my gratitude to the steering commitee and the editorial board for the Bryggen Project: Professor Knut Helle, Chairman of the steering commitee, Senior Curator Asbjørn E. Herteig, project leader and editor-in-chief, Professor Anders Hagen (until 1985), and Senior Curator Svein Indrelid (since 1985), who have read and commented upon several drafts of the manuscript and given valuable advice and viewpoints. Throughout the years, my colleagues in Bryggens Museum, at the Medieval Archaeological Section and on the Bryggen Project have given me incentive and have had many constructive comments. Special thanks are due to Asbjørn E. Herteig, who generously shared with me his unpublished data from his investigation of the general chronology of Bryggen.

Several persons from various disciplines have contributed with valuable anlyses of the material: Types of wood were mainly determinded by Laboratory technician Aud Simonsen at the Archeological Museum in Stavanger and Cand. Real. Ellen Schjølberg at the Botanical Institute, University of Bergen. Osteological examination of bone and antler artefacts was carried out by Curator Rolf Lie and Technician Pirjo Lachtipera at the Zoological Museum, University of Bergen. Lecturer Helge Askvik, Geological Institute, University of Bergen, has been responsible for the petrographic analysis. All deserve my deepest gratitude for their willing assistance.

Statistician Øivind Bolstad gave me useful and positive help during the processing of the material. Most of the graphic work was done by Svein Skauge and Robert Gaarder, both on the Bryggen Project. Photographer Ann-Mari Olsen from the Historical Museum, University of Bergen, photographed the artefacts. Secretaries Eli Rødseth at Bryggens Museum and Elin Carlsen on the Bryggen Project have written out several versions of the manuscript in Norwegian and English. Antiquarian Clifford Long has translated the study into English. I extend my warmest thanks to all of them.

A grant from the Nansen Fund in 1979 enabled me to study parallel material from medieval excavations in Lund, Ålborg, Århus, Ribe and Schleswig. The Norwegian Research Council for Science and the Humanities and the University of Bergen through the Olav Kyrres Fund have contributed to the cost of printing this monograph.

Bergen, June, 1987

Ingvild Øye

INTRODUCTION

1 The subject and aims

This monograph deals with the various equipment for textile production found in the archaeological excavations at Bryggen (ie the Wharf) in Bergen. The material belongs to the period c 1150-1500 and represents a short span in a very long and comprehensive tradition.

As far back in time as it is possible to distinguish a division of labour determined by sex, the production of textiles has usually been the work of women. In the Nordic countries this can be traced back to the Neolithic (eg Hagen 1982, 156). In the High Middle Ages a decisive change took place in the textile industry in Europe: it became more strongly specialised and professional. As towns grew and developed, the various handicrafts became organised separately and they were carried out overwhelmingly by men. Behind this change were many technical innovations. It was basically due, however, to considerable changes in the social system: a stronger specialisation in handicrafts and to some extent an almost industrialised production as part of a more extensive and permanent organisation of long distance trade. In the production of textiles this specialisation and industrialisation became particularly well-developed in Flanders and the adjacent areas of the north-west continent, in Eastern England and in Italy. Woollen cloth especially was mass-produced in these areas for export. However, in addition to the specialised textile production, women continued to produce textiles as a home-craft at the same time as they carried out their household and mothering duties.

Legislation from the 1270s provide an insight into the aspects of textile production which had been established in Bergen. The Urban Code issued by King Magnus in 1276, which was

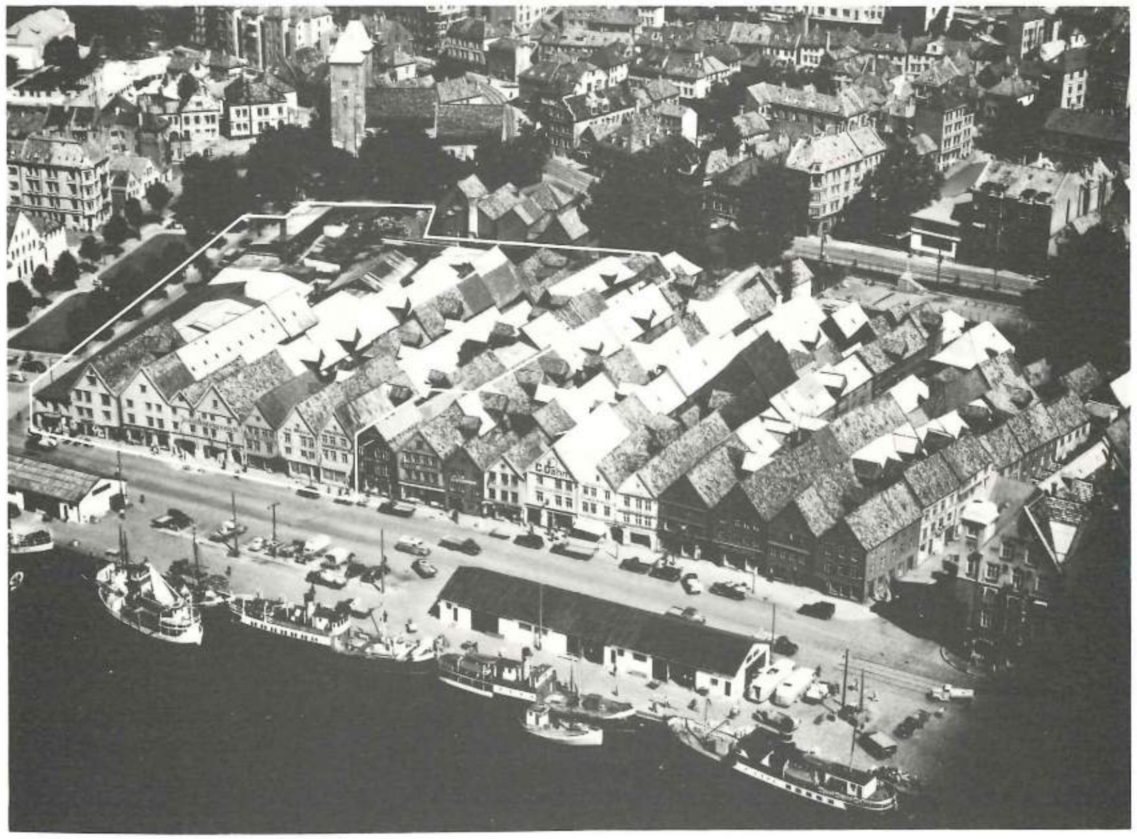


Fig 0.1 Bryggen in Bergen before the fire in 1955. The line indicates the extent of the fire and the area subsequently excavated

based on the situation in Bergen at the time, mentions tailors and weavers. The tailors were to keep to either side of Øvrestretet (ie Upper Street) from Bua-almenning (almenning = transverse street) northwards to the gate of St Peter's churchyard, an area still known in 1398 as Skreddergaten (ie Tailor Street). The weavers are mentioned among the craftsmen who according to the Urban Code were to pay tax, but no locality is specified in the Code, perhaps because this group of craftsmen was so small that it was not considered necessary to assign them a particular quarter. Taking the clothing industry in a wider sense, there were also the furriers who prepared skins and furs in the production of clothing. They were to keep to both sides of Øvrestretet from Auta almenning northwards to St Martin's churchyard, an area known as Skinnerstretet (ie Furrier Street). The assignment of tailors, furriers and other craftsmen and small traders to specific areas goes back perhaps to an extensive replanning after the great fire in 1248.

In the local by-laws for Bergen from 1282 and 1302 a new group of textile craftsmen appear, the shearmen. They were to be paid according to how many ells of cloth they cut, indicating that they were rather more than retailers selling small quantities of linen and cloth. It is most probable they were engaged in

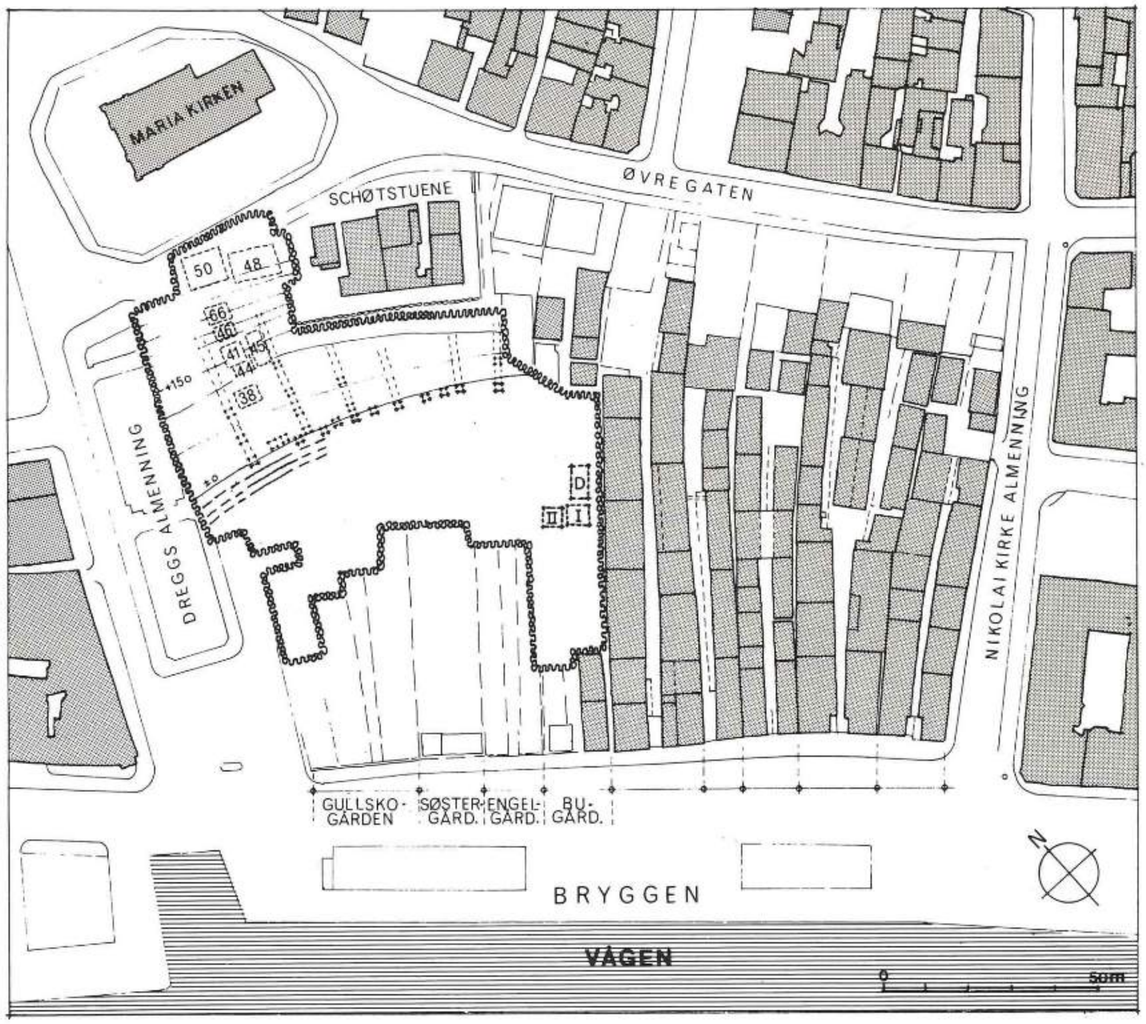


Fig 0.2 The limits of the extensive Bryggen excavations in 1955-69, 1972, 1974 and 1979 are marked with a wavy line. The original shoreline is shown by the 0-contour (plan by E Reimers)

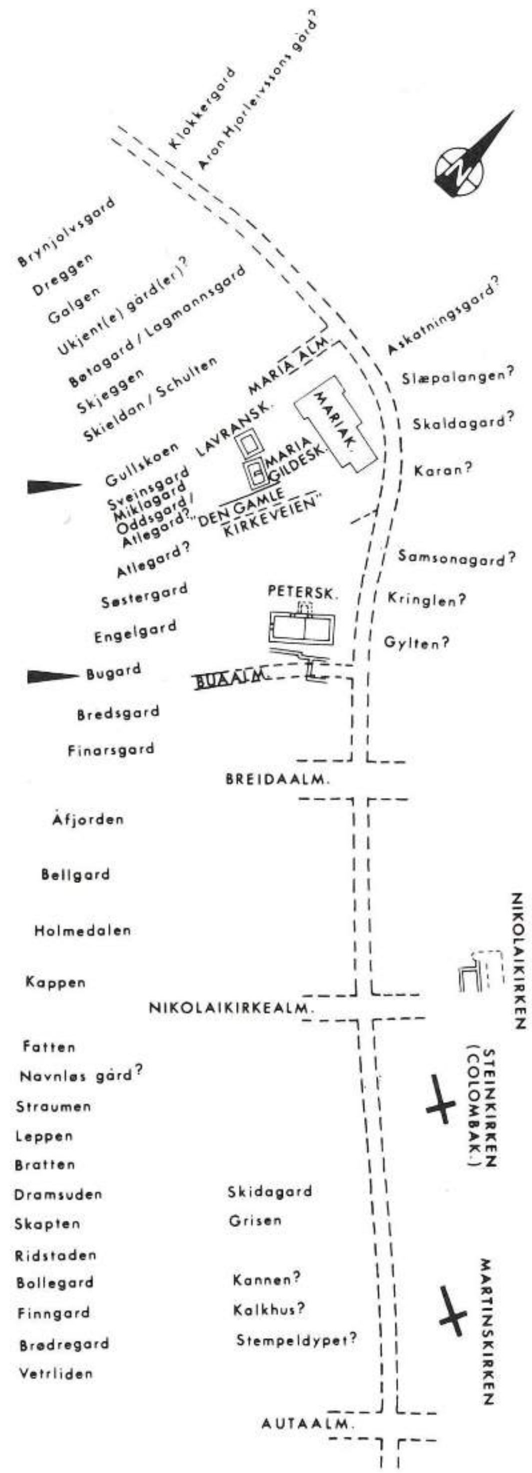


Fig 0.3 The location of the tenements at Bryggen and along Øvrestretet the first half of the 14th century (Helle 1982, 231). The arrows mark the outer limits of the excavated area

cropping, ie trimming the superfluous nap on cloth. In the Late Middle Ages the tailors and shearmen moved down to Vågsbotn to the street formerly known as Sutarestrete (ie Shoemaker Street), the modern Kong Oscars gate (Helle 1982, 429-30, 752).

The textile equipment discussed in this volume was all found within an area of 7500 square meters in the northern part of Bryggen and, as already mentioned, can be ascribed to the period c 1150-1500 (figs 0.1 & 0.2). It seems that this area in the Middle Ages covered at least seven or eight tenements: Gullskoen, Sveinsgard, Miklagard, Atlegard, Oddsgard, Søstergard, Engelgard and Bugard (Helle 1982, 236, cf fig 0.3). Belonging to the tenements were passages and quays, and separating them were public thoroughfares and alleys. The excavations included none of the textile workers' areas mentioned in the written sources (fig 0.4), yet an extensive amount of textile equipment was found. A major problem is to find an explanation for this.

The first and most comprehensive task will be to identify, catalogue and classify the items of textile equipment found in the excavations. What type of equipment is it? What material do the artefacts consist of? Where were they found? Were they spread over the whole area or confined to a particular locality? How old are they? Do they change in the course of time? The equipment from Bryggen will be compared with that which we know from other medieval towns and it may thus be possible to suggest whether the equipment is based on local traditions or is common to a wider area, whether it has been made locally or was imported.

The analysis of the excavated material will serve as a basis for defining the activity related to textile manufacture in the actual period. We shall try to determine technical aspects of the local textile industry about which written sources are silent and will also consider the difficult question of the relationship between specialisation and domestic handicraft: to what extent the finds from Bryggen testify either the former or the latter.

From about the middle of the thirteenth century German merchants established themselves permanently at Bryggen. Around 1360 a Hanse *kontor* or factory was set up there and in the course of the following century it appears that most of the houses at Bryggen came to be either owned or rented by the Germans. Judging from the documentary sources the Hanseatic part of Bryggen became an entirely male society

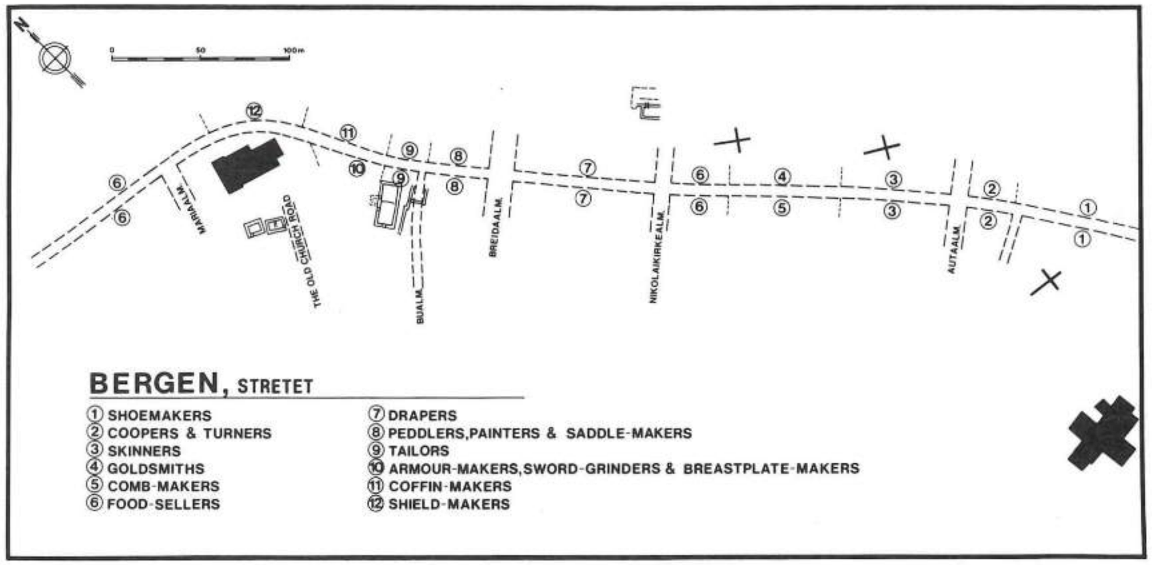


Fig 0.4 Sketch illustrating the areas allocated to the various craftsmen according to the Urban Code of 1276

(Helle 1982, 722-28, 731-34, 746-48, 761-62). A further aim of this investigation is to see whether the items of textile equipment reflect the transition from a Norwegian to a German settlement and whether it is possible to say anything more specific about the nature of this transition or its date. The central question here is whether Bryggen actually ceased to be an area where women (and children) resided and, if so, when this did happen. Since the production of textiles was for a long time more or less the work of women and in spite of professionalisation, certain types of textile work continued to be the work of women or a domestic handicraft, specifically spinning and weaving on an upright loom. Spinning equipment and remains of upright looms in the excavated area should therefore indicate the presence of women.

The term textile production in this study covers the working of fibres into thread, yarn and cord, nets, braiding, ribbons and cloth. As already mentioned, the various textile equipment provide the basis on which I distinguish the production of textiles, but there is also among the finds from the excavations at Bryggen a wide variety of textiles and fragments of textiles. This matearial is being investigated separately by Ellen Schjølberg (Schjølberg in prep). It is desirable to see the equipment and the products in the same context and this will be done as far as is practically possible in the current research situation. The major problem here is that it is almost impossible to decide where the textiles found at Bryggen originally came from – whether they have been produced at Bryggen or in the immediate area, or have come from some distant part. From the textile finds it will therefore only to a limited extent be possible to throw light upon the various questions posed above.

2 The source material

2.1 Type and extent

The source material for considering the textile industry at Bryggen is a complex and heterogeneous group of objects of stone, wood, bone, clay and metal. They include tools and parts of equipment used in the production of textiles – spinning, weaving, sewing and binding – and in the post-manufacture treatment of textiles.

In all there are 1928 objects from Bryggen which will be brought into the discussion on what are certain, probable or possible implements or parts of equipment used in the production of textiles. Identification is often a problem, but an attempt will be made to consider all groups of objects which have previously been mentioned or discussed in this context.

This figure does not, however, represent an equivalent number of single items of equipment: in many cases there will be several items from one piece of equipment, eg the warp-weights of an upright loom. In practice it can often be difficult to decide which pieces belong together.

Equipment for spinning and weaving makes up the largest group, comprising in all 1355 items. Spinning equipment includes distaffs, drop-spindles and spindle-whorls. Equipment for twisting the strands and possible winding equipment is also included. From the activity of weaving, it is basically warp-weights which survive, but the group also includes weaving-swords, loom-knives, heddle-frames and weaving-tablets. In addition there is a group of pieces less securely identified as being connected with weaving. Equipment which may have been used in the preparatory stages of textile manufacture, such as the working of fibres prior to spinning, eg cards, flax-combs and flax-brakes, will also be discussed. This is only a small group. Equipment for sewing and binding consists of needles and scissors. Scissor-cases, thimbles, needle-cases and small whetstones for sharpening needles are also included. This group contains in all 503 objects or fragments of objects. Equipment used in the post-manufacture treatment of textiles is very sparsely represented, consisting of only 15 possible linen- smoothers.

2.2 Condition of the finds

There are quite a number of whole objects among the Bryggen finds, such as needles and scissors, but a large amount of the textile equipment consists only of parts of objects. There is, for example, no complete loom, nor in fact a single intact example of a drop-spindle with its spindle-whorl. The various items of equipment – loom-weights, spindle-whorls, etc – may be whole or consist only of fragments.

This can also create problems in identifying the parts of equipment, in particular the large complex items, such as a loom. It is, for example, very difficult to identify the uprights of a warp-weighted loom or the major parts of a horizontal loom. Some objects are so simple and utilitarian that they are almost impossible to identify when they are found out of context. This applies to a certain extent to loom-weights which can be difficult to distinguish from net-weights when they occur as loose finds. This means that we must assume that there is a potentially larger proportion of the excavated material which may be connected with the manufacture of textiles than the 1928 items discussed here and that certain types of objects may therefore be underrepresented.

At least two groups, however, are clearly overrepresented: loom-weights and wooden and bone needles. All weights with the exception of those we definitely know to be fishing or net-weights have been included here, and the same applies to needles. An analysis of the objects will most probably make it possible to distinguish certain types of weights and needles as less likely to be connected with the textile industry.

The broken fragments of objects cannot be fully used in the analysis, since not all the features of the object can be compared. However, this does not represent a big problem. The total material will in any case be significant in the chronological and geographical distribution. The manner in which the objects have been broken can in many instances provide information about the way they have been used.

2.3 Distribution patterns and representativity

The pattern of distribution which appears when the objects are mapped chronologically and geographically is not immediately representative. The site, which was divided into 8mx8m grid-squares, was not excavated and recorded in the same way from the uppermost to the lowest layer over the whole of the 7.500 square meter area. The plan (fig 0.5) indicates the grid-squares or areas which have been completely investigated archaeologically from top to bottom, those where the upper layers (later than Fire Level V) were removed mechanically and those which have only been partly excavated. The plan shows that there are dissimilarities in the distribution of finds both chronologically and geographically. This irregular representation must be taken into account when the various distribution patterns in time and space are being interpreted.

One of the problems connected with plotting the distribution of the objects is the inconsistency of the location data over the twenty years of field-work. The greatest problems are that the actual find-spot is not given precisely and that not every object has yet been dated. The incomplete data create naturally great problems when attempts are made to place the objects in their chronological and geographical contexts.

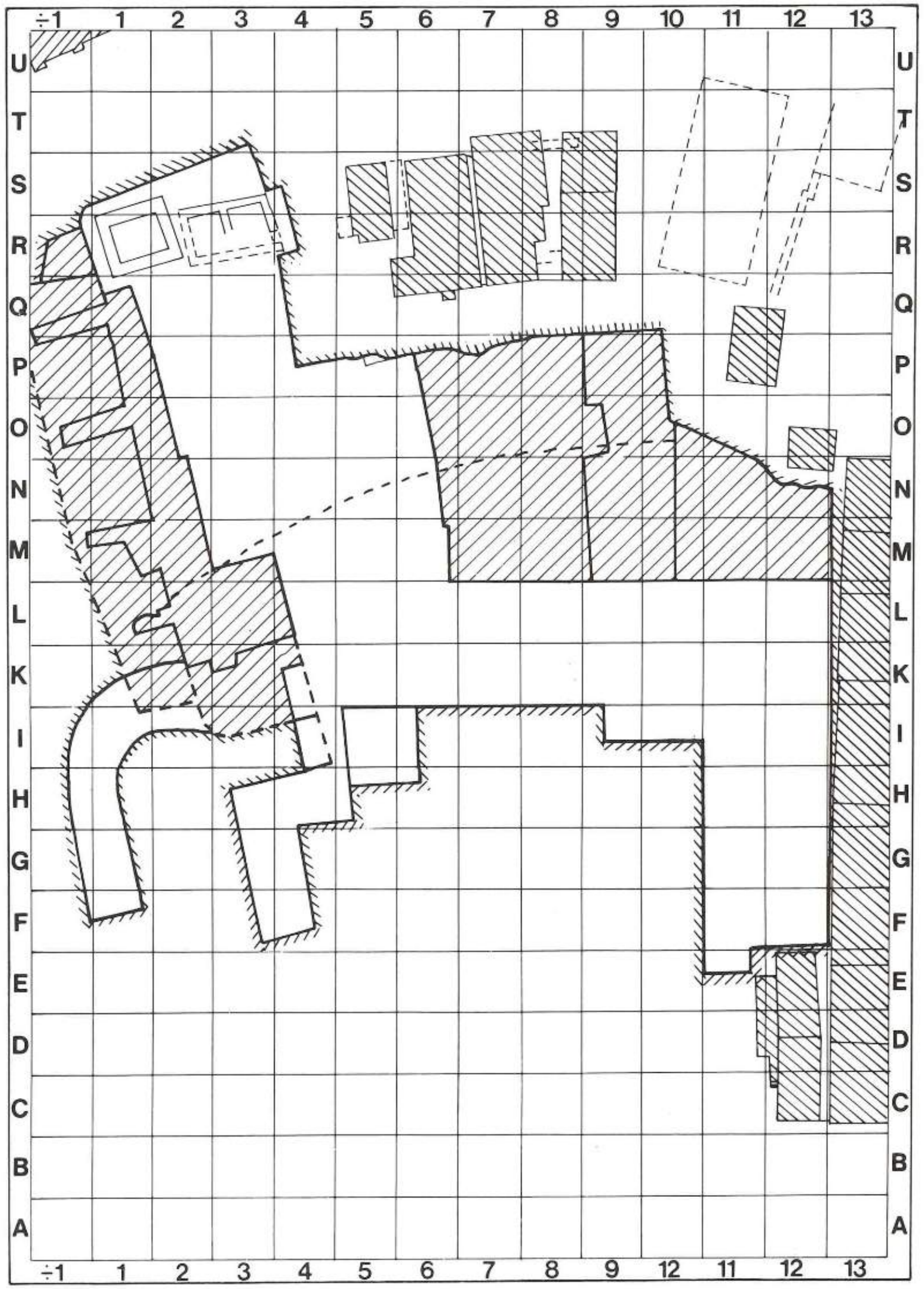


Fig 0.5 Site of the excavations, divided into grid-squares of 8m x 8m. Those areas where the upper layers were removed by machine down to Fire Layer V are hatched. Over the rest of the site the deposits were excavated archaeologically from the uppermost fire layer down to Fire VII

For this reason I have partly dropped making a detailed distribution-map of the whole material. I have, however, attempted to present a general impression of the environmental contexts of the various objects schematically.

The geographical distribution of the textile equipment in the field can indicate whether there have been special areas where work involving textiles has been carried out for a shorter or longer period. Especially interesting in this context are burnt buildings where concentrations of weights have been found in the fire-layers , being perhaps the remains of upright looms.

In such cases I will consider the total collection of finds in the building in order to investigate what type of environment they may represent. Tools or pieces of equipment which may thus have been lying *in situ*, ie where they were actually used, represent key groups in this study. Weights which have been found in such a situation will represent a reference collection when identifying the function of all other weights and even of other objects or pieces of equipment. I have therefore found it necessary to establish the exact position of objects found in a fire layer, despite the incomplete state of the data, and much work has therefore been expended in clarifying the extent and data of the relevant structures.

When considering the distribution pattern of the finds from Bryggen, it is especially important to understand the great expansion and the filling in of the harbour area, resulting in a great difference in the thickness of the layers per time unit for the front area compared with the accumulated occupation layers in the areas behind the original shoreline, the so-called 0-line (cf fig 0.2).

The state of preservation of the different types of material such as stone, bone, wood, etc, varies for the different parts of the site. Only objects made from inorganic material, such as stone and fired clay, are unaffected by the situation. Objects made from wood, bone, leather and other organic material have generally had very favourable preservation conditions at Bryggen right up to the latest deposits, but are of course best preserved in the wettest and most compressed layers. The thinner occupation layers above the original shoreline provide much poorer preservation conditions than the grid-squares further down the site. The deeper earlier layers also provide better preservation conditions than the upper, later layers. Preservation conditions for metal have been relatively unfavourable in the saline backfill in the old harbour basin.

It is reasonable to assume that the broken objects have been thrown away as rubbish, while complete objects have presumably been lost either by chance or for some other reason, such as in a fire, where on the whole only objects of stone of fired clay would be preserved.

The chronological distribution of textile equipment is no less important. The pattern which appears here will indicate how long certain forms of textile production have continued in the area and suggest how extensive the activity has been at various times.

We have earlier noted that the chronological distribution of finds is not even, owing to differential excavation in the various parts of the site. Only certain areas of the excavations are therefore significant when it comes to a chronological representativity. If there happen to be concentrations of textile equipment in other areas with a limited or irregular chronological distribution, we can only draw limited conclusions about the development in time.

2.4 *Chronology*

The question of chronology in the Bryggen excavations is closely connected with fires and fire-layers. During the period 1955-68 work was based on seven inter-fire phases for this area associated with historically recorded fires affecting this part of the town. Fire I in this chronological system represents the latest fire in 1702 and fire VII the oldest in 1170-71 (Herteig 1969, 28-29). The finds were recorded continuously in the field with their location and date, the latter being related to these fire levels I-VII wherever possible. The fire-layers, however, did not extend as a thick blanket across the whole site. They could be thick and obvious in some places, in other places a thin, faint line. The layers fluctuated greatly and a break in a fire deposit could give rise to problems in establishing definite links from one area to another. The problem was aggravated as the excavations continued over a long period of time.

After the field-work provisionally ceased in 1968 a project was established to correlate the fire-layers across the whole site and to separate the inter-fire construction phases. This project had to stop before a reliable chronology had been established. Asbjørn Herteig's more recent work on the chronology of the Bugården area has, however, demonstrated the need for adjusting the fire chronology used in the field (Herteig 1985). There appear to have been at least eight fires within the excavated area. Knut Helle has listed and discussed the historically recorded fires in medieval Bergen (Helle 1979). He has shown that the picture is more complicated than previously thought and that during the period 1170-1702 more fires can have affected the Bryggen area than the seven originally considered, which thereby affects the dating of the finds from here.

In 1982 the Bryggen Project was established and since then Herteig has continued the work on clarifying Bryggen's chronological development and of correlating the fire-layers recorded during excavation. This work is not yet completed (1987), but the main results are available. It is now necessary to adjust the chronology over a greater part of the site compared with the original scheme. There is an extra fire, Fire VIII, which predated the earliest historically recorded fire in 1170/71 in the north-eastern part of the excavations.

In the present work this new chronology has been used to date all the datable finds of textile equipment. Only 9% lack information about their date, either due to mistaken numbering or missing numbers, or because they lack sufficient site-data. With such a high number of datable finds, this group of material must be regarded as statistically significant.

The textile equipment on the whole is simple and functional and therefore not subject to great changes, so that there has not been a great need for a more detailed chronology than that represented by the fire-layers.

When dating the objects I have found it expedient to work with periods or intervals of time between two fire-layers. To some extent I have been able to make use of the more precise inter-fire phasing resulting from the chronology project. This has been particularly significant in the discussion in Part II where the various pieces of equipment are considered as the remains of a textile milieu at Bryggen. In the actual analysis of the objects themselves, such a detailed and complex chronology was of less significance.

A period is defined as beginning with the layers and finds lying over a fire-layer and ends with the fire-layer of the next fire. The fire-based chronology for Bryggen will thus give eight periods in all, with period 1 as the earliest (fig 0.6).

There are no finds of textile equipment at all in period 1, while period 8 (1476-1702) is only

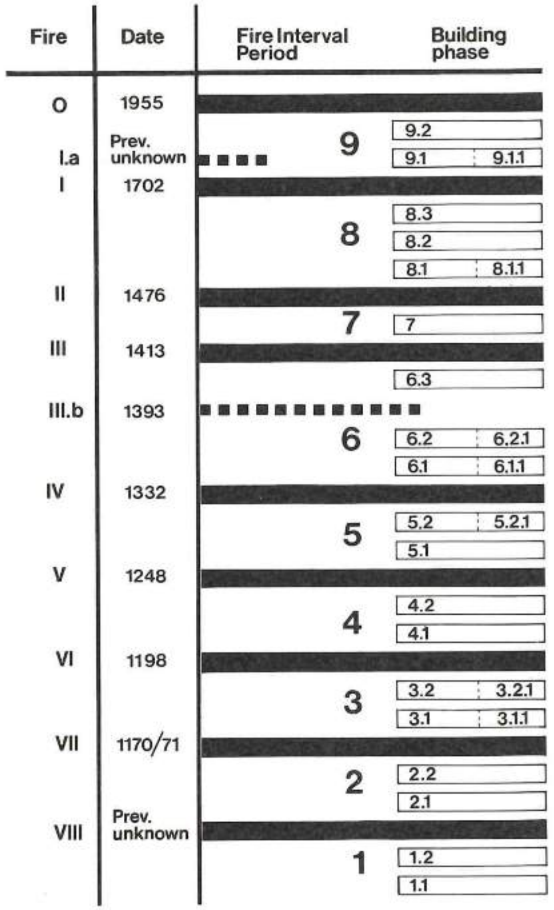


Fig 0.6 Division into periods, based on the fire-chronology at Bryggen and historically recorded fires.

represented with sporadic finds. The chronological limits of this present study are thus c 1150-1500.

3 Method

It is quite obvious that the choice of method must be related to the aims of the operation and type of source material. A number of methodological questions are raised and discussed in the presentation of the material, in particular the question of representativity.

3.1 Identification

When one takes as a starting-point a group of objects with a particular function, a practical and methodological question is immediately raised: how to identify tools or equipment used

in the manufacture of textiles. The identification is based on two interrelated principles: comparison with (1) archaeological and (2) ethnological material whose identity has already been established.

When the objects have been lost or thrown away as rubbish, it will be difficult in many cases to make a definite decision about function. The objects may have had several areas of use or they may differ from other known objects. These points will be discussed in each case.

3.2 Classification

As it is the area of use which is central in this study, special emphasis will be laid on the functional features in the classification of the objects. However, it is the form of the object within its function group which is the basis for the further division into types. The identifying characteristics must, of course, be valid for all the examples of a type, while special characteristics which do not occur in all cases will provide the basis for sub-types.

Also absolute measurements will be recorded for comparative purposes and in such a way that the objects will be recognisable from the measured characteristics. The criteria and scheme for each type will be presented for each group of objects.

The material comprises 1928 objects or fragments. However, these are unevenly distributed among the various groups of tools or equipment, the largest groups being the weights with 792 items in all and the spindle-whorls with 410 items. Both these groups have been computer-processed, since they are so large and have so many possible cross-references that it was possible to save time by using a computer. The other groups of objects have been processed manually, but according to the same principles. At least half the material has location data which has been computerised, but information about the remainder of the material has been taken from the finds registers. Putting the location data on computer has been of great help in obtaining an overview of the geographical and chronological distribution of the material.

4 Earlier research

Up to now there has been little archaeological research in Norway into the tools and equipment used in the manufacture of textiles in the Middle Ages (in Norwegian archaeological chronology starting about AD 1050). There are no detailed studies of any of the types of objects in this group, the only publication being Sigurd Grieg's work on the finds from medieval Bergen and Oslo (Grieg 1933). They are, however, given an extremely summary treatment there.

Jan Petersen has made a much more detailed and investigative study of textile equipment for the Viking period (AD 800-1050) preceding the medieval period in Norway.

Since Grieg's work on Norwegian urban finds appeared in the early 1930s, the known material has increased enormously through the extensive excavations at Bryggen and also from excavations in the 1970s in medieval Oslo (Gamlebyen), Trondheim and Tønsberg. Of these more recent excavations, only part of the material from Oslo has been published. The Oslo post-excavation project has chosen to deal with groups of objects based on the raw material rather than function. Textile equipment will therefore appear divided in several volumes. So far only those made in bone or antler have been published as part of a study of the bone and antler objects from one of the sites (Wiberg 1979, 209-213). Those made of wood are being analysed together with other wooden objects, but the results have not been available.

In Trondheim a rather similar arrangement to Bryggen has been chosen. Textile equipment from recent excavations will be treated as a group, together with the textiles (K Gjøl-Hagen).

Øivind Lunde has presented some of the textile equipment found in Trondheim prior to the current series of excavations which began in 1970 (Lunde 1977, 128-132). His treatment, however, is extremely summary, since the aim of his research was other than that of illustrating textile manufacture.

In general articles about the excavations at Bryggen and at Borgund in Sunnmøre, as well as in the popular account of the Bryggen excavations published in 1969, Herteig has touched both on the manufacture of textiles and on textile equipment, though not as a main topic (Herteig 1957, 33-35; 1969, 120-21).

In the Nordic countries generally, there is a somewhat wider range of archaeological literature on the subject. Particular mention should be made of the presentation of the finds from the Søndervold site in Århus in Denmark (Andersen *et al* 1971) and the thematic articles from the recent excavations in Lund in Sweden (Blomquist 1963, Mortensson 1976). Information on textile equipment is also found in other archaeological publications, details of which will be given whenever the material is referred to for comparative purposes.

Of the medieval archaeological material from Northern Europe generally, the textile equipment from Novgorod is particularly numerous and well documented, especially the wooden objects (Kolĉin 1968). Bone and horn objects from the Frisian Islands, including equipment for textile production, have also been fully described and discussed (Roes 1963). Other archaeological publications contain information which will be used as comparative material but they will not be mentioned in detail here, except for the particularly important contributions made by Agnes Geijer in her articles on important finds of textile equipment (Geijer and Anderbjörk 1939, 232-41) and by the Polish scholars J Kaminska and A Nahlik in their work on medieval textile handicrafts based on the archaeological material from Poland (Kaminska and Nahlik 1960).

J P Wild's work on the production of textiles in the Northern Roman provinces provides a valuable survey of the topic based on both the written sources and the archaeological material (Wild 1970). Even though he deals with a period well before the Middle Ages, his results are useful for comparative purposes.

Similarly, we will make use of Margarete Hald's great study from 1950 on the early Danish textiles (Hald 1950).

Textile research has had and continues to have a much more important place in Norwegian and Nordic ethnology than in archaeology. Descriptions of textile equipment and methods of production from more recent times may also be significant for identifying or understanding the medieval material. In many cases it is possible to extrapolate this sort of information directly back to the Middle Ages. Marta Hoffmann's investigative study of the modern warp-weighted loom in Norway and the way it is used provide clear proof of the value of the restrospective method. Her thesis on the warp-weighted loom has made an essential contribution to the understanding of prehistoric and medieval weaving techniques (Hoffmann 1964). She has also made many important contributions to the history of textiles in Norway in the Middle Ages through her short articles in the Kulturhistorisk leksikon for nordisk middelalder (Encyclopaedia of Nordic medieval cultural history – abbrev. KLNM). Nevertheless, detailed surveys of the various kinds of textile equipment are lacking in Nordic ethnological research.

The international ethnographical and ethnological literature on textiles and textile production is extensive and much of this work has been studied and used for comparison and reference.

Even though the Norwegian material which is available for comparative purposes is sparse, it is of some help that the more extensive foreign material can be drawn in for comparison and discussion. The sound ethnological research and studies in textile history provide a solid basis for further research.

In the present study I have not attempted to give an exhaustive description of the equipment and processes employed in the production of textiles in the Middle Ages. My aim is simply to provide a background for the finds of textile equipment from Bryggen. Comparative material is drawn in only where it can throw light on problems concerning specific finds from Bryggen.

PART I
ANALYSIS OF THE ARTEFACTS

CHAPTER I
EQUIPMENT USED IN THE PREPARATION OF TEXTILE FIBRES

1 Textile fibres

The first step in the production of textiles consists of obtaining and preparing the various types of fibres which can be used to make thread. The most important raw material was sheep's wool and to a lesser extent the hair of other animals, such as goats and cattle. Among plant fibres, flax (Linum usitatissimum) and hemp (Cannabis sativa) were particularly important in Norway, but nettle (Urtica dioica) was also used. All these raw materials were presumably used in the production of textiles at Bergen in the Middle Ages. Among the textiles found at Bryggen wool occurs in various degrees of fineness, but they also include goat and cattle hair (Schjølberg 1984, 73-91). The preservation conditions for plant fibres were essentially poorer than for animal fibres, and this is probably the reason why only a few small pieces of carbonized flax were recorded. Traces of silk have also been found (pers comm from E Schjølberg). To provide a background for the analysis of the equipment used in the preparation of textile fibres, we shall first consider the properties of the different types of fibres and the preparation process which the equipment was used for.

1.1 Animal fibres

Wool was without doubt the most important raw material in medieval production of textiles. The value and usefulness of wool is dependent on many factors: fineness, colour, gloss, softness, curliness, evenness, length, suppleness, elasticity, stretchability, cleanness, strength and durability (Hoksmark 1955, 8).

The quality of wool varies throughout the fleece. After shearing which in former times usually took place in late spring or early summer, it was important to sort the wool according to quality. Good sorting is the foundation for a good end-product. The primary task of the sorter is to separate the different qualities of staple within the fleece. The number will vary according to the breed of sheep and its environmental conditions. The following features are important: length and strength of the fibre, softness and colour.

It was also necessary to remove impurities, to get rid of tangles and foreign bodies and to comb the wool so that the fibres were lying in the same direction. Long-fibred wool was combed to remove the short staples and to get the long staples parallel, thus enabling a finer thread to be spun than if the fleece were left unsorted, since fewer fibres were required to produce a stable yarn (Wild 1970, 25-26).

Other animal hair could also be used for spinning, including goat hair, cattle hair, the hair from the mane and tail of horses, and dog hair. The goat has a good full coat with both underfleece and topfleece. The shaggy topfleece could give a coarse, hard-wearing yarn. Cattle hair on the other hand is too short and stiff to be spun on its own and was therefore mixed with sheep's wool, making the yarn coarser and stronger. Horse hair from the mane or tail gave a glossy and unusually hardwearing material, but with limited areas of use. Dog hair is regarded as a good material for spinning but is best when mixed with other fibres.

1.2 Plant fibres

In the medieval period it was not unusual in Western Norway to produce textiles from locally produced flax (Linum usitatissimum) (Sølvberg 1976, 48-50). Flax is an annual plant, thriving best in a relatively damp and cool climate. The plant grows today as tall as 1.25m. The fibres lie around a woody core. To get the best quality, flax must be harvested before the seeds are fully ripe (Hoksmark 1955, 7). In modern times it is dried outdoors on poles or in stacks after being pulled up.

Once it has been dried, the seeds can be removed by drawing the stems over a comb or ripple. Next the stems must be retted, ie soaked in water to decompose the outer layer. They may be left out in the dew or soaked in bundles in a well or pool. After a couple of days a fermentation process begins which causes the outer bark to decompose. The stalks are then dried in a kiln, after which they are broken or beaten with an implement known as a brake, causing the bundles of bast fibres to loosen from the outer bark and the woody core. The fibres are then separated by scutching or swingling, by which the broken stems are held over a block and are tapped or stroked with a blade-edged wooden tool called a scutching-knife. To complete the cleaning, separating and combing process, the scutched fibres are pulled through a hackle. The short tow fibres separated during scutching and hackling can be spun separately (Kaukonen & Hoffmann, KLNM X 590-94; Wild 1970, 25-26; Burnham 1980, 114).

Hemp (Cannabis sativa) was also used as spinning material in Western Norway in the Middle Ages, but was probably of relatively limited production (Sølvberg 1976, 50-51). Summer hemp gives the softest and finest fibres but are nevertheless coarser and stiffer than flax fibres. The fibres can be as much as a couple of metres long and are very strong, being mainly used in the production of cord and rope, but also for canvas. On the whole hemp was grown and processed in the same way as flax (Hoksmark 1955, 7).

The fibres of the nettle (Urtica dioica) were also probably used in medieval textile production. The fibres are firm and strong but irregular and it is difficult to separate them completely from the other plant cells. In Norway the earliest indications of such a use can be traced back to the Migration period (c 400-600 AD). In Jølster in the West Norwegian county of Sogn og Fjordane there is still a living tradition that nettle has been used for the warp in wall hangings (Høeg, KLNM XII 284-85).

2 Equipment used in the preparation of textiles

It had become usual in the Middle Ages to shear the sheep. The medieval shears consisted of a U-shaped piece of metal with the two flattened ends forming the blades. The most effective cutting part has been calculated to approx. 15cm (Wild 1970, 23).

For carding the wool either a wool-comb or a card was used. Cards appear as a new piece of equipment in the Middle Ages consisting of a small rectangular board with a handle and covered with small metal hooks. In the European sources the cards appear for the first time in the 14th century, whereas in the Nordic countries they cannot be traced further back than to the 15th century (Hoffmann, KLNM VIII, 278-79). The wool-combs had one or more rows of metal teeth fixed to a wooden handle (Hoffmann, KLNM, XIX, 277-78). Another type of comb has also been associated with carding. This is a relatively small bone comb with long teeth and a variation with shorter teeth. The function of this type is more doubtful and I shall return to this question when dealing with the actual finds from Bryggen.

To treat the plant-fibres a comb was needed for removing the seeds, a beater for loosening the hard parts of the fibres, and a brake for beating out the remains of the bark. To remove the rest of the hard particles and to separate the fibres a hackle was used. Breaking as well as scutching goes back to the Middle Ages (Hoffmann, KLNM X, 594).

We shall now consider whether the remains of any of these tools used in the preparation of textiles can be identified among the finds from Bryggen.

3 Possible tools for the preparation of textiles found at Bryggen

3.1 Sheep-shears

Most of the wool which was spun and woven in Bergen was probably shorn elsewhere. However, we know that a certain amount of farming was carried on in the town and that animals, including sheep, were kept.

Of the 21 U-shaped shears or scissors from Bryggen, there is only one which is large enough to have possibly been used for shearing sheep (see V, 3 p 108). Only one half of it has survived, 29.5cm long with a 13.5cm long cutting edge and an almost circular spring at the top end (no.36627). It comes from Period 7.

3.2 Long-toothed combs from Bryggen

Of the two types of combs mentioned above, only the type with long teeth is represented among the Bryggen material. There is much uncertainty about the function of this type of comb and several suggestions have been made: that it was for carding wool, used in weaving, as an ornament comb or as an ordinary hair comb. Until we can be certain about its function, we will use the neutral term long-toothed comb.

The Bryggen material contains 19 long-toothed combs of bone, only 8 of them complete. The majority (14) are made from metapods (probably Bos Taurus), both metatarsals and metacarpals, the distal epiphysal being sawn off. The bone is cut laterally and the relative flat ventral part is even more flattened. The teeth are sawn from the distal end. They are closely

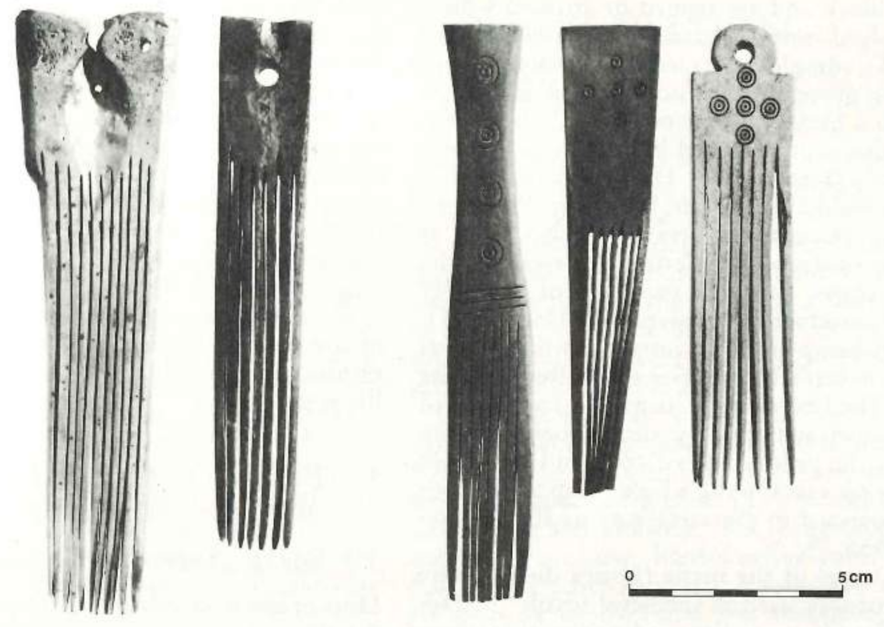


Fig I.1 Long-toothed combs from Bryggen (nos 3962, 43851, 46648, 3577. 19943)

spaced, sharpened and polished at the end. Five of the combs are made from antler, probably reindeer.

The bone combs are all of much the same size, between 11,9 and 13,5 cm in length. The greatest width at the handle varies from 2 to 4,2 cm – the metatarsal-examples being naturally narrower than the metacarpals. The numbers of teeth vary from 6 to 12. The teeth are in some cases irregular in thickness and somewhat unevenly sawn. The length of the teeth ranges from 8,4 to 10,2. The distance between the teeth is approximately 0,5 mm, widening at the points to 1-1.5 mm. The combs are rather coarsely made and without any ornamentation.

The antler combs are somewhat shorter, slender and flatter than the bone combs. They are more neatly made, especially the handle. They vary in length from 8,4 to 12,9cm, and the greatest width at the handle is between 1,9 cm and 2,3 cm. The numbers of teeth are 7 – 8, with a length from 3,6 to 7,7 cm. Three of these combs are decorated and have a neat design: one with an elongated curved handle, another with a loop on the top. They are decorated with single or double ring-and-dot-decoration. On one comb this is combined with three simple horizontal lines.

The combs come from periods 2-7, ie before 1170 to 1476.

Comparable combs have also been found in other medieval excavations in Norway and the other Nordic countries. Among the Viking Age finds there are only two known examples, neither of which resemble the medieval types (Brøgger 1930, 85, 87 & 105). It has therefore been claimed that the long-toothed combs described here first came into use in Norway during the medieval period (Grieg 1933, 237).

From previous excavations, we know of long-toothed combs from the Kjøpmannsstuen site in Bryggen, from Trondheim (illustrated in Lunde 1977, 132), from the Mindet site in Gamlebyen, Oslo, (Wiberg 1977, 211), as well as from earlier excavations in medieval Oslo (Grieg 1933, 336).

In Sweden similar combs have been found in the excavation of the PK Bank site in Lund (Persson 1976, 317). They have been dated to the period ca 1000 to ca 1200, but they do not appear to undergo any changes during this period.

In Denmark the type has been found in several towns but published examples are few.

On the Søndervold site in Århus eight fragmentary long-toothed combs were found, most of them dated to around the thirteenth century (Crabb 1971, 247ff).

Sixty examples are known from Frisia, and the type here has been traced back to the Roman period but does not become usual until the eighth and ninth centuries. In some parts it did not come into use until later. In the region between the Elbe and the Saale they are most common between the twelfth and fifteenth centuries (Roes 1963, 27-8). 247 examples were uncovered at different sites in Schleswig, dating from the period 11th to the 14th century (Ulbricht 1984, 41). On the whole long-toothed combs are widely spread in both the eastern and the western parts of the continent. Most of the finds are from the twelfth, thirteenth and fourteenth centuries (Crabb 1971, 250). The combs from Bryggen thus fall into the general pattern for form and dating of this type of comb.

Various functions have been suggested for the long-toothed combs. The usual view is that they were used in weaving for beating up the weft. More recent research has brought this interpretation into doubt, but the term «weaving comb» is still partly in use (eg Grieg 1933, Blomquist 1963 and Lunde 1977).

Anna Roes says that «it is difficult to see how the long teeth could have been in any way useful for closing up a weft» (Roes 1963, 26) and suggests instead that the type was used for carding wool. Jan Persson maintains on the other hand that a long-toothed comb would not have been practical for carding, as wool is «much too tangled». He suggests that the spacing of the teeth indicates combing the hair or beard. It is especially the finding of a double-ended long-toothed comb with human hair between the teeth, which leads Persson to doubt the probability of a weaving or carding function. He takes this find as proof that the combs were used either for holding the hair in place or for combing beards (Persson 1976, 217-19).

Christina Wiberg expresses doubt about the use of this type of comb as an implement for textiles but does not discuss the point further (Wiberg 1977, 211). P J Crabb, however, maintains that it is most likely a comb-beater with some special function, but probably not for an upright loom. One of the combs from Århus shows wear-marks on the teeth.

P J Wild, the English textile researcher, also maintains that a similar type, but with wider spacing of the teeth, has been used to pack the weft in weaving and are still used by weavers in Central America (Wild 1970, 66). Such comb-beaters are primarily used for tapestry weaving and rug weaving where only small sections of the weft at a time are beaten up (Burnham 1980, 28). They are rather different from the long-toothed combs, being more like the comb found in the Oseberg excavation. It has been suggested that the Oseberg comb and the two-beam loom which was also found there had been used for weaving the narrow figured fabrics in soumac weave which were found in the grave (Hoffmann 1978a, 17).

Modern textile scholars such as H B Burnham and M Hoffmann are of the opinion that the long-toothed combs are unlikely to have been used in weaving (Hoffmann & Burnham, 1973, 59). In a recent study Ingrid Ulbricht supports this view. As the long-toothed combs are rather simple and coarsly made, she finds it unlikely that they were used as decorative hair-combs for the coiffure. She finds it more plausible that they represented a less expensive alternative to three-component combs (Ulbricht 1984, 42-43).

To sum up: The spacing and number of the teeth tell against the long-toothed comb being a comb-beater or wool carding comb. As the pointed form of the teeth and the polish marks are the same as on ordinary medieval combs, I find Ulbrechts interpretation the most plausible: that the combs have been most likely used for combing the hair. The long-toothed combs from Bryggen will therefore not be included among the textile implements in the present study.

3.3 Possible flax beaters from Bryggen

Twenty-two wooden objects have been found at Bryggen which may have been used as pestles. Some of the larger and heavier ones may possibly have been used as flax beaters, but the objects in this group are generally smaller and lighter than would be expected if they had been used for beating flax. Their identification as flax beaters is therefore somewhat uncertain.

Each has been cut from a single piece of wood. They can be divided according to shape into four groups. The two main types, A and B, consist of a cylindrical shaft and a thicker club-like cylindrical head. Type A has a right-angled or nearly right-angled shoulder, while type B

TYPE	A	B	C	D	Σ
N	4	12	3	3	22

Fig I.2 Possible flax beaters from Bryggen: types

has a sloping shoulder. Types C and D also slope from shaft to head. Type C has an oval head and a flat shaft; type D has a square head and cylindrical shaft. The distribution is shown in fig I.2.

The implements are made from pine (Pinus) (14), birch (Betula) (2), hazel (Corylus Avellana) (2), oak (Quercus) (1) and Norway maple (Acer) (1). They range from 19.8 to 48.7cm in total length. The shaft varies between 9 and 29cm. The diameter of the head ranges from 2.8 to 6.4cm and the shaft from 1.6 to 3.9cm. They fall into three groups according to length: 20-27cm (10 examples), 32-35cm (7) and 38-48cm (5). One is incomplete. Fig I.3 shows the whole group arranged according to type and size.

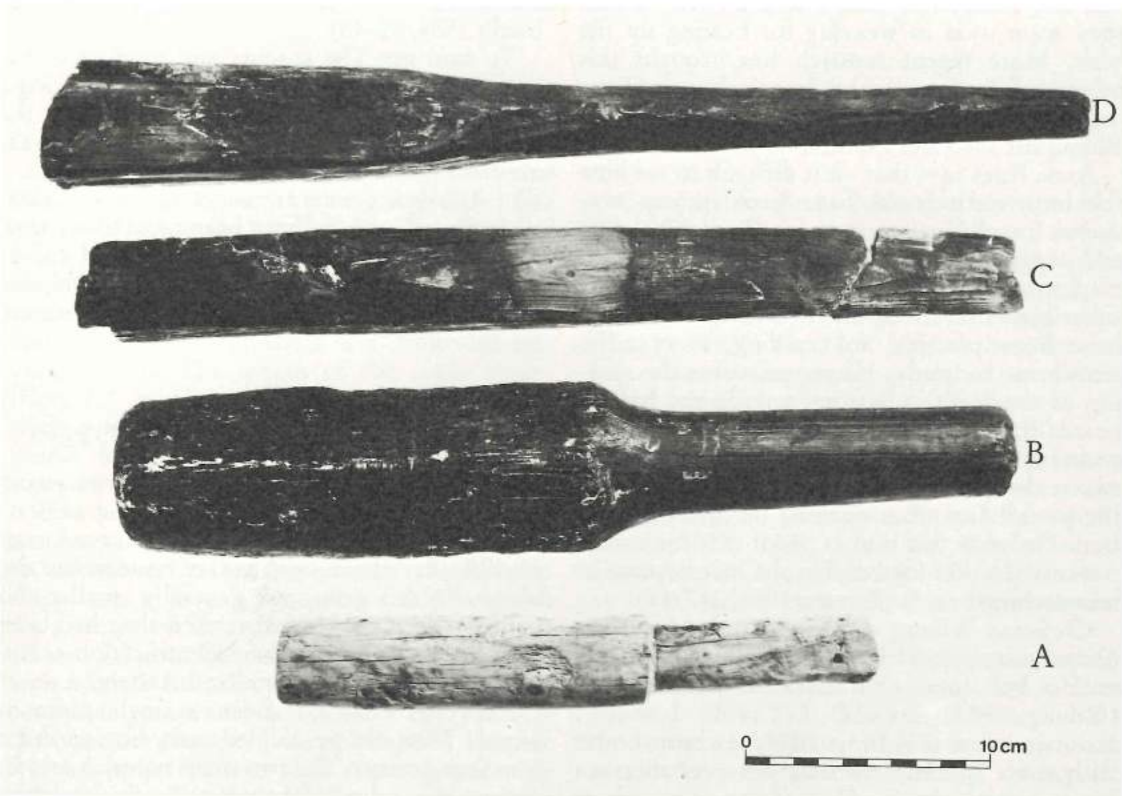


Fig I.3 Possible flax beaters from Bryggen arranged according to type (nos 89130, 63664, 64136, 63285)

On the largest of the clubs (no.73214) is a runic inscription which has been interpreted by Helge Dyvik as follows: «illa hefir sá maðr er hefir slika konu sem þu er» («Unhappy is the man who has a wife like you.») The implement has probably been used for beating, but not presumably like a club or the traditional comic-drawing rolling-pin. It may have been a laundry beater or a flax beater. The smaller clubs may have been used as pestles.

Similar implements of the same shape and size as type A from Bryggen have been found at Oseberg (Grieg 1928, 183-85) from Borgund, Sunnmøre, and in medieval Lund (Nilsson 1976, 249). These have been interpreted as flax beaters.

The clubs appear in the periods 2 to 6, from before 1170 to c 1413.

3.4 Possible flax combs or ripples from Bryggen

Thirty-three fork-shaped or comb-like wooden implements found at Bryggen form a group which has been considered as having some connection with textile production (Herteig 1969, 47). I have not found comparable objects in the archaeological and ethnological material, except for an incomplete example from a recent excavation in Tønsberg (pers comm A-L Eriksson). It will therefore be necessary to examine this group of implements more closely and discuss possible functions.

The implement consists of two main parts: 1) the head or comb section with its coarsely cut tines and 2) the shaft. In only two examples has

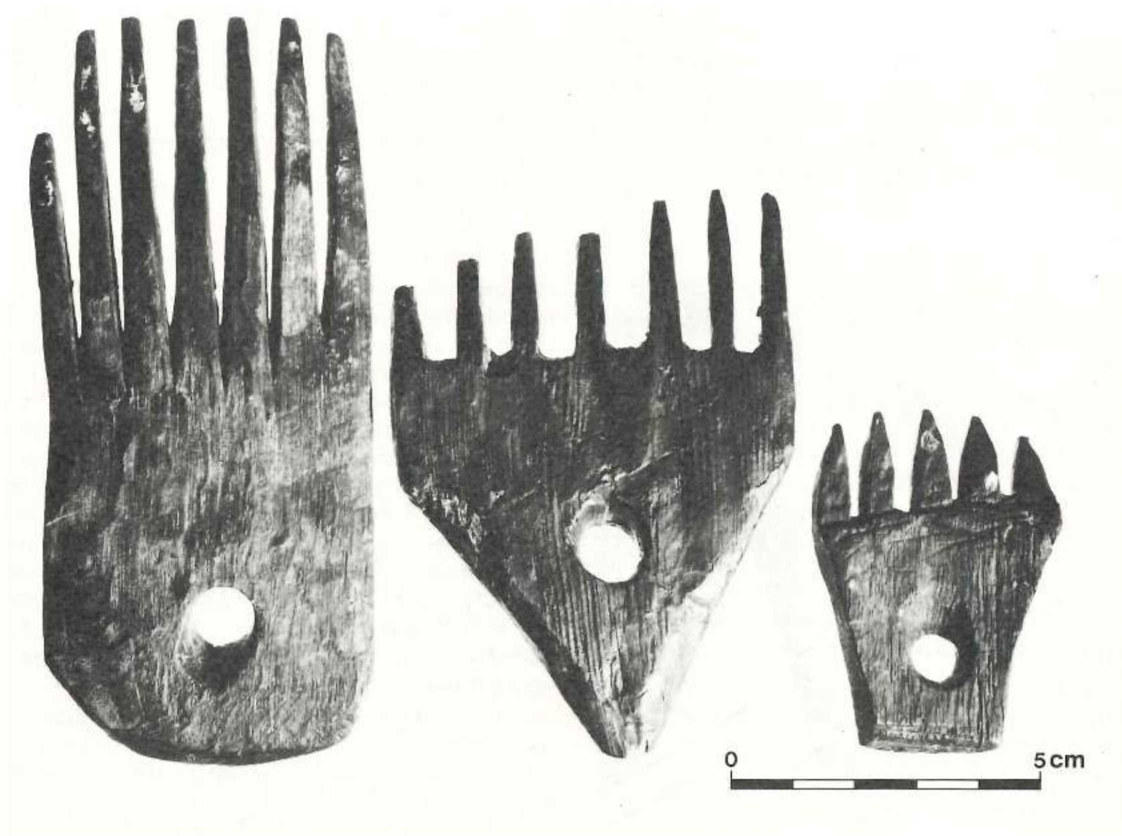


Fig I.4 Possible flax combs or ripples: different types (nos 29729, 63346, 21124) part of the shaft survived and only eight have a complete head section with the tines and the part where the shaft joins intact. The remainder are damaged. Two examples are interpreted as roughouts (fig I.6).

In the majority of cases, however, both the width and height of the head can be interpolated. The size, the number of tines and the shape of the head can all vary. The top of the head in twenty cases is triangular or nearly so, in five cases rounded and sometimes pointed, in five cases trapezoidal, and in three cases rectangular (fig I.4).

The hole for the shaft is round, with a diameter ranging from 1.2 to 2.6cm, with an average of 1.9cm. All the holes are made on the slant so that the shaft joins the head at an acute angle (fig 1.5). Two of the combs still have part of the shaft in place (nos 63758, 88532) and these have been fixed to the head in one case with a wooden wedge in the end of the shaft and in the other with an iron nail across the shaft.

The total length of the comb-heads varies from 9 to 32cm. Two-thirds of them are between 13 and 22cm long. The average length is 17.3cm. The number of tines ranges from 4 to 8 with 5 as the average. On eleven combs the longest surviving tines are less than 5cm, sixteen have tines between 5 and 10cm and on six the tines are longer than 10cm. They are not always of equal length, but the difference is never great. In most cases the tines are thickest at the head and they narrow evenly to a rounded or pointed end. The distance between them varies from 3 to 9mm at the head and from 5 to 21mm at the point, the average being 5mm at the head and 10mm at the point.

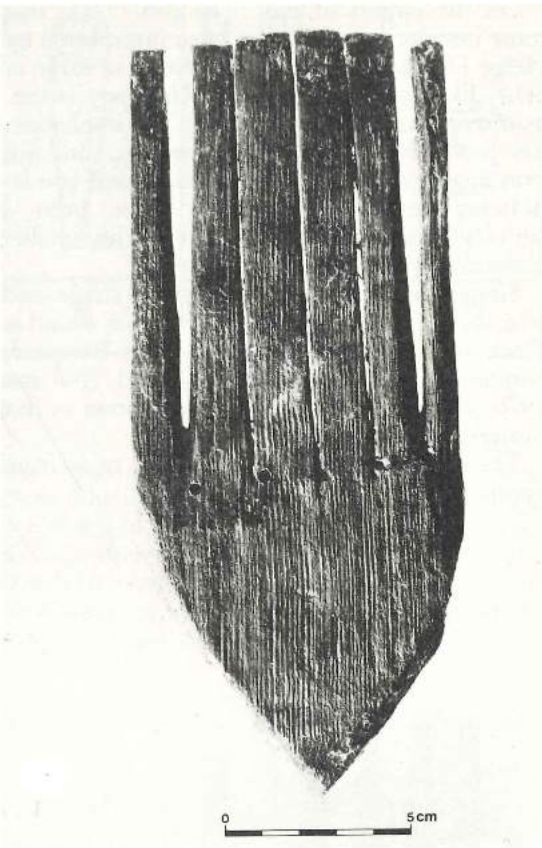


Fig I.6 Unfinished example of possible flax comb or ripple (no 10972)


Fig I.5 Combs with part of the shaft in place (nos 88532, 63758)

The width of the heads measured at the widest part, which is often at the base of the tines, varies from 6.8 to c 16cm with an avarage of 9.8cm.

The heads have been made from one piece of wood between 1 and 2.7cm thick at its thickest point (average thickness 2cm). One comb (no.81363) also has nails through the shaft both above and below the hole, presumably to prevent breakage.

The majority (28) are made of oak (Quercus), but three have been made from pine (Pinus), one from beech (Fagus Silvatica) and one from an unidentified hardwood.

The combs on the whole are coarsely made. The two unfinished examples demonstrate the technique for making the tines. First a hole was bored to make the base of the gap between the teeth. These were then sawn down to the holes which created a series of even, rounded curves between the base of the teeth. Finally the tines were pointed and polished.

All the combs have more or less noticeable traces of wear on the upper edge of the outermost teeth points. The teeth on one of the two combs with the shaft intact are completely worn.

Most of the tines are rectangular in section, but some are rounder, especially near the points, probably because of wear.

The combs occur between periods 2 and 5, ie before 1170 to c 1332. The various shapes of the comb head do not seem to be tied to specific periods.

As long as clear parallels are lacking in the ethnological or archaeological material, we have no secure basis for determining the function of these combs. Herteig has previously interpreted them as flax hackles but without further discussion or reasons (Herteig 1969, 47). Marta Hoffmann has later objected to this. She strongly doubts that the combs have any connection with the preparing of flax fibres (Hoffmann, pers comments).

The closest parallels I have found to the Bryggen combs come from a first century AD context at Vindonissa in Switzerland. The combs are coarsely made from wood and are approximately of the same shape and size as the Bryggen finds. They are all 10-14cm long, c 10cm wide and have from 8 to 12 tines, c 7cm long and c 5mm thick (Wild 1970, 124, table D). They have a hole at the base for a handle or shaft, but unlike the Bryggen finds this is bored at right angles. J P Wild has interpreted these as flax combs, used to remove the seed-cases from the flax after drying. He suggests that the flax was either drawn through the tines or that it was combed on a smooth surface. He emphasises, however, that the tines are so coarse that they can only have been used for coarse fibres. He also points out that this interpretation is open to question as no clear parallels have been found (Wild 1970, 28).

Objects of about the same size and shape as the coarse wooden combs from Bryggen are known from more recent times from Sweden. However, these have metal tines, but they are set at an angle to the handle, so that the working angle is the same as the wooden combs. According to R Jirlow, they were used for removing the seed-cases from the flax. Such instruments were also known as «hemp-combs» and were used to comb the cleaned flax (Jirlow 1924, 150 f).

It is possible that the Bryggen combs had the same function. Their shape and the angle of the handle indicate that they have been used as a small rake. The traces of wear on the upper edge of the teeth-points and not between the teeth would suggest that they were not used as rippling combs.

As many as eight of these combs were found in association with buildings and the detailed investigation of buildings with textile equipment given in Part II shows that they often appear in such context (see p 134). They are found in association with various textile implements such as needles, spindle-whorls, weaving equipment and scissors, indicating that they were often used in the same place as textiles were produced, but we do not have sufficient evidence to include them definitely among the textile equipment.

3.5 Conclusions

A total of 75 objects from Bryggen have been considered as possibly being connected with the preparation of textile fibres from plant fibres and animal hair, but in no case was the function proved satisfactorily. Some are implements which have previously been considered as textile implements, some are without clear parallels in the comparative archaeological and ethnological material. The long-toothed combs will not be included among textile equipment in the subsequent discussion. Nor are the possible flax-combs considered as certain textile equipment.

CHAPTER II
EQUIPMENT FOR SPINNING AND WINDING

In this chapter the Bryggen material will be examined to see how varied and differentiated the spinning equipment is and whether there are indications reflecting the technical level, degree of specialisation, etc.

1 Methods of spinning

To spin is to twist together fibres of limited length to form a thread of unlimited length. All raw material for spinning consists of more or less short fibres which are drawn out and twisted together to form a thread. The process thus involves two actions: 1) drawing out the fibres, 2) twisting them together to form a thread.

The spinning equipment used in Norway in the Middle Ages comprised the distaff and the drop-spindle with its weight or spindle-whorl (fig II.1). The distaff held the fibres in place during spinning. It could vary in shape and size but appears often to be conditioned by the type of fibres being used. It was often in the form of a stick, sharpened at one end and with notches to prevent the raw material from slipping off. This could be held on to the distaff with a strap or thong (Hoffmann KLNM XVI, 500). Uncarded and teased wool was best held loosely on a simple forked distaff. The distaff was either held in the left hand or else tucked under the arm or fixed to the belt, so that both hands were left free to perform the operation of drawing out the fibres and twisting the spindle. Fixed, stationary distaffs were also used.

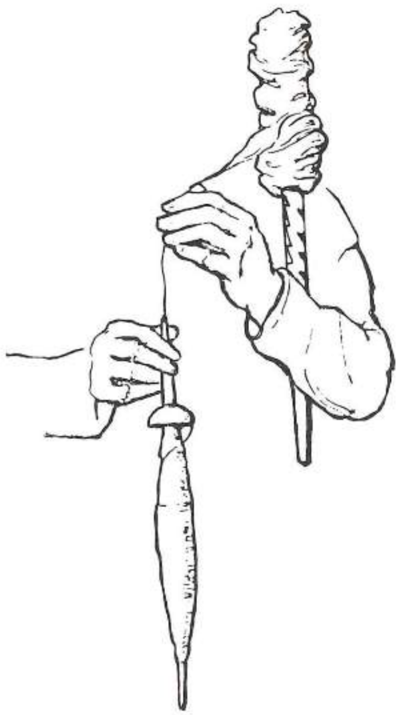


Fig II.1 Distaff and drop-spindle

With the index finger and thumb of the right hand, fibres are drawn out from the middle of the bundle of fibres on the distaff and twisted as they are carefully drawn downwards (fig II.1). When a convenient length of thread has been formed, it is fixed to the top of the drop-spindle and the spinning process can then begin. The twisting of the spindle is controlled by the right hand while fibres are drawn out from the distaff with the left hand. It is also possible to spin without a distaff, by simply holding the wool in the left hand.

A yarn may also be spun by rolling the fibres between the hands or on the thigh, or by means of a hooked wooden stick, but the addition of a weight to the stick, thus turning it into a proper drop-spindle, gives added momentum and produces a much finer and more even thread (Hoffman & Burnham 1973, 54 f).

The drop-spindle consists of a thin, round, carved or turned wooden pin ca 20-30cm long. It often has a symmetrical thickening to hold the weight, incidentally increasing the rotation effect. By rotating the spindle, the spin is transferred to the thread, thus twisting it. Generally speaking a thicker thread requires a heavier weight than a fine thin thread. The weight or spindle-whorl is usually fixed at the upper or lower end of the spindle and its function is to augment the rotation movement.

Before the spindle can be set in motion, the thread must be fixed to it. There is sometimes a hook in the end or a notch cut c 1cm from the end going into the middle of the spindle, ie to its rotation axis. Most prehistoric and medieval spindles, however, have no particular method for fixing the thread, which is simply twisted once or twice round the thumb and then slipped over the end of the spindle to form a knot (La Baume 1931, 71-73, Warburg 1974, 7) (fig II.2).

Fig II.2 Spinning with a drop-spindle

The end of the spindle is then held between the index finger and the thumb and given a good twist to set it in rotation. The thread with the freely rotating spindle at the end hangs down from the bundle of fibres on the distaff. By continuously drawing a small number of fibres from the distaff and feeding them into the twisting yarn, the spinning process can continue until the spindle comes to rest on the ground. The weight of the spindle provides both the rotation action and the tension required to make a fine thread. When the spindle can fall no further, the thread is wound up, the end is fastened and the spinning process continues as before. When the spindle is full, the thread can be wound into a ball or on to a spool.

This spinning process which is described in classical sources (see Wild 1970, 35-37) and which can still be studied in some contemporary cultures, has been classified by Grace Crowfoot as «suspended-spindle spinning» (Crowfoot 1931, 20-22). We can assume that this was the usual method of spinning also at Bryggen.

Another method which Crowfoot calls «supported-spindle spinning» differs in that the lower end of the spindle rests on a surface such as a bowl or dish. This method was used to obtain especially thin threads. It is difficult to find archaeological evidence for this method, but the presence of especially fine thread may indicate that it has been used (Wild 1970, 37). On the whole the different structure and quality of the fibres is important with regard to spinning and the choice of method and equipment. Crowfoot also refers to spinning with a «grasped spindle» where the drawn fibres pass through a ring or over a forked stick or other support, and are then spun on a large spindle grasped and rotated in both hands. This produces a coarse uneven yarn. She also mentions the most primitive method where the spindle is rolled on the thigh. The spinner draws the fibres between her hands, and then rolls the spindle on the thigh to twist it (Crowfoot, in Singer, Holmyard *et al* 1956, 425).

It was not until the Later Middle Ages that more efficient methods of spinning by hand were introduced. The spinning wheel came to Europe together with the horizontal loom and other specialised equipment, leading to a more rational and efficient textile production. The earliest evidence for the spinning wheel is an illustration in an English manuscript from 1338, but it does not seem to have been used in Scandinavia until after the Reformation (Hoffmann, KLNM XVI, 449-500).

The quality of the spun yarn is dependent on at least three factors: 1) the quality of the fibre, 2) the skill of the worker, 3) the efficiency of the equipment. It is usual to regard the craftsman's skill as the most important and the equipment as a less decisive factor since it is so simple: Wild goes so far as to say that the implements used in spinning are so simple that «the quality of their production is unlikely to be reflected in the final product» (Wild 1970, 31). He therefore does not consider it necessary to give a more detailed description of this group of implements. Other scholars have presented a more discriminating view, pointing out that the dimensions and weights of the drop-spindle and its whorl are determined by the strength of the yarn desired and the fibres used. Heavier spindle-whorls could be used for doubling or plying yarns to obtain greater regularity or strength (Patterson 1956, 202). The German scholar A Linder has undertaken a careful study of both prehistoric and historic spindles and spindle-whorls and compared the weight of the spindle-whorls and the length and diameter of the spindles. On the basis of this information, plus the fact that it is known how drop-spindles were used, he has calculated the relative speed of the various spindles and spindle-whorls and has found exact figures for the relationship between spindle and spindle-whorl and between the equipment and the type of raw material which is to be spun (Linder 1967, 54-56).

The following points are important for spinning and for the quality of the thread: the length and thickness of the drop-spindle and the size, shape and weight of the spindle-whorl.

The thickness of the spindle, for example, determines the amount of twist of the thread. A thin spindle turns more than a thick one and therefore turns more strongly. The weight of the spindle-whorl determines the thickness and strength of the thread. A large spindle-whorl does not spin as strongly as a small and relatively heavy one; a conical spindle-whorl turns more quickly than a disc-shaped one, and so on.

These conclusions show that Wild's approach is not quite acceptable: an investigation into the spinning equipment should provide information about how differentiated the local use of spinning equipment was and should also indicate the quality, specialisation and range of the products.

2 Spinning equipment from Bryggen

2.1 *Distaffs*

Among the Bryggen finds are six wooden objects which have possibly been used as distaffs.They are long and narrow sticks with small notches or cuts evenly spaced along the sides. One is complete but broken in two. It was originally 25.5cm long.

The other five are somewhat damaged at the ends but the surviving lengths range from 16 to 24.5cm and they were probably originally nearer 30cm long. They are rectangular or oval in cross-section. There are also variations in the shape (fig II.3). Five are made of pine and the sixth one is an unidentified hardwood. Three come from Period 4 (1198-1248), one from Period 6 (1332-1413), and two are undatable.

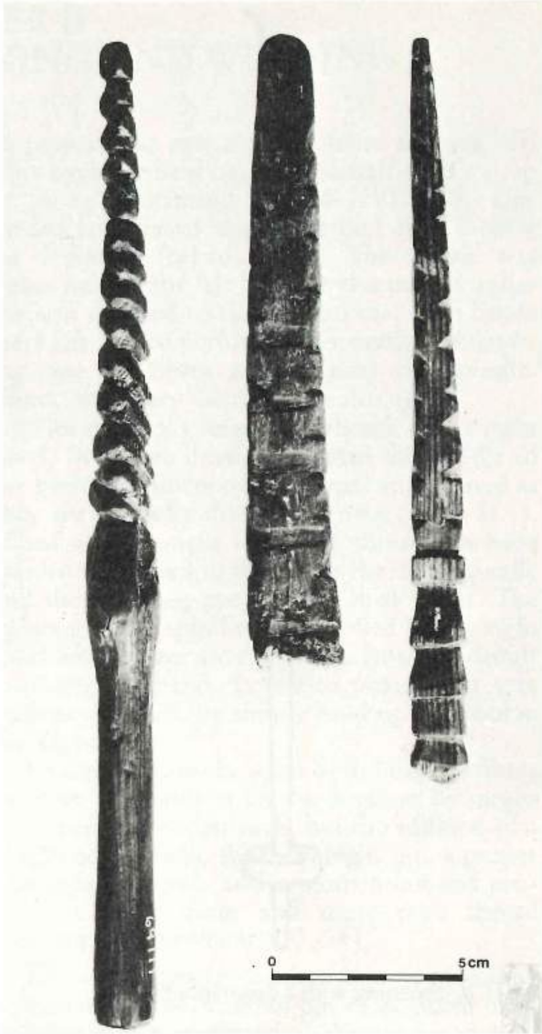


Fig II.3 Distaffs from Bryggen (nos 19729, 31784 and 69111)

A group of large wooden needles with ornamental heads – type F (see p 90) – may also have been used as distaffs, since the design of the head could easily have been used to hold the wool (fig II.4). Moreover, the lengths of the longer ones are similar to more recent distaffs (Lithberg 1930, 169). Objects of this form are known from Gdansk where they are interpreted as distaffs and dated to the eleventh century (Kaminska & Nahlik 1960, 90, fig 2a).

Only two of the possible distaffs from Bryggen can be parallelled in the comparative medieval material. This type is known from more recent times in both Western and Eastern Norway, as well as in Sweden and other European countries.

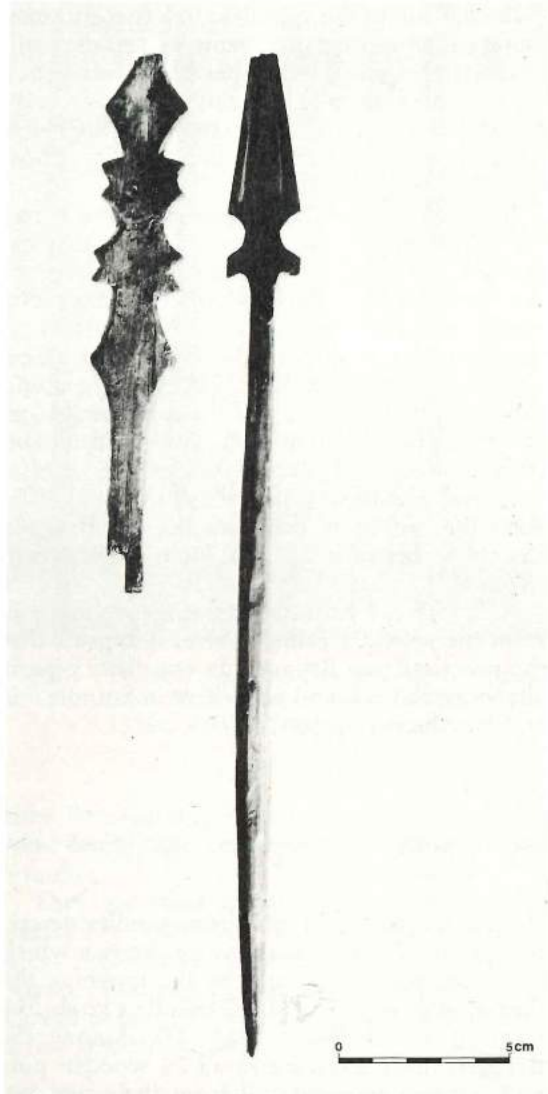


Fig II.4 Needles of type F possibly used as distaffs (cf p 90) (nos 6659, 360491)

Recent examples are of about the same length, from 23 to 35cm (Lithberg 1930, 169). They may be carved or turned, but it is usually only the finest which have survived. The other objects with notches have no clear parallels in the comparative material.

2.2 *Drop-spindles from Bryggen*

Among the Bryggen finds, only the type with a symmetrical thickening in the centre can be definitely identified as a drop spindle (fig II.5.1).

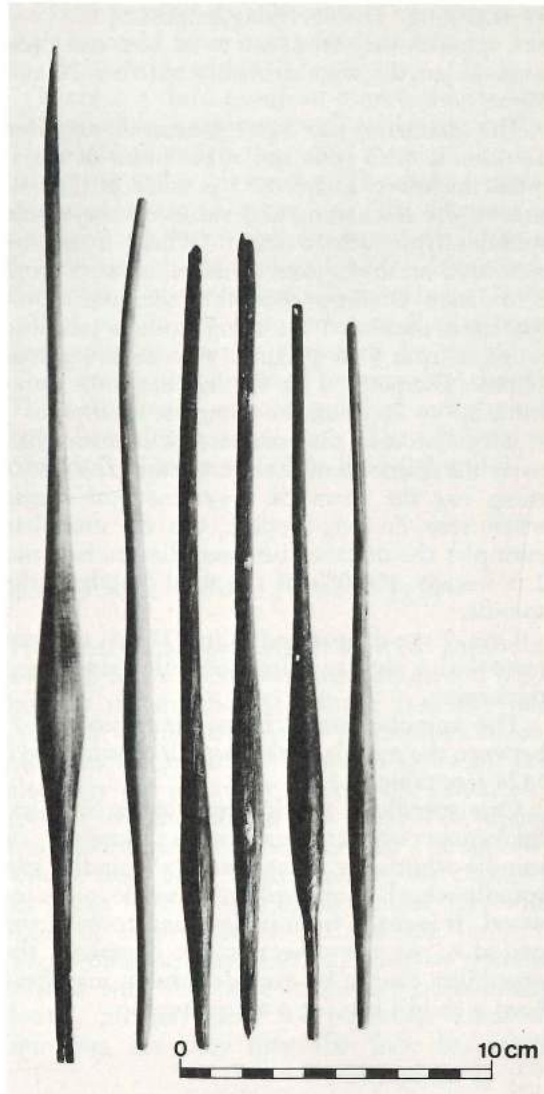


Fig II.5.1 Drop-spindles from Bryggen (nos 74538, 2842, 31669, 47864, 1 without no., 83003)

There are thirty-one examples of this type, including twentythree which are damaged in some way. They are all of wood, with both softwood and hardwood represented: willow/aspen (2), birch (4), Norway maple (?) (7), oak (1), pine (4), juniper (3) and yew (3). Seven have not yet been identified. All of them have been lathe-turned and have a smooth surface. The ends are all plain, a common feature for medieval spindles. La Baume has demonstrated how the yarn is fixed to a spindle which has no hook or notch (see p 33 above).

The complete spindles are between 15 and

34.4cm long. The surviving lengths of the broken spindles vary from 6.6 to 22.6cm and their original lengths were probably between 20 and 30cm.

The diameter has been measured at three points – at both ends and at the point of maximum thickness. Diameter 1 is taken at the end nearest the thickening and varies on the whole spindles from 3.5 to 6mm. Where it can be measured on the broken spindles, it varies from 3 to 7mm. Diameter 2 at the maximum point has been measured on every spindle and the range is from 9 to 16.5mm with an average of 12mm. Diameter 3 at the further end varies from 2.5 to 7mm on the complete examples.

It can be seen that diameter 2 is more than twice the diameter of the nearer end. The thickening has the form of a symmetrical ellipse when seen in long-section. On the complete examples the distance between diameters 1 and 2 is usually 20-40% of the total length of the spindle.

One of the drop-spindles (no.17358) is decorated with a zig-zag pattern on either side of the thickening.

The spindles come from the periods 2-7, between the middle of the twelfth century and c 1476 (see table II.1).

One spindle is atypical and has a biconical thickening which functions as a weight or spindle-whorl, in other words spindle and spindle-whorl combined in a single piece of wood. It is made from juniper and comes from period 6. As the object is not complete, the possibility cannot be excluded that it may have been a child's toy, eg a whipping top.

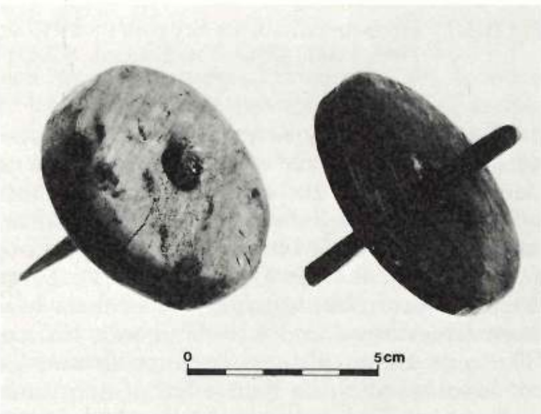


Fig II.5.2 Spindle-whorls with fragments of spindles (nos 12080, 18887)

In addition to the spindles already mentioned there are also seven fragments of spindles still attached to some of the spindle-whorls. They are all made from pine. One of them, a decorated whorl, shows that the spindle-whorl was fixed at the lower end of the spindle, 4.5cm from the end (fig II.5.2).

In the published Norwegian medieval material there are no references to drop-spindles, but the published archaeological material from the medieval period elsewhere in Scandinavia and Northern Europe contains references to drop-spindles with a thickening at the centre similar to those found at Bryggen, eg Lund (Mårtensson 1970, 96) and the Søndervold site in Århus (H J Madsen 1971, 225), Amsterdam (Baarth 1982, 58), Basel, Würtsburg, Strassburg and Heidelberg (Scholkmann 1982, 107). Also the length is the same as the Bryggen examples, between 20 and 30cm (Mårtensson 1970, 114).

Although the published comparative material from the period is rather sparse, it appears that the spindles from Bryggen do not differ especially from those found elsewhere in Scandinavia and Northern Europe.

2.2.1 Possible drop-spindles with knob terminal

In addition to the simple drop-spindles described above, a more recent type is known which has a constriction at one end for fastening the thread, giving the end of the spindle a knob-like terminal (cf La Baume 1955, 37). Among the Bryggen finds there are in all 24 wooden pins with a knob terminal and from their size and shape they could well have been drop-spindles of this type.

The terminal can take various forms, the most usual (14 examples) being a small knob, somewhat thicker than the spindle itself, from which it is separated with an incised constriction. Another type (6 examples) has a double knob, formed by two or more incisions, and a third type (4 examples) has a conical head (fig II.6).

Only three of these possible drop-spindles are complete. They vary in length from 21 to 34cm, and the shaft of the spindle can be either cylindrical or slightly thicker at the centre with a diameter between 6 and 12mm (average diameter 8mm). The rest are defect in some way but they have all had similar dimensions. It can

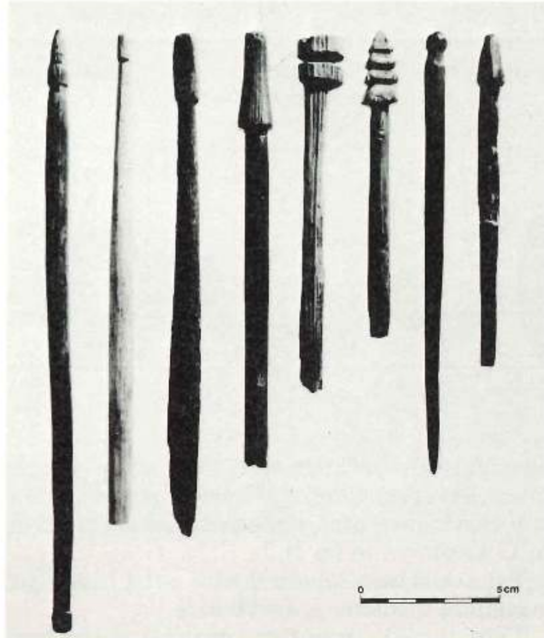


Fig II.6 Possible drop-spindles with knob terminal (nos 8533, 42634, 16937, 8801, 29060, 19369, 50935, 32211)

thus be seen that they have more or less the same length and thickness as the simple drop-spindles.

They are most usually made of juniper (12 examples), with pine in second place (6 examples), then oak (2), rowan (1), birch (1) and two which could not be identified. They are either carved or turned and polished and they all have a fine smooth surface.

These possible spindles with a knob terminal are associated with layers dated to periods 3-6, ie c 1170-1413 (table II.1).

There is a third group of objects which may also possibly be interpreted as drop-spindles. These are of much the same form as the last group but are much smaller. The three complete examples are 11-15cm long, the diameter at the point where the spindle-whorl would sit is 5-7mm, and this corresponds to the diameter of the holes in the small spindle-whorls (fig II.6).

The possiblility that these small pins were drop-spindles cannot therefore be excluded. They may have been used for very fine thread. They all have a smooth polished surface and have been made from yew. They belong to periods 3-6, from c 1170 to 1413 (table II.1).

2.3 Spindle-whorls from Bryggen

The criterion for defining an object as a spindle-whorl is that it is circular or nearly so and has a hole in the middle. The shape can vary and includes varying degrees of hemispherical, conical, biconical and flat forms. The weight can also vary but is usually under 50g. This corresponds to the weight of West Norwegian spindle-whorls from later periods. The spindle-whorls from Sogn Folkemuseum, for example, all weigh from 10-12g up to around 50g, with most of them between 20 and 35g (inform. Sogn Folkemuseum 29.09.82). Heavier spindle-whorls with the same forms are occasionally found, possibly used for particular kinds of spinning, but they may also have had other

TABLE II.1. DATING OF ALL DROP-SPINDLES FROM BRYGGEN

Period	Drop-spindles	Possible drop-spindles with knob terminal	Possible small spindles with knob terminal	Total
8				
7	1			1
6	4	3	1	8
5	15	12	3	30
4	5	2		7
3	4	5	1	10
2	1			1
Undated	1	2		3
Total	31	24	5	60

TABLE II.2 SPINDLE-WHORLS FROM BRYGGEN

Material	total excl rough-outs	rough-outs	complete	uncertain more than 50g (incl in total)	Total
stone	206	43	162	11	249
wood	115	3	91	2	118
bone/antler	15	1	12	–	16
clay/pottery	20	0	12	–	20
metal	7	0	7	2	7
Total	363	47	284	15	410

functions – as drilling-stones, etc. The drilling-stones at Sogn Folkemuseum weigh between 400 and 1300g, with most of them around 500g. The perforated round objects from Bryggen which weigh more than 50g are therefore classified as uncertain spindle-whorls.

Using these criteria, it has been possible to identify 410 spindle-whorls in the Bryggen material (table II.2). They can be made of stone, wood, bone/antler, clay, pottery and metal.

There are also rough-outs in stone, wood and bone.

An essential criterion for identifying the type is the shape. This is also important for determining the function as well as the chronological development. In identifying the functional implications in the shape, the profiles of the upper and lower halves of the spindle-whorl, together with the way they meet, have been chosen as the criteria. The various elements of each shape, such as size, weight, material and decoration, have been analysed and compared. In this way it has been possible to investigate whether there are any important characteristics which are independent of the spindle-whorl's shape and which may therefore be primarily functional.

Using these criteria, it has been possible to distinguish seven main types of spindle-whorls in the Bryggen material. For the sake of simplicity these have been designated letters from A to G as shown in fig II.7.

Type A is hemispherical with a flat base. The maximum diameter is at the base.

Type B also has a hemispherical upper part giving a convex curve in cross-section. The sides curve in to the base so that the maximum diameter is at a point above the base.

Type C is conical with a flat top. The greatest diameter is at the base which is flat.

Type D is lentoid or biconical in cross-section. The point of maximum diameter is approximately through the middle.

Type E is flat on top and below and has straight sides.

Type F is also flat on top and underneath but has rounded, slightly convex sides. The maximum diameter will therefore occur at some point near the middle.

Type G has the shape of a flattened sphere.

When dealing with the spindle-whorls I have chosen to divide them firstly according to raw material. The shape of the spindle-whorl is to some extent dependent on the raw material and its particular characteristics.

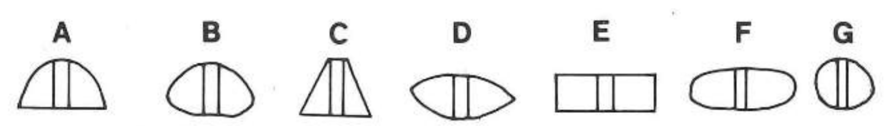


Fig II.7 Types of spindle-whorls from Bryggen

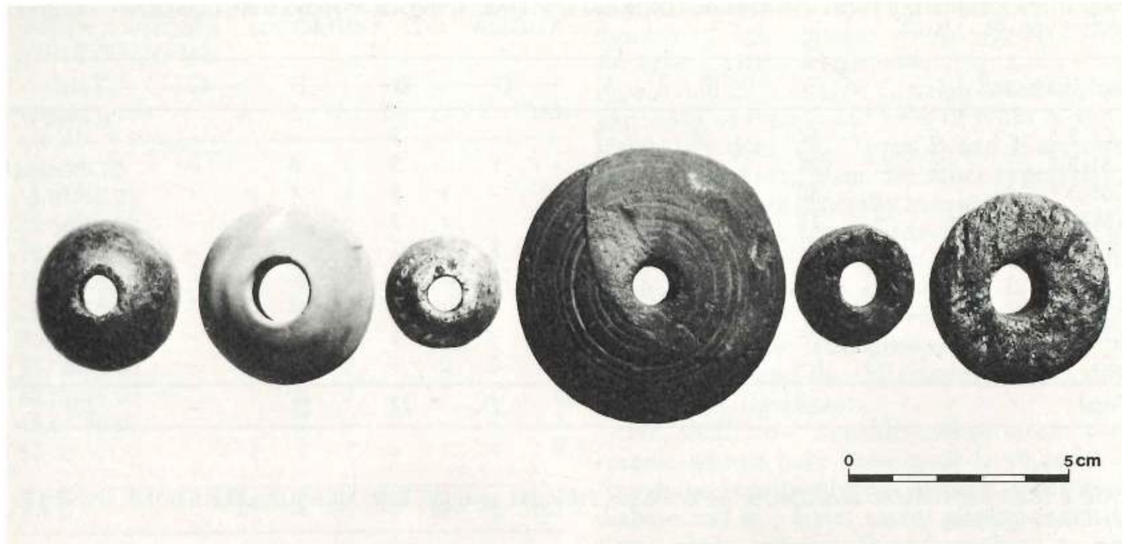


Fig II.8 Stone spindle-whorls from Bryggen: different types (nos 6166, 61697, 79611, 8541, 8896, 36820)

2.3.1 Stone spindle-whorls

Stone spindle-whorls form the numerically largest group with 60.7% of the total material – rough-outs included. All types are represented in stone (fig II.8). Table II.3 shows the stone spindle-whorls divided according to type.

TABLE II.3 STONE SPINDLE-WHORLS FROM BRYGGEN: TYPES

Type	No.	% of total	complete examples
A	83	40.3	62
B	38	18.4	34
C	37	18.0	31
D	2	1.0	2
E	22	10.7	18
F	21	10.2	15
G	3	1.4	0
Total	206	100	162

The size of the different types is given in the following tables II.3.1, 3.2. & 3.3 which show the distribution of the types according to size, diameter and height.

TABLE II.3.1 MINIMUM, MAXIMUM AND MEAN DIAMETER (CM) OF THE MEASURABLE STONE SPINDLE-WHORLS (N=193)

Type	No.	Min	Max	Mean	Standard deviation
A	83	2.1	4.-	3.04	0.45
B	38	2.4	4.5	3.21	0.52
C	37	2.1	4.95	3.01	0.57
D	2	2.7	4.35	–	–
E	18	2.-	5.9	3.58	1.02
F	15	2.7	7.-	3.94	1.06
G	–	–	–	–	–

The hemispherical and conical types A, B and C are generally of smaller diameter than the other types. Types A and C include a relatively larger number of small spindle-whorls, less than 2.51cm in diameter. The range between 2.51 and 3.5 is the most common and includes 65% of the measurable spindle-whorls.

Table II.3.3 shows that the hemispherical and conical types A, B and C are generally higher than the flat types E and F. At the same time it is clear that there is some variation in height within each group, the highest being 2-3 times higher than lowest.

TABLE II.3.2 DISTRIBUTION OF THE MEASURABLE STONE SPINDLE-WHORLS ACCORDING TO SIZE AND TYPE (N=203)

Size (diam cm)	A	B	C	D	E	F	G	Total
2.01-2.5	17	2	9	–	3	–	–	31
2.51-3.0	26	15	13	1	5	5	–	65
3.01-3.5	30	14	10	–	5	4	–	63
3.51-4.0	10	6	3	–	3	4	–	26
4.01-4.5	–	1	1	1	1	4	–	8
4.51-5.0	–	–	1	–	2	–	–	3
5.01-5.5	–	–	–	–	2	3	–	5
5.51-6.0	–	–	–	–	1	–	–	1
6.01	–	–	–	–	–	1	–	1
Total	83	38	37	2	22	21	–	203

TABLE II.3.3 MINIMUM, MAXIMUM AND MEAN HEIGHT (cm) OF THE MEASURABLE STONE SPINDLE-WHORLS (N=194).

Type	No.	Min	Max	Mean	Standard deviation
A	80	0.8	2.4	1.48	0.37
B	37	1.1	3.3	1.78	0.41
C	32	1.05	2.45	1.73	0.36
D	2	1.15	1.2	1.17	–
E	22	0.5	1.7	1.92	0.29
F	21	0.6	2.5	1.4	0.47
G	–	–	–	–	–

Type A contains a larger number of relatively low spindle-whorls (height less than 40% of the diameter) and fewer high ones (height more than 60% of the diameter) than groups B and C. Group C is best represented with high spindle-whorls. Groups E and F are generally low, but type F is somewhat higher than type E.

The weight expresses the spindle-whorl's total volume and we shall now consider whether this is independent of the type and whether there are differences within the various types (table II.4.1 and 4.2).

TABLE II.4.1 MINIMUM, MAXIMUM AND MEAN WEIGHT (g) OF COMPLETE STONE SPINDLE-WHORLS (N=162)

Type	No.	Min	Max	Mean	Standard deviation
A	62	6.5	53	20.36	9.56
B	34	10.15	78.2	27	13.42
C	31	6.5	99.5	22.26	15.95
D	2	8.5	34.5	21.5	–
E	18	6.0	90.8	24.15	18.64
F	15	10.0	130.8	39.15	21.30
G	–	–	–	–	–

TABLE II.4.2 DISTRIBUTION OF THE STONE SPINDLE-WHORLS ACCORDING TO WEIGHT AND TYPE (N=162)

Weight (g)	A	B	C	D	E	F	Total
under 5.00	–	–	–	–	–	–	–
5.01-10.00	8	–	4	1	4	1	18
10.01-15.00	11	4	5	–	4	2	26
15.01-20.00	15	8	8	–	2	2	35
20.01-25.00	9	6	2	–	4	1	22
25.01-30.00	9	4	7	–	1	1	22
30.01-35.00	3	3	1	1	1	1	10
35.01-40.00	5	4	–	–	0	2	11
40.01-45.00	1	2	3	–	1	1	8
45.01-50.00	–	2	–	–	–	–	2
50.00 <	1	1	1	–	1	4	8
Total	62	34	31	2	18	15	162

Among the stone spindle-whorl material from Bryggen there is a high proportion of light ones: nearly half (48%) weigh between 5g and 20g. Groups A, C and E contain the highest number of light spindle-whorls. About half of the type E group weigh under 15g, and 31% of type A and 29% of type C weigh between 6 and 15g. 83% of type E and 84% of types A and C weigh less than 30g. Types B and F are more evenly distributed than the other types and at the same time are generally heavier.

The clustering around specific points on the weight scale can be seen in the diagram (diagram II.1). It shows clusters of 10 or more around 8-9g, 11-12g, 14-16g, 18-19g, 27-29g and 34-36g. The total group, however, is not large enough and the differences are too small to be clearly significant.

We shall now consider what stone these spindle-whorls have been made from and how they have been produced. Steatite, greenstone, diabase and to a lesser extent sandstone, chalk, slate, schist, anorthosite and amphibolite have been used in the production of stone spindle-whorls. The dark variety of greenstone containing chlorite has often been used and the steatite or soapstone is also to a great extent rich in chlorite.

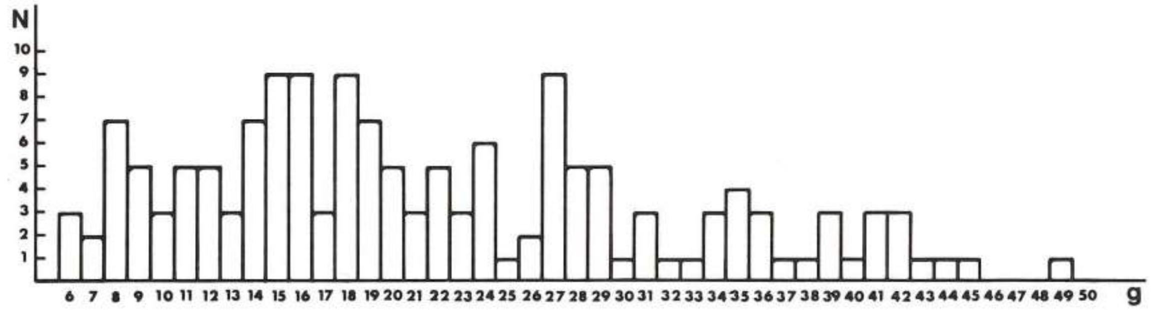


Diagram II.1 Distribution of the stone spindle-whorls according to weight

TABLE II.5 STONE SPINDLE-WHORLS DIVIDED ACCORDING TO RAW MATERIAL

Type	Steatite	Greenstone/ Diabase	Slate schist	Anorthosite	Amphibolite	Sandstone	Chalk	Unident	Total
A	51	29	1	1	–	–	–	1	83
B	26	9	1	1	–	1	–	–	38
C	24	12	–	–	1	–	–	–	37
D	1	–	–	–	–	1	–	–	2
E	20	–	2	–	–	–	–	–	22
F	19	–	–	1	–	–	–	1	21
G	2	–	–	–	–	–	1	–	3
Total	143	50	4	3	1	2	1	2	206

The table shows that steatite is about three times more common than greenstone/diabase. Greenstone is only used as the raw material for the high types A, B and C.

There is on the other hand no significant correspondence between the choice of raw material and the weight of the spindle-whorls. There are light, medium-heavy and heavy spindle-whorls in greenstone. A constant feature, however, of the greenstone spindle-whorls is that they are more carefully made than those in steatite. They are always highly polished, while the steatite spindle-whorls in many cases are coarsely finished.

The shape of the hole for the spindle indicates both function and production. The commonest is a slightly conical hole tapering upwards, but parallel-sided and, more rarely, biconical holes also occur.

The size of the hole is usually relative to the size of the spindle-whorl. The general tendency is the smaller the spindle-whorl, the smaller the hole and vice versa. The diameter can vary between the limits of 3.5 and 15mm at the top and 4 and 15mm at the base. All types with the exception of F have an average of 7mm at the top and a c 1mm larger opening at the base. On account of the higher proportion of larger, heavier spindle-whorls in type F, the average hole is 1mm wider in this group. The size of the hole therefore is not dependent on the shape of the spindle-whorl, although the flat spindle-whorls have a greater proportion of parallel-sided holes.

Three spindle-whorls of type A, B and C have a small cone-shaped hole on the side of the main hole tapering to a point in the body of the spindle-whorl. What the function of these holes has been is not yet known.

In order to give an even spin to the drop-spindle, the hole in the spindle-whorl should be absolutely central both on top and at the base. Not all the spindle-whorls from Bryggen fulfil this requirement. Scarcely 40% of the spindle-whorls, where it can be measured, have an absolutely central spindle-hole (N=173). It must therefore be assumed that a deviation of 1-2mm from absolute centricity must have been an acceptable margin.

With a deviation greater than 2mm the spindle can hardly have been a good instrument for spinning. Types A and C are generally most accurately made, while the flat types E and F are rougher and more imprecise.

Table II.6.1 shows the distribution of decorated spindle-whorls according to type. About 17% of the stone spindle-whorls have some form of decoration. It is particularly types A and C which are decorated on either the upper surface or the base, or both.

TABLE II.6.1 DECORATED STONE SPINDLE-WHORLS

Type	A	B	C	D	E	F	G	Total
N	21	3	8	1	2	–	1	36

The decoration can be divided into five groups.

Decoration 1 consists of areas or segments filled with geometric patterns and bounded by lines running radially towards the base. The patterns may consist of lines crossing to form diamonds or lattice-work (1.1) or just diagonal lines (1.2). There may be three or four fields of decoration on the spindle-whorl.

Decoration 2 consists of concentric rings. Both the number of rings and their position on the spindle-whorl may vary, and the decoration may occur both on top and on the base of the spindle-whorl.

Decoration 3 has radial lines running down to the base or on the base itself.

Decoration 4 has various patterns imitating plaiting or basketry.

Decoration 5 is a miscellaneous group of various simple markings, such as lines, notches, crosses and dots.

These five groups of decoration occur both separately and in combinations.

Decoration 1 is the commonest on the stone spindle-whorls from Bryggen but is only found on types A, B and C. Decoration 2 is also relatively frequent and is found on types A, B, C and D.

When comparing occurrence of decoration and weight, it is the relatively light spindle-whorls that dominate. Of the whole spindle-whorls with some form of decoration, about half are less than 15g and over two-thirds are lighter than 20g. Decoration does occur, however, on heavy spindle-whorls, including one example weighing 78.2g and decorated with type 1 decoration. Form and decoration, therefore, provide a good indication that even a very heavy weight was used for spinning or twisting yarn. In other words, not only spindle-whorls used for spinning yarn of a particular thickness were decorated.

TABLE II.6.2 RELATIONSHIP BETWEEN DECORATED STONE SPINDLE-WHORLS AND RAW MATERIAL

Raw material	Types of decoration 1	2	3	4	5	Total
Steatite	12	5	3	–	4	24
Greenstone	2	3	1	1	1	8
Anorthosite	–	1	–	–	–	1
Slate/schist	–	–	–	–	2	2
Chalk	–	–	–	1	–	1
Total	14	9	4	2	7	36

Table II.6.2 shows that it is particularly spindle-whorls made from steatite – ie the softest type of stone – which were decorated. However, there is not a great difference between decorated steatite and decorated greenstone spindle-whorls in proportion to the total number in these two groups from Bryggen.

Nearly 90% of the stone spindle-whorls have been dated according to the fire-chronology for Bryggen. Table II.7.1 demonstrates that types A, B, E and F occur at Bryggen in all periods from the earliest (pre-1170) to period 7, ie 1476, and type E even longer. Type C also covers a long period but examples are not definitely known later than period 6, ie 1413. Types D and G are poorly represented in the Bryggen material and can give no indication of a proper time-span. Spindle-whorls as a whole are most strongly represented in period 2 to 6, ie from before 1170 to 1413, and reaching a peak in period 5, 1248-1332.

An examination of possible changes in the weight of decorated stone spindle-whorls over the course of time, showed that light, medium and heavy spindle-whorls occurred in every period. This would seem to indicate that there were no changes in the way that spindle-whorls were used during the period covered by the excavations.

Concerning the choice of raw material for the decorated stone spindle-whorls there are no indications of important changes in the course of time. Steatite and greenstone spindle-whorls have a somewhat parallel development with perhaps the greenstone spindle-whorls being a little more common in the earliest periods than later, but the total sample is too small for definite conclusions to be drawn.

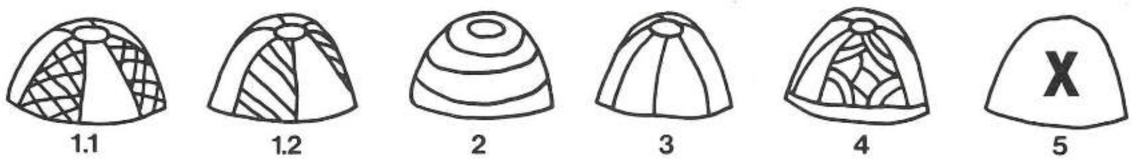


Fig II.9 Stone spindle-whorls: types of decoration

TABLE II.7.1 DATING OF STONE SPINDLE-WHORLS FROM BRYGGEN

Period	Types A	B	C	D	E	F	G	Total
8	0	0	0	0	1	0	0	1
7	3	2	0	0	3	1	0	9
6	14	5	3	1	4	4	0	31
5	32	11	15	0	6	7	3	74
4	12	6	5	0	1	1	0	25
3	4	6	4	0	1	5	0	20
2	10	4	4	0	3	1	0	22
1	0	0	0	0	0	0	0	0
Undated	8	4	6	1	3	2	0	24
Total	83	38	37	2	22	21	3	206

Table II.7.2 shows the distribution of the various types of decoration through the periods.

TABLE II.7.2 DISTRIBUTION OF DECORATED STONE SPINDLE-WHORLS IN TIME

Period	Decoration 1	2	3	4	5	Total
8	–	–	–	–	–	
7	1	1	–	–	–	2
6	2	2	–	–	1	5
5	9	5	1	2	1	18
4	2	–	3	–	2	7
3	–	–	–	–	–	–
2	–	1	–	–	1	2
Undated	–	–	–	–	2	2
Total	14	9	4	2	7	36

Decorated stone spindle-whorls occur particularly often in periods 4, 5 and 6, ie 1198-1413. 28% of all the spindle-whorls from period 4 are decorated, 24% from period 5, and 1/6 of all the whorls from period 6. Decoration 1 is found at Bryggen from 1198 and on through most of the Later Middle Ages until 1476, while decoration 2, concentric circles, was recorded from before 1170 to c 1476. The other types are more poorly represented and give no indication of a proper time-span.

2.3.2 Unfinished stone spindle-whorls

Among the finds from Bryggen are 43 objects in steatite with the same shape and size as spindle-whorls, but either the spindle-hole has not been completely drilled or they are unfinished in some other way (fig II.10). These objects are interpreted as unfinished spindle-whorls. It has only been possible to divide these into two general categories: rough-outs for hemispherical and for flat spindle-whorls.

The hemispherical and flat rough-outs have approximately the same range as the finished A, B, E and F spindle-whorls. The height of the rounded ones in most cases does not indicate the final height of the finished product. The minimum height varies from 1 to 2.1cm with an average of 1.5cm and thus corresponds to type A. The flat ones are somewhat smaller, varying in height from 0.6 to 2.3cm with a mean height of 1.1cm, corresponding on the whole with type E.

Since the spindle-hole often has not been completely drilled through or the edges rounded off, the weight of these rough-outs will be generally greater than that of the finished objects.

Figure II.10 Unfinished stone spindle-whorls from Bryggen (nos 87578, 87386/01-03)

Traces of the spindle-hole occur in various stages of completion: 1) completely drilled through (20 examples) 2) partially drilled from either above or below, or from both sides (18 examples) 3) not begun (5 examples). Those without a hole may possibly be finished or unfinished gaming-pieces; they were, however, found together with a larger group of spindle-whorls and rough-outs and are therefore most probably unfinished spindle-whorls.

In most of the rough-outs with a spindle-hole or the beginning of a hole, this is not quite central: only in two examples is the hole exactly in the middle. From the rough-outs with a partially drilled hole it can be seen that the hole was begun from the upper surface, the most practical way for the rounded spindle-whorls. In most cases the hole was in fact bored from both sides, which would produce a biconical hole. However, the finished spindle-whorls most often have a conical spindle-hole.

It is therefore possible that the hole was given this form in the final stages of the production process. A conical hole must have been the most practical as the narrowest part would serve as a stopper.

The rough-outs are from periods 2-7 (before 1170-1476) with the majority from the period 5, 1248-1332 (see table II.14 p 51).

2.3.3. Wooden spindle-whorls

Among the Bryggen finds are 118 flat, circular or nearly circular small wooden discs with a hole in the centre. In shape they correspond to type E spindle-whorls and from both the shape and size it is natural to regard the objects as spindle-whorls. However, they may have had other functions, such as gaming-pieces, parts of spinning-tops or wheels from various toys. Similar objects found elsewhere have been interpreted as parts of toys, such as whipping tops or the wheels from a toy cart or toy horse (Weber 1982, 84). We will return to the question of function later in this chapter.

Of the possible wooden spindle-whorls 91 are complete, 24 fragmentary and 3 are unfinished. The species of wood has been investigated by Aud Simonsen from the Archaeological Museum in Stavanger; some were impossible to identify because of the method by which they have been conserved. Well over half of them have been made from various softwoods (pine, yew and juniper), while birch is the most represented hardwood, with oak, willow or aspen, beech, ash, bird cherry, rowan and Norway maple also present (table II.8).

Many of the wooden spindle-whorls have changed their shape due to methods of drying and/or conservation, expanding along the grain and contracting across it. The discs are therefore not always quite circular. In table II.9 the minimum diameters are given.

The minimum diameter of the spindle-whorls varies from 2.6 to 8.9 cm. Table II.9 shows that the diameters of the majority lie between 3.1 and 6 cm. The mean diameter is 4.9 cm. There is less variation in the hight (thickness), the range being from 0.2 to 2.2 cm. The majority lie within the 0.6–1.6 cm range and the average thickness is 1 cm.

The table shows that there is great variation in the diameter/thickness relationship. The thickness may vary between 5% and 71% of the diameter, but is usually under 40%. There is also a tendency for the small and the large spindle-whorls to be relatively thin compared with the numerous middle group with diameters between 4.1 and 6cm.

TABLE II.8 POSSIBLE WOODEN SPINDLE-WHORLS: IDENTIFICATION OF SPECIES

	Softwood pine	yew	juniper	Hardwood birch	oak	aspen/ willow	ash/ beech	bird cherry/ rowan/ N maple	un-iden-tifi-able hard-wood	un-iden-tifi-able	Total
Total	50	10	1	13	7	4	3	3	12	15	118

TABLE II.9 WOODEN SPINDLE-WHORLS: THICKNESS AND DIAMETER (cm).

Diam,cm Thicknes cm	2.6-3	3.1-3.5	3.6-4	4.1-4.5	4.6-u	5.1-5.5	5.6-6	6.1-6.5
0.2-0.5		7	3	1	1	4		
0.6-1	2	7	8	5	5	12	3	4
1.1-1.5		1	3	6	10	7	6	2
1.6-2	1				4	2	3	1
2.1 <								1
		6.6-7	7.1-7.5	7.6-8	8.1-8.5	8.6-9		
0.2-0.5			1					
0.6-1			1	1		1		
1.1-1.5		1	2					
1.6-2				1				
2.1 <						1		

Methods of conservation and/or drying have also led to minor changes in the original weight of the wooden spindle-whorls, and there is consequently little point in showing the distribution by weight in a table. In their present state 45% of them are lighter than 15g and over a third fall within the 15-30g range. The original weights were presumably somewhat higher due to the natural moisture content of the objects.

The discs have usually been cut from a piece of wood with the grain running along its length. Only one spindle-whorl has been made at right-angles to the grain. Many of the discs are rather coarsely made, but there are also examples of careful, well-finished manufacture.

The spindle-hole in most cases is round or slightly oval, with just a single example of a square hole. The holes have usually been made with parallel sides or are slightly biconical with the same diameter at both ends. The remainder have a conical perforation.

The hole in these wooden spindle-whorls is generally smaller than in the stone ones, the diameter ranging from 3mm to 19mm. The mean for the parallel-sided holes is 6mm and for the conical holes the base is 1mm wider.

Three of the wooden spindle-whorls have been defined as unfinished rough-outs. On two of them the unfinished hole has been started from both sides, while on the third, the hole only just penetrates, being no more than 1mm across at one end.

Nearly 25% (28 examples) of the wooden spindle-whorls have been decorated in various ways. Two of the patterns recorded on the stone spindle-whorls are found: concentric rings (decoration 2) and radial lines (decoration 3). The rings which may vary from one to four and may be formed as deep grooves but are most often only weakly incised. Decoration 5, various marks and symbols, is also represented. Dots and ring-and-dot decoration form group 6, while group 7 is a miscellaneous group including various elements which only occasionally occur on the Bryggen finds: diagonal marks, lentoid shapes and cross-hatching. The forms of decoration can also occur in combination.

Decoration is not restricted to any particular sizes, weight or material. Compared with the total weight-range, the groups between 15 and 20g and 25 and 30g are relatively better represented with decorated examples.

Seven of the wooden discs have the remains of a wooden rod or pin in the hole, presumably from the drop-spindle, but not impossibly the remains of the axle from a wheeled toy. They are firmly held and measure between 3mm and 8mm in diameter. One of them ends in a point, 4.5cm from the base of the spindle-whorl. The remainder have been broken at both ends.

The presence of the rods or pins show that the discs have at least not been used as gaming-pieces (cf fig II.5.2). Decoration occurs in four cases, which suggests that they have not originally been wheels on a wheeled toy. They have most probably been used as spindle-whorls for drop-spindles. They include light (under 10g), medium (10-20g) and heavy varieties (50g).

TABLE II.10 WOODEN SPINDLE-WHORLS: DATING

Period	Hardwood	Softwood	Unident	Total
8	0	0	0	0
7	4	1	0	5
6	10	9	4	23
5	21	18	2	41
4	8	2	2	12
3	11	6	5	22
2	5	3	0	8
1	0	0	0	0
non-dated	2	3	2	7
Total	61	42	15	118

Wooden spindle-whorls occur at Bryggen between periods 2 and 7, ie from before 1170 to

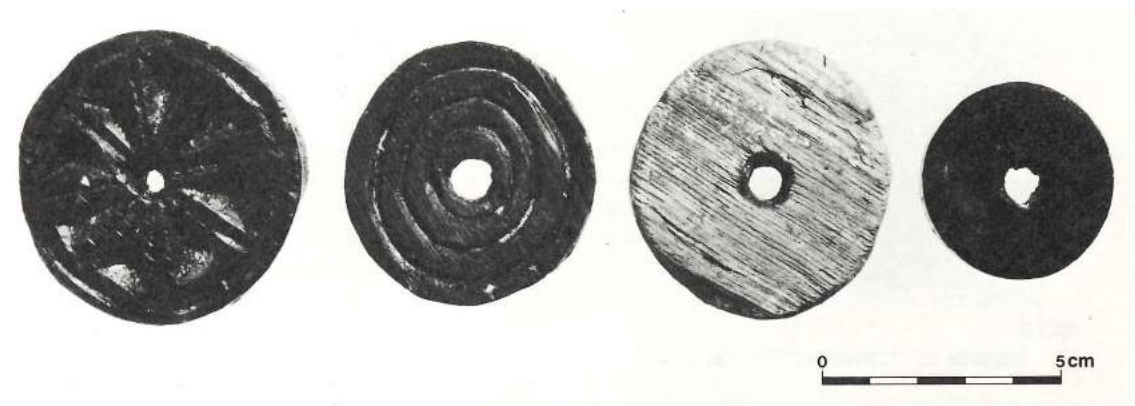


Fig II.11 Probable spindle-whorls made from wood (nos 7237, 53666, 37972, 12160)

Fig II.12 Bone spindle-whorls from Bryggen (nos 1051, 38093, 32816, 1816, 51118, 78444)

1476 with the greatest number in periods 3 to 6, ie c 1170-1413. Period 5 (1248-1332) has the greatest number, but when the length of periods is taken into account, period 3, 1170-1198, represents the most significant.

Most of the decorated examples come from periods 3, 4 and 5, ie 1170-1332, and continue sporadically to the beginning of the 15th century. It is not possible to distinguish between early and late elements in the decoration, which is hardly unexpected considering the very simple repertoire.

The unfinished examples come from periods 5 and 7.

2.3.4 *Spindle-whorls in bone/antler*

The Bryggen material contains sixteen bone and antler discs and hemispherical objects with the shape as spindle-whorls of type A (1), B (1), E (12) and F (1). One is a rough-out (fig II.12).

Because of their size and shape they are interpreted as spindle-whorls. The function is, however, not unambiguous, and the objects are sometimes interpreted as pieces in a board game (eg Ulbricht 1984).

The two hemispherical spindle-whorls (types A and B) have been made from the head of the femur of deer or cow. Of the E-type spindle-whorls only ten have been osteologically identified.

Eight have been made from antler, probably deer (possibly reindeer in three cases), and two are probably whalebone.

The bone and antler spindle-whorls have been made on a lathe and afterwards polished, giving a fine, smooth surface.

The diameter varies from 3.1 to 8cm, but table II.11 shows that the majority are less than 4.5cm across and under 1.6cm thick.

TABLE II.11 BONE AND ANTLER SPINDLE-WHORLS: DIAMETER AND THICKNESS (cm)

Diam in cm thickness	3.1-3.5	3.6-4	4.1-4.5	4.6 <
0.3-0.5	1		1	
0.6-1		5	1	1
1.1-1.5	2		3	
1.6-2	1			
2.1-2.3	1			

The two hemispherical spindle-whorls (A and B) differ distinctively from the rest by their extra height.

Weight varies from 6g to 33.1g. Generally they are relatively light, more than half being under 16g.

The size and shape of the spindle-hole correspond on the whole to the spindle-whorls made from stone, the hemispherical ones with their conical spindle-hole and the flat varieties most often with a parallel-sided hole (11 examples). Nine of the spindle-whorls are absolutely centric, while there is a radial deviation of 1-3mm on the others.

In all, seven of the flat spindle-whorls are decorated, five with ring-and-dot decoration. Another simple pattern within this decoration group just consists of small dots. Ring-and-dot also occurs in combination with one or more concentric circles. In one example these are combined with a pattern of leaves. Two spindle-whorls simply have concentric circles, in one case with grooves of varying depth, and they also have some kind of ownership mark on the base.

Of the decorated spindle-whorls six are under 20g and the seventh weighs 27g.

The bone and antler spindle-whorls belong to periods 2-8, ie before 1170 to 1702 (see table II.14 p. 51).

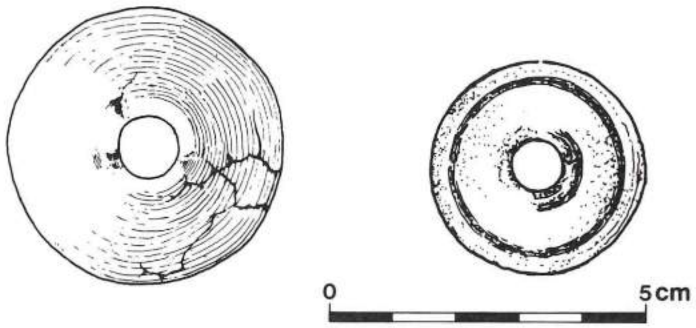


Fig II.13 Spindle-whorls in clay and pottery from Bryggen

TABLE II.12 SPINDLE-WHORLS IN CLAY AND POTTERY: DIAMETER AND HEIGHT OR THICKNESS (cm), REFERRED TO TYPES ( )

Diam. / Height	2.2-2.5	2.6-3	3.1-3.5	3.6-4	4.1-5	4.6-5	5.1 <
< 1		(A)1	(A)1				
1.1-1.5	3 (AAG)	(D)1		(AA)2			
1.6-2	1 (G)	(B)1	(A)1	(D)1			1(A)
2.1-2.5		(DG)2	(DB)2		(C)1		1(B)
2.6 <				(D)1			

2.3.5 *Spindle-whorls in clay and pottery*

Five types are represented among the 20 spindle-whorls made from clay or pottery: type A (8 examples), B (3), C (1), D (5) and G (3) (fig II.13). Eight of the spindle-whorls are damaged.

Six of them are made in glazed pottery: type A (1), D (3) and G (2). The glaze is grey-green and yellow.

The spindle-whorls vary in diameter from 2.2 to 5.4cm and in height from 0.9 to 2.85cm. Table II.12 gives the distribution within these extremes, showing that there is no clear connection between size and type.

The spindle-hole is usually conical but parallel-sided holes also occur (5). The conical holes have a mean diameter of 7.2mm at the top and 8.6mm at the bottom, while the parallel-sided holes are somewhat narrower, with a mean diameter of 6.3mm. With one exception the holes are absolutely central.

The twelve complete spindle-whorls range in weight from 5.5 to 28.5g (table II.13), but many of the damaged ones are in fact heavier, so that the undamaged spindle-whorls give an unrepresentative picture of this group with regard to weight.

TABLE II.13 SPINDLE-WHORLS IN CLAY AND POTTERY: WIEGHT (g)

	Type A	B	C	D	G	Total
Weight						
5-10	2	1		3		6
11-15	1					1
16-20	2	1				3
21-25				1		1
26-30			1			1
31-40						–
41-45						–
Total	5	2	1	4		12

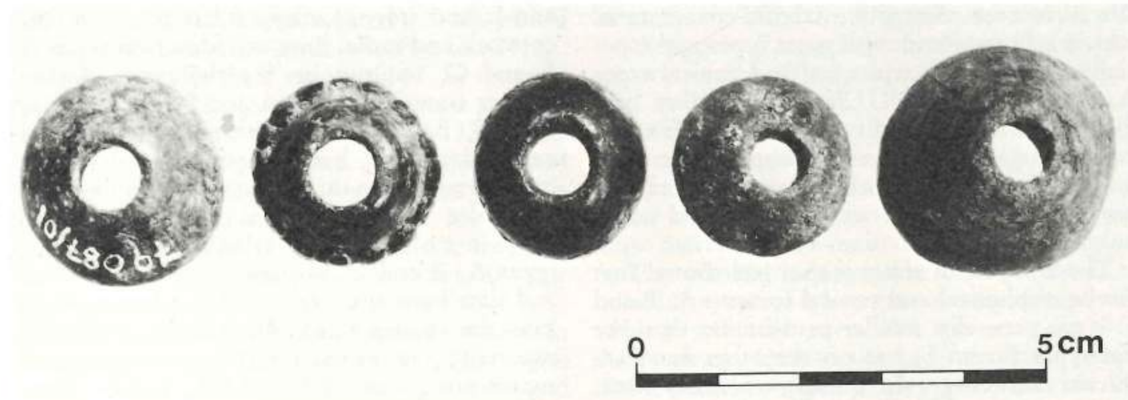


Fig II.14 Metal spindle-whorls from Bryggen (nos 79087, 63646, 1 without no., 8279, 51995)

In all, six of the ceramic spindle-whorls are decorated, with simple concentric circles, decoration 2; type A(1), type B (1), type D(1) and type G(3).

The dated spindle-whorls in this group come from period 2-8, ie before 1170 to 1702 (see table II.14 p 51).

2.3.6 *Metal spindle-whorls*

The seven spindle-whorls made in metal are all made of lead and belong either to type A (2) or type C (5) (fig II.14 p 51).

Their diameters vary from 1.9 to 2.8cm and the height from 0.85 to 2.2cm. As with the other hemispherical or conical spindle-whorls, the spindle-hole is usually conical, and the size corresponds well with the size of the spindle-holes on the stone spindle-whorls. Three of them are absolutely central, but the others have a radial deviation of between 1 and 3.5mm.

With lead as the raw material, relatively small variations in size produce large variations in weight. The range is from 9.5 to 71.3g.

Two of the metal spindle-whorls are decorated, one with faint traces of a diagonal lattice pattern, while the other has a thick, heavily notched collar around the bottom edge and shallow depressions around the edge of the base.

The dated spindle-whorls of lead were found in layers belonging to period 2 to 6, ie before 1170 to 1413 (see table II.14).

2.3.7 *The spindle-whorls from Bryggen reviewed as a whole*

We have seen that stone is the raw material which is represented with most types and especially with the hemispherical and conical types A, B and C (77%). Clay and pottery also include a wide range of types, although E and F are missing. The remaining groups have a more limited range: metal with only types A and C, bone/antler with A, B and E, and wood where only type E is found.

The analysis of the material has shown that the hemispherical and conical forms – A, B and C – are generally smaller in diameter than the flat types E and F, but on the other hand are thicker. Moreover, the spindle-whorls in bone, antler and wood are larger than those in stone and metal.

Variations in weight, however, seem to be independent of both type and raw material, the various types all having a relatively similar mean weight. As we have seen in the detailed analysis there are nevertheless groups of lighter and heavier spindle-whorls within the various type-groups. If we compare the spindle-whorls of different raw materials, we see that wooden spindle-whorls contain a larger proportion of light ones (under 15g) than is found in other raw materials. Bone/antler spindle-whorls are also generally lighter than stone and metal ones. Certain weights appear to be more common than others in all groups: c 11g, 15g, 18g and 27g (cf diagram II.1). But as already mentioned, the total sample is relatively small and the differences are not great enough for them to be regarded as significant.

The size of the spindle-hole is another feature which is independent of type and raw material. The average diameter is 6-8mm. The conical and hemispherical spindle-whorls usually have a conical or funnel-shaped hole, while parallel-sided or biconical holes are commonest in the flat spindle-whorls.

Decoration is most frequent on the bone and antler spindle-whorls (over 40%), concentric circles and the ring-and-dot motif in various combinations being used repeatedly. Wooden spindle-whorls are more often decorated than stone ones, c 25% as opposed to c 17%. Concentric circles and radial lines, alone or variously combined, are the commonest elements on the wooden spindle-whorls, though dots, ring-and-dot and diagonal lines also occur. The patterns can be shallowly incised or deeply carved. Among the stone spindle-whorls, decoration is commonest on types A and C. The patterns are generally independent of the type. Horizontal concentric circles are found on types A, B, C and E, and areas of diagonal hatching and lattice-work and radial lines are found on types A, B and C, but not on the flat types. Incised crosses occur on types A and F, dots only on type E. Both light and heavy spindle-whorls can be decorated, but decoration is nevertheless more common on the light ones.

Steatite is the most usual raw material for all types in stone, greenstone being found only in types A, B and C. Diabase, anorthosite, schist and slate have also been used to a lesser extent. For the wooden spindle-whorls, softwood, especially pine, is the commonest raw material, representing over 60% of this group. Many varieties of hardwood have also been used, but mostly birch.

TABLE II.14 DATING OF ALL SPINDLE-WHORLS FROM BRYGGEN

Period	Stone	Rough outs	Wooden	Bone/ antler	Clay/ Pottery	Metal	Total	%
8	1	0	0	1	1	0	3	1
7	9	1	5	1	1	0	17	4
6	31	7	23	2	4	1	68	17
5	74	28	41	4	6	3	156	38
4	25	3	12	3	4	0	47	11
3	20	0	22	0	0	1	43	10
2	22	3	8	1	1	1	36	9
1	0	0	0	0	0	0	0	0
undated	24	1	7	4	3	1	40	10
Total	206	43	118	16	20	7	410	100

The type of raw material chosen seems to have affected the form. Antler and bone are best suited for flat, disc-shaped spindle-whorls, except where the head of the femur was used. In the larger mammals this naturally has a hemispherical form and in young animals will not have fused with the shaft of the bone, presenting therefore an object which needed little preparation to turn it into a spindle-whorl. In wood as with antler it was most practical to make disc-shaped spindle-whorls.

All the main types with the exception of C, D and G occur in the earliest layers at Bryggen, ie before 1170, and continue to appear right through the Middle Ages until the end of the fifteenth century. Among the stone spindle-whorls only type E can be followed right up to the beginning of the eighteenth century. Spindle-whorls made of greenstone seem to be earlier than the other stone ones. Spindle-whorls with decoration are best represented in the period between the mid-thirteenth century and c 1413.

If we consider the distribution of the material in time (table II.14) we see that most spindle-whorls belong to period 5, 1248-1332. This applies to all groups. If we take the length of the periods into account, we find that there is also a high frequency in period 3, 1170-1198, but this is nevertheless lower than the frequency in period 5. The frequency is about the same in periods 4 and 6.

The presence of unfinished spindle-whorls in stone and wood shows that spindle-whorls have in fact been made at Bryggen from the end of the twelfth to the second half of the fifteenth century. In contrast to the finished products, the tendency in the unfinished examples is towards the simple forms, such as the flat steatite spindle-whorl. In size, however, they correspond well to the full range of the finished spindle-whorls.

2.3.8 *Comparative material*

In order to find out to what extent we are dealing with local production, the borrowing of ideas or the actual importation of objects, we shall make comparisons with other medieval finds in Norway and with the foreign material. In order to see whether new types were developed, it is also necessary to compare with the material from just before the Middle Ages.

In earlier excavations in Bergen a small selection of spindle-whorls has been found, 25 in stone, 4 in bone/antler and 1 in pottery (Kjøpmannstuen, Schaften, Dramshusen and Bratten on Bryggen, Fangegården in Kong Oscarsgate, excavations in Øvregate and Kong Oscarsgate and at Tanks school). Detailed descriptions of the find-location are lacking for these early excavations and therefore also a basis for dating the finds. Finds from the more recent excavations in Bergen are currently not available and have therefore been omitted from this survey.

The whole group is rather small and gives no new information when considering the spindle-whorls from Bryggen. We can see that these finds clearly fit into the general pattern which has been shown for the Bryggen material. The stone spindle-whorls are, however, generally bigger and heavier than the Bryggen finds, but the sample is too small for any conclusions to be drawn.

On the deserted medieval farm of Høybøen at Vindenes in Fjell, Hordaland, 25 spindle-whorls have been found on house sites from the Early (ie post 11th cent.) and High Medieval periods.

The archaeological excavations uncovered two buildings, divided into three rooms and two rooms respectively (Randers 1981, 127). Two of these rooms were interpreted as living-quarters where spinning and weaving were carried on and where various objects in steatite and other tools were made or repaired. In these two rooms were found large collections of spindle-whorls (op cit, 78, 93. I am grateful to mag.art Kjersti Randers for making this material available to me). The majority of the spindle-whorls are made in steatite; there is also one in serpentine and one in lead. In comparison with the spindle-whorls from Bryggen, those from Høybøen are on the whole somewhat heavier, none is under 10g and most of them are between 25g and 35g.

To what extent do the spindle-whorls from the Viking period correspond to the Bryggen spindle-whorls? There are 103 spindle-whorls found in graves from this period within the area covered by the Historical Museum in Bergen (status as in 1979). The various raw materials which are represented include stone (88 finds), unburnt clay (8), amber (5), metal (1) and glass (1).

Following our previous typology, we find that the stone spindle-whorls include the same types as the Bryggen finds: A 64%, B 11%, C 3%, D 6%, E 5% and F 11%. Even though the types are the same, the distribution is different. First and foremost, type A is much less frequently represented at Bryggen (40%), and this is also true for type D (1%). The remaining types on the other hand are more strongly represented in the medieval finds, especially type C (18%) and E (11%), but also B (18%) and F (10%).

For both periods stone is the commonest raw material, judging from the finds which have survived. Of the total material from the Merovingian and Viking periods in Western Norway 85% are in stone, as against 61% in the medieval material at Bryggen (rough outs included). Moreover, the range of stone varies.

Greenstone is relatively more common than steatite in the premedieval period, while 69% of the stone spindle-whorls from medieval Bryggen are in steatite and 24% in greenstone. The proportion of steatite is even higher when the unfinished spindle-whorls are included.

Spindle-whorls made from clay, amber, metal and glass are so few that there is really little point in a detailed comparative analysis. Amber and glass spindle-whorls were not found at Bryggen. The unburnt clay spindle-whorls from the pre-medieval period include types A, B and G, while the metal one is a type A in lead.

About one-third of the spindle-whorls from Bryggen are made in wood, bone or antler, material which is completely lacking in the pre-medieval collection. Jan Petersen's catalogue from 1951 includes six in bone (types A and E) from other parts of the country, but none in wood (Petersen 1951, 305).

However, it is doubtful whether the different distribution in the two periods presents a fair picture of the situation. It is reasonable to believe that the lack of spindle-whorls in organic material such as bone and wood in the pre-medieval period is really due to the poor conditions of preservation rather than the fact that this material was not used for spindle-whorls. Yet the possibility cannot be excluded that there was an increasing use of wood and bone for this purpose during the Middle Ages. The increase in the use of the flat disc-form, type E, which we see in the stone spindle-whorls of the medieval period, can be due to influence from an increased use of spindle-whorls made from wood, bone and antler. A closer examination of the foreign material may perhaps throw some light on this question.

A comparison of size and weight shows that the pre-medieval spindle-whorls are somewhat heavier than the Bryggen finds. There are fewer lighter ones, less than 10g, and relatively more weighing over 30g, but as we have seen, the comparative material is limited and any conclusions drawn must be regarded with care.

In the Merovingian and Viking periods horizontal concentric circles dominate among the decorative forms on the West Norwegian spindle-whorls. Decoration occurs most often on type A. The grooves are often deep, giving the pattern an impression of relief, in contrast to Bryggen finds, where the equivalent design is lightly incised. Decoration types 1 and 2, areas with diagonal lines and cross-hatching and ring-and-dot motifs combined with concentric circles and vertical lines, are not found on the Viking spindle-whorls and it is therefore possible that these elements are special for the medieval material.

The comparative analysis shows therefore that the Bryggen spindle-whorls are based on forms known previously, but that it became more usual to use other forms than the hemispherical type A. It also became more usual to use steatite rather than greenstone, but it is difficult to draw firm conclusions as far as the other types of raw material are concerned because of variations in the preservation conditions and the poor representation. Size and weight became more varied in the Middle Ages, and new forms of decoration were possibly developed.

As mentioned above, a comparison with the foreign material may clarify the question of the choice of raw material and possibility of specifically medieval forms of decoration and size.

Spindle-whorls in other countries are seldom made of the same raw materials as those found at Bryggen. Where stone has been used, it is usually slate, schist, sandstone, limestone or chalk, ie softer kinds of stone. The commonest raw material amongst archaeological finds is burnt clay or pottery, but bone and antler also occur. Wooden spindle-whorls have been found in medieval urban ground in Stockholm at the site Helgeandsholmen (Dahlbäck 1982, 249) and in Early Medieval contexts on settlement sites in the Slavic region (Hensel 1965, 200), but are otherwise seldom mentioned, no doubt due to the preservation conditions on most sites.

The shapes we have at Bryggen are also found abroad, but it is difficult to obtain an impression of how representative the different forms are in the various places. Conical, biconical and conical tending towards biconical all seem to be forms which are very common for clay spindle-whorls. Stone spindle-whorls are often flat, disc-shaped or have the form of a flattened sphere.

In Sweden biconical and conical with a slight return at the base are regarded as particularly characteristic forms for clay spindle-whorls in the Early Middle Ages (Blomquist 1961, 173). They were presumably shaped on an ordinary potter's wheel, as is demonstrated by the regular, concentric ornamental lines which often occur on these spindle-whorls (Stjernquist 1951, 101). The type is known from the end of the 10th century and became common in the 11th and 12th centuries. In layers from the 13th century onwards it is completely lacking for example in Skanör and Lodöse. Conical spindle-whorls, however, are common much earlier on the continent, especially in the western part (Stjernquist 1951, 228). The commonest decoration on Swedish spindle-whorls from the Middle Ages are lines running round the spindle-whorl with the spaces between them filled with small round impressions. Grooves running radially towards the base ending in two concentric circles is another common pattern. Ring-and-dot also occurs (Stjernquist 1951, 228).

Conical spindle-whorls of fired clay are also common in Denmark in the Early Middle Ages. At the Søndervold site in Århus the type has been dated to the period from about the 10th to the early 13th century (Crabb 1971, 227). The type is also universal among Viking grave finds in Jutland and from settlement sites, as well as from the military sites at Trelleborg and Fyrkat. It is also known from Hedeby and the North Frisian Islands. P J Crabb who has analysed the spindle-whorls from Søndervold suggests that the type is typical for the Jutland peninsula and that it is associated with areas in Scandinavia where there are no easily workable kinds of stone. He has also found that the type is seldom found south of the Elbe. The biconical type of spindle-whorl in burnt clay, according to Crabb, is common first and foremost in the Slav collections. Disc-shaped spindle-whorls in steatite he considers to be Norwegian (Crabb 1971, 226). P Nørlund regards the smoothly finished clay spindle-whorls as imports, perhaps from the North-West German or Dutch area (Nørlund 1948, 141).

Medieval urban excavations at Århus, Ribe, Randers and Ålborg in Denmark have produced spindle-whorls in other raw materials, including bone, stone, wood, amber and metal. They are usually flat or hemispherical. The forms of decoration where they occur are similar to the Bryggen forms: concentric circles, radial lines and simple ring-and-dot motifs. The conical or biconical clay types, however, are much more common (pers observations, 1979).

The medieval spinning equipment from Sweden also includes spindle-whorls in stone. Of the seventy spindle-whorls from recent and earlier excavations in Lund, 40% more were made of stone, mostly sandstone, while some 25% were the fired clay types already mentioned, and ca 20% were in bone or antler. Most of the stone spindle-whorls were flat, but the bone ones were hemispherical, as they had been made from the rounded epiphysis of a femur or humerus (pers observations, 1979).

From the Frisian region there is a rich and interesting comparative material from the Merovingian and Medieval periods. The Merovingian material contains little variation. One common type is a low truncated sphere, c 3-4cm in diameter at the base which is often decorated with a six-pointed star contained within two or three concentric circles (Roes 1963, 29). The medieval spindle-whorls are made in clay, bone and antler. The majority are flat or disc-shaped. The decorative elements are simple: circles and straight lines. In size they vary between 4 and 5.5cm in diameter and between 1.3 and 2cm in height. Another common type is shaped like a flattened sphere and is decorated with concentric circles. Even more common are spindle-whorls with a flat base and rounded upper part. Hemispherical spindle-whorls form a smaller group than the disc-shaped ones and are made from the head of ox-femurs (Roes 1963, 29-31).

Medieval spindle-whorls found in Lübeck (42) are overwhelmingly made of clay/pottery, with only one example in glass. They are all biconical or have the shape of a flattened sphere, ranging in weight from 6 to 26 g – the majority between 10 and 20 g (Kempke 1984, 18-19; 1985, 67-68).

Spindle-whorls from England have a different character. Most are made of limestone and the common forms are our types D, F and G. All the twenty-one spindle-whorls found in King's Lynn are of these types. The average spindle-whorl here measures 3.2cm in diameter and weighs 30g, but there is a wide range in both size and weight (Clarke and Carter 1977, 315-17).

The comparative material presented here is of course extremely fragmentary, yet these samples from other countries are to a certain extent instructive. We can see that the Bryggen spindle-whorls on the whole must have been made from local raw materials, presumably from Western Norway, such as local species of wood and, in particular, steatite and greenstone for the stone spindle-whorls. Bone, antler and metal spindle-whorls can also be of local production, while on the other hand those made from fired clay, pottery and chalk are most likely imported, but these make up only a small fraction of the spindle-whorls from Bryggen. The hemispherical forms (types A and B) are much more common at Bryggen than in the comparative material from the other Nordic and North European countries, where the conical form is much more commonly found. The biconical and spherical forms (D and G) have a much sparser representation at Bryggen than abroad.

It seems therefore that the spindle-whorls from Bryggen on the whole are of local production, even though there are similar forms among the foreign material.

The Frisian material shows that the use of bone and antler spindle-whorls goes back beyond the Middle Ages. Several of the spindle-whorls from Bryggen have the same decorative features and the decoration placed in the same way as the Frisian spindle-whorls (Roes 1963, pl XXXIII, 6; XXXIC, 1, 12; XXXV, 4-6). The decoration in question is simple, consisting of ring-and-dot and various combinations including this. It is very common on bone objects and is known over a long period from the Bronze Age onwards. It is therefore not possible to draw the conclusion that this material at Bryggen is imported. The use of concentric circles as elements in the decoration on the stone spindle-whorls may be influenced by the decoration on clay, wood, bone and antler spindle-whorls which have been made on a lathe or wheel.

2.3.9 Function

The size and weight of the spindle-whorls from Bryggen cover, as we have seen, a wide range. Weight may vary from under 10g to over a 100g. The comparative material from abroad also covers a wide range.

The German textile researcher, Linder, has, as previously mentioned, investigated the connections between spindle, spindle-whorl and thickness of yarn. Fine yarn which needs a faster rate of rotation was spun with light spindles. The weight of the spindle-whorls in his investigation varied from 3 to 60g. The light ones, between 3 and 5g, were used for spinning cotton. For wool, spindle-whorls of 30-35g were most often used (Linder 1967, 54). To spin the wool from the common Norwegian short-tailed sheep, weights of c 25-35g were used and weights of 50g for plying the yarn (Lønning 1976, 20). It is worth drawing attention to the high proportion of light spindle-whorls at Bryggen, indicating that very thin, fine yarn was also spun, presumably fine wool or perhaps nettle-fibres.

Linder's research into the speed of rotation of the spindle-whorls showed that the light ones were markedly faster than the heavy ones. While a 4g spindle-whorl had a frequency of 3600 rotations per minute, a 15g weight had

2500, 23g 2100 and 40g 1600 rpm (Linder 1967, 56).

The differentiation in weight and the concentrations around certain weights are probably therefore significant and reflect the variety of uses for the spindle-whorls at Bryggen. Equipment of different kinds was needed in order to produce yarn with different grades of fineness and strength. The shape of the spindle-whorl was also relevant, conical ones, for example, turning more rapidly than spherical or flat ones and producing therefore a close, fine thread.

3 Equipment for winding

The spun yarn had to be wound before it could be used for weaving or stitching. Various pieces of equipment could be used, such as winding-frames, reels and spools. A skein-winder or reel could consist of a short rod with cross-arms at each end. It was held in the hand and twisted from side to side so that a skein was gathered on the cross-arms (NTT, 34). The skein may be held on a revolving winding-frame or swift while it is wound into a ball or transferred to spools ready for use as the warp (NTT, 26), while yarn to be used as the weft will be wound on bobbins (NTT, 81).

4 Winding equipment from Bryggen

4.1 The wimble

The Bryggen finds also include part of a rather special piece of spinning or winding equipment which has been in use in some areas right up to our own time. It is in the form of a rotating reel, consisting of a central rod to which a handle is attached and two parallel side-rods held by cross-pieces at either end.

It is the central spindle which has been found at Bryggen (fig II.15). It is 22cm long with an 8.3cm long handle and is made from yew. The handle is thicker than the axle itself and this is also thicker at one end where the cross-arm was attached. It was found in a layer belonging to Period 5, 1248-1332.

This piece of equipment is also known in the Faeroes where it is known to have been used for spinning hemp in the 1780s (Warburg 1974, 96) and in England where it was used for twisting straw (Sauce 1939, 195).

4.2 Possible stick-reels

Among the Bryggen finds there are three pieces of wood which may have been the end-pieces of a stick-reel, a simple device for gathering the spun yarn into a skein or hank. It consists of a central bar which is grasped in the hand and two curved end-pieces on which the yarn is

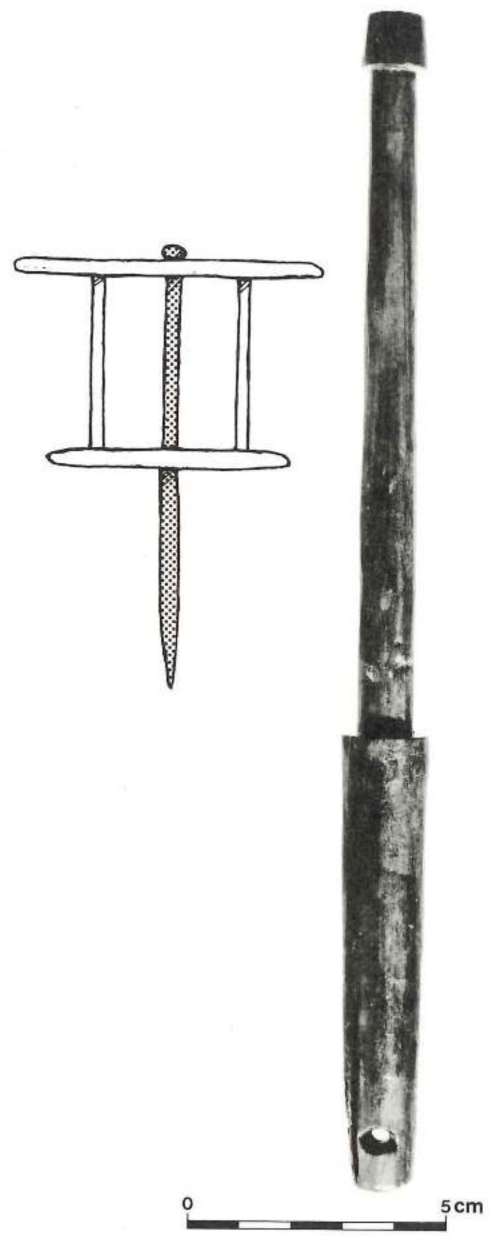


Fig II.15 Part of a wimble from Bryggen (no.41381) with a suggested reconstruction

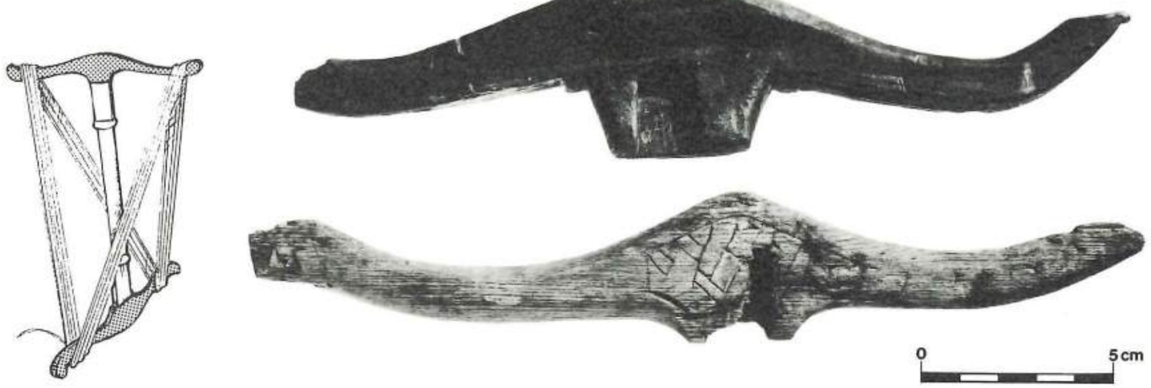


Fig II.16 Possible end-pieces from stick-reels or hand-reels from Bryggen (nos 18025 and 29448) with a suggested reconstruction

laid. The end-pieces are often at right-angles to each other (Burnham 1980, 69).

The three pieces from Bryggen have curved arms on either side of a central projection containing a rectangular hole into which the tongue at the end of the cross-bar could be inserted (fig II.16). They are approximately the same length, 22 and 23.2cm, and are therefore much smaller than the stick-reels from Oseberg which were c 40cm long (Grieg 1928, 189). They are made of birch and pine. One is decorated with a basket-work design within a frame around the point where the cross-bar joins and has an animal's head at each end. There are clear traces of wear in the centre of the upper edge of both arms.

Two of the endpieces were found in layers associated with period 5, 1248-1332; the third is undated.

4.3 *Possible bobbins*

4.3.1 Possible bobbins or quills

Perforated metacarpals or metatarsals of sheep or goat have occasionally been interpreted as bobbins or quills on which the yarn to be used as the weft is wound, the end presumably going through the hole (eg Wild 1970,34).

Among the Bryggen finds are six objects made from the metacarpal or metatarsal of a sheep or goat. A transverse hole has been bored through the middle (fig II.17).

The interpretation of these objects as bobbins, however, is rather doubtful and other functions have been suggested such as the spool from a shuttle, but in that case they should also have a hole bored into each end. It is more likely that these objects have been used as toys, being part of a string game. This kind of usage is known from Western Norway, where it was called *snorlebein,* twisting bone. It is also known from the Shetlands where it is known as *snorie bane* (Weber 1982, 86).

4.3.2 Bobbins used in plaiting

Another object which should be included here is the bobbin used in making a quadruple plait.

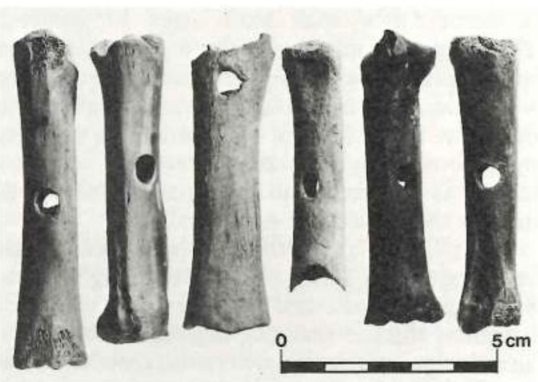


Fig II.17 Perforated metacarpals or metatarsals of sheep or goat from Bryggen (nos 20897, 9801, 11587, 30422, 23253). These objects have occasionally been interpreted as bobbins, but it is more likely that they have been used as toys in a string game

There are four bobbins in a set. Yarn is wound around them, the ends are fastened to some fixed point, and the bobbins are then moved in a regular pattern so that diagonally opposing yarns change places (Hald 1942, 11). This technique is known over a wide geographical area and was also well known in the Middle Ages (Hald 1950, 286). Most plaiting techniques, however, did not need any special equipment.

Among the Bryggen finds a single plaiting bobbin has been found. It is made of unspesifiable hardwood and is in the form of a miniature axe (fig II.18). It is 9.9cm long and belongs to period 7 (1413-1476). It has probably been used for making coarse plaits.

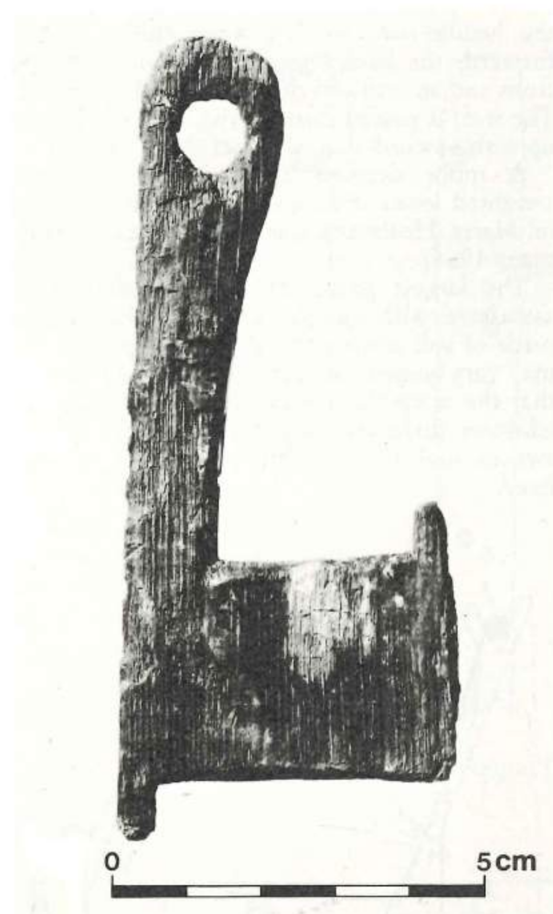


Fig II.18 Bobbin probably used in plaiting (no.1065)

4.4 *Possible spool*

A quite unique object among the Bryggen finds is a long slightly curving piece of antler with a marked groove running right around it. It has probably been used as a spool for thin thread. It measures 7.0x0.9cm externally and 6.0x0.3cm internally at the groove. It is from Period 6, 1332-1413.

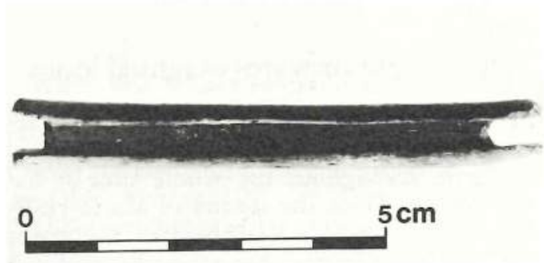


Fig II.19 Possible spool (no.22100)

5 Summary

Altogether there are 488 objects which have been considered in connection with spinning and winding. The spinning equipment found at Bryggen consists of 6 possible distaffs, 31 drop-spindles and another 29 possible spindles, and 410 spindle-whorls. The winding equipment comprises part of a wimble, three possible end-pieces from stick-reels and a bobbin used in plaiting. There are also 6 possible bobbins or quills used for holding the weft when weaving and a possible spool.

The various items come from all periods from the earliest to the latest, with the greatest proportion in period 5, 1248-1332.

CHAPTER III
WEAVING EQUIPMENT

It is usual to divide the large looms into two main types, those where the warp is stretched vertically and those with the warp stretched horizontally (Hoffmann 1978a, 13). The vertical type can be further divided into two categories: (1) the two-beam or tapestry loom, and (2) the warp-weighted loom. It is particularly the second which is of interest and which will therefore be described in more detail.

In addition to the large looms there are also several implements for band-weaving, such as weaving-tablets, rigid heddle or heddle-frames, band-looms, etc.

1 The upright or warp-weighted loom

The warp-weighted loom has continued in actual use until the present day and has changed very little throughout the whole time it has been known. From the studies of Marta Hoffmann we know how it was operated. It consists of a pair of uprights leaning backwards and holding a cross-bar or beam at the top (fig III.1). Fixed to this is a twisted band or narrow woven strip forming a starting-border for the warp-threads which hang down from the beam and are held taut by freely hanging warp-weights or loom-weights, which are fixed to the warp-threads by means of a cord passing through the hole. A shed-rod is placed so that the warp-threads either pass over it or hang freely behind it, thus dividing the warp into two and forming a natural shed. The back threads are individually attached by heddles to the heddle-rod, so that when this is pulled forward, the back threads are brought to the front and an artificial or countershed is formed. The weft is passed through the shed and beaten up with a sword-shaped beater (NTT, 57-58).

A more detailed account of the warp-weighted loom and its operation can be found in Marta Hoffmann's doctorate thesis (Hoffmann 1964).

The largest group of finds which can be associated with upright looms are the weights made of soft stone or fired clay. Shape and size may vary somewhat, but they all have a hole so that the warp threads can be tied to them. In addition there are sword-beaters or weaving-swords and the possible remains of a loom itself.

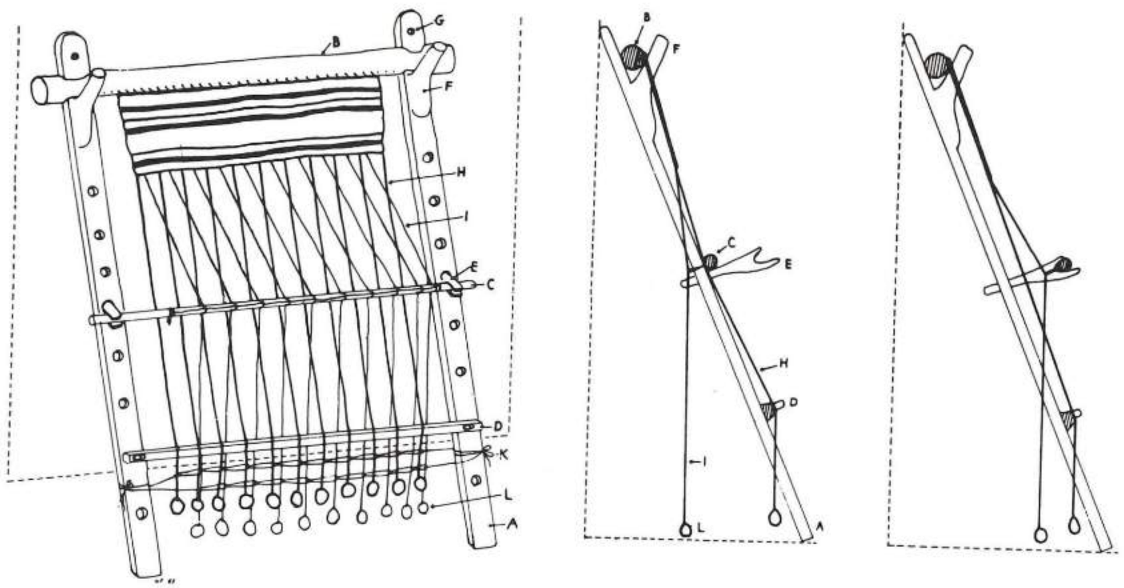


Fig III.1 The upright or warp-weighted loom. The two diagrams on the right show the system of changing the natural shed (left) to the counter-shed (right) (From Hoffmann 1964)

1.1 Possible uprights from warp-weighted looms

Amongst the so-called building material recovered from the excavations is a beam with regularly spaced holes and a crook at one end (fig III.2). From its shape and dimensions it is easy to imagine that it has been used as one of the uprights in a vertical loom. The crook would have held the cloth beam at the top and the holes would hold the pegs which supported the heddle-rod at various heights. It is dated to period 6.

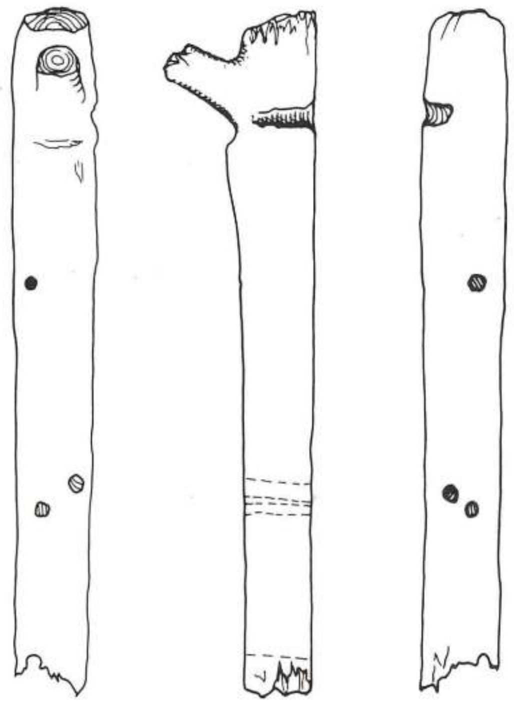


Fig III.2 Possible upright from a warp-weighted loom

1.2 Possible warp-weights from Bryggen

1.2.1 Description

A common feature of warp-weights is at least one hole for attaching the warp which is then held taut by the weight of the stone. The shape, size, weight and raw material can vary. Four main types based on shape are recorded from the Bryggen excavations (fig III.3).

Type A is round with a central hole.
Type B has gently sloping sides.
Type C has nearly parallel sides.
Type D is oval.
Type X is reserved for atypical or unidentifiable weights.

While type A has a central hole, in types B, C and D the hole is in the upper part of the stone. The types are divided into sub-types, sub-type 1 being the standard form and sub-type 2 being irregular variations.

These weights may, of course, have had other functions than loom-weights. They may have been used by fishermen as net or line sinkers, and the round type may have functioned as a drilling-stone. I shall therefore use the term «weight» to denote these objects. After I have classified and described the material, I shall return to the question of function.

In the classification and description of these weights, emphasis is given to the following points in addition to shape: size, weight, raw material, method of manufacture and marks or decoration. The following measurements (cf fig III.4) have been taken in order to obtain a comparable and identifiable expression of type and size: 1) length of the weight along the long

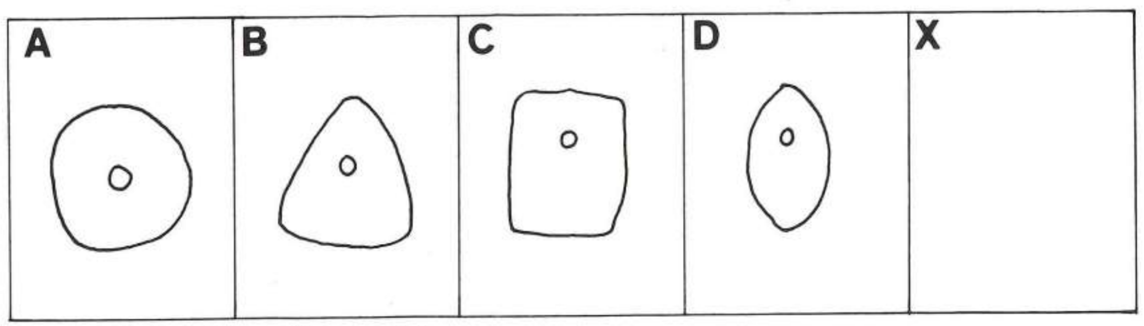


Fig III.3 Types of warp-weights

axis through the hole, A1-A2, 2) width of the weight along the cross-axis through the hole, B1-B1, and at the widest part, B2-B2, 3) position of the hole measured along the long axis from the upper edge of the weight down to the top edge of the hole A1-C1, 4) thickness measured at the widest point which varies from weight to weight but which can be seen from the cross-section, 5) cross-section, recorded as elliptical, semi-elliptical, lentoid, rectangular or triangular, 6) shape of the hole in order to gain information about the method of manufacture.

From the excavations at Bryggen 792 weights have been recorded, of which 555 are complete.

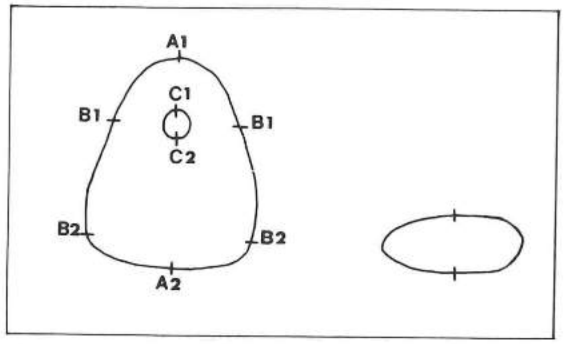


Fig III.4.1 Weights from Bryggen: measuring system

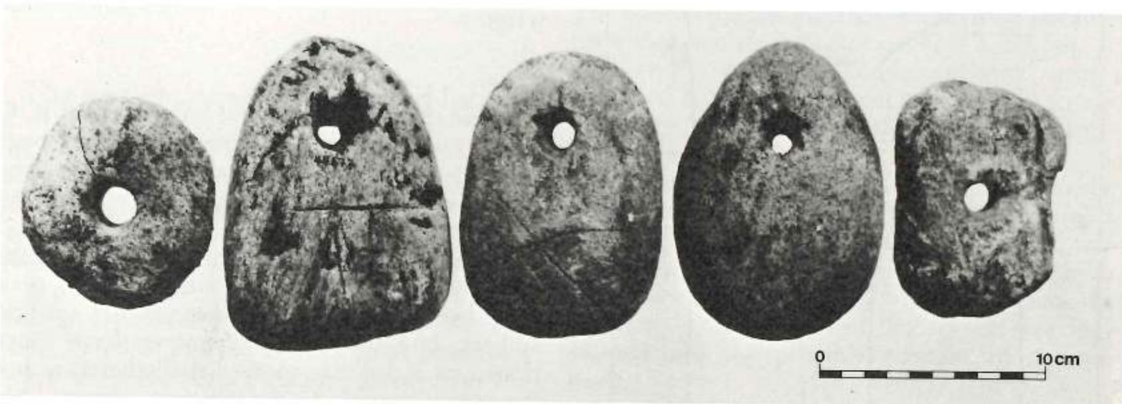


Fig III.4.2 Weights from Bryggen, different types (nos 70770, 44677, 53634, 6394, 9453)

Type	A	B	C	D	X	Σ
Total	105	332	198	67	90	792
Whole Weights	80	243	151	54	27	555
Variations	A1 A2	B1 B2	C1 C2	D1 D2		
N	74 31	265 60	145 52	41 25		
		B/C B/D	C/D	D/B		
N		6 1	1	1		

Table III.1 Weights from Bryggen: distribution according to form

TABLE III.2.1 WEIGHTS FROM BRYGGEN: LENGTH (cm) OF WHOLE WEIGHTS (N 555)

Type	N	Min.	Max.	Mean	SD
A	80	5.4	14.5	9.22	1.58
B	243	4.5	16.5	12.07	1.43
C	151	7.6	16.5	11.95	1.69
D	54	7.3	16.5	11.94	2.13
X	27	6.5	15.3	12.04	1.15

TABLE III.2.2 WEIGHTS FROM BRYGGEN: DISTRIBUTION ACCORDING TO LENGTH (WHOLE WEIGHTS, N 555)

Type	A	B	C	D	X	Total
Length (cm)						
Under 4.5	0	1	0	0	0	1
4.51-6.0	2	0	0	0	0	2
6.01-7.5	8	4	0	1	1	14
7.51-9.0	23	12	8	5	1	49
9.01-10.5	32	32	20	10	5	99
10.5-12.0	11	75	41	9	5	141
12.01-13.5	3	65	55	13	6	142
13.51-15.0	1	46	22	14	7	90
15.01-16.5	0	8	5	2	2	17
Total	80	243	151	54	27	555

The vast majority (98%) are made from steatite (soapstone), but other types of stone, including schist and gneiss, also occur (see appendix 1).

From table III.1 it can be seen that types B and C are clearly the commonest forms (67%) at Bryggen.

There is very little difference in the length of types B, C and D. The circular type A, on the other hand, clearly differs with its shorter maximum length (ie greatest diameter).

For type A the commonest lengths (ie greatest diameter) lie between 7.6 and 10.5cm. Types B and C have approximately the same distribution, with the commonest lengths falling between 10.6 and 13.5cm. Type B has a rather greater number of weights longer than 13.5cm than type C. Type D is more evenly spread among the longer weights than types B and C (table III.2.2).

As described above, it is the relationship between the width at the hole (B1) and the maximum width (B2), and the position of the greatest width which determine the type. Table III.3.1 gives the mean width for the various types and table III.3.2 gives the co-efficient of the relationship between B1 and B2 for the different types.

TABLE III.3.1 WEIGHTS FROM BRYGGEN: WIDTH (cm) OF MEASURABLE EXAMPLES (N 582)

	Width at hole (B1)					Max width (B2)				
Type	N	Min	Max	Mean	SD	N	Min	Max	Mean	SD
B	320	3.4	10.8	7.29	1.42	288	3.4	12.9	9.16	1.52
C	197	3.8	13.0	8.22	1.76	177	4-	13.2	3.79	2.02
D	65	3.3	12.8	7.07	1.75	56	6.4	12.1	8.42	1.23

TABLE III.3.2 WEIGHTS FROM BRYGGEN: RELATIONSHIP BETWEEN WIDTHS B1 AND B2

Type	No.B1/No.B2	Co-efficient B1/B2
B	320/288	0.8
C	197/177	0.94
D	65/56	0.84

Type C is generally wider at the hole (B1) than the other types, which display less difference between B1 and B2 (cf table III.3.1). It is the relationship between B1 and B2 which separates type B from type C (table III.3.2). We have already noted that they otherwise have a fairly similar size-range (tables III. 2.1 and 2.2).

TABLE III.4 WEIGHTS FROM BRYGGEN: GREATEST THICKNESS (cm) (ALL WEIGHTS)

Type	N	Min	Max	Mean	SD
A	105	1.3	8.5	3.1	0.97
B	332	1.1	6.8	3.8	0.85
C	198	1.1	6.3	3.08	0.94
D	67	0.7	5.8	3.32	0.99
X	90	0.8	10.0	3.54	1.56

Table III.4 shows that there are large differences in the greatest thickness within all types, whereas the mean thickness shows less variation between the types. Type B is generally

TABLE III.5 WEIGHTS FROM BRYGGEN: CROSS-SECTION OF MEASURABLE EXAMPLES (N=633)

Type	Elliptical	Semi-ellipt	Lentoid	Rectang (approx)	Triangular	Other	Total
A	28	12	17	31	3	1	92
B	106	13	45	116	3	2	285
C	41	13	30	80	4	1	169
D	22	2	13	16	2	1	56
X	8	3	3	11	1	5	31
Total	205	43	108	254	13	10	633

thicker than types A, C and D. The various thicknesses are to a great extent connected with the shape of the cross-section (table III.5).

The commonest forms for the cross-section are either approximately rectangular or elliptical. This is regardless of type, although types B and D have more weights with an elliptical cross-section than types A and C. This shows that the form of the cross-section is not determined by type, as the various forms are spread fairly evenly among all types.

Common for all loom-weights is the hole through which the warp is tied. In recent times the warp-threads were not tied through the hole in the weight, but were attached by means of a looped cord through the hole in the loom-weight (Hoffmann 1964, 37). The size of the hole does not therefore necessarily indicate the number of warp-threads attached to the weight.

An analysis of the holes has shown that the smallest hole is more or less the same size for all types and is between 4 and 6mm in diameter.

TABLE III.6.1 WEIGHTS FROM BRYGGEN: WEIGHT (g) OF WHOLE WEIGHTS (N=555)

Type	N	Min	Max	Mean	SD
A	80	81	823	358.4	163.8
B	243	175	1190	640.6	214.8
C	151	172	1360	640.3	235.3
D	54	158	1070	492.6	207.7
X	27	188	1120	539.9	262.6

Type A, however, differs in that the mean diameter of the hole is greater than for the other types.

The hole can be parallel-sided, slightly conical or almost biconical in shape. The biconical hole is the commonest shape for all types.

There is a wide range in the distance between the top of the weight and the hole, independent of type. Taking the average, it was found that the «normal» position for types B, C and D is approx. 3cm down from the top. The atypical and unidentifiable types do not fit this pattern, the hole always being much lower.

The purpose of the loom-weight is to keep the warp taut and evenly stretched and it is likely that its weight is important both for the process of weaving and for the end-product. To some extent it is possible to regulate the tension on the warp threads by adjusting the number of threads attached to the weight. This method has been used in Norway in modern times (Hoffmann 1964, 21). The heaviness of the weight is nevertheless an important functional characteristic.

Table III.6.1 shows that the outer limits of the weight range do not vary greatly among the types. The mean weight, however, shows that types A and D are generally lighter than B and C.

Table III.6.2 which gives the distribution of the weights in groups of 100g for each type shows that there is a clustering between 300 and 900g. Altogether 80% of all the weights lie within this range, and each of the 100g groups here contains more than 10% of the weights. However, there is not the same distribution for each type, type A being decidedly lighter than the other types, with the majority (72%) weighing between 200 and 500g. Type D is generally somewhat heavier than A, with a concentration (63%) between 300 and 600g. Types B and C have a rather similar distribution of weight with about 80% falling between

TABLE III.6.2 WEIGHTS FROM BRYGGEN: DISTRIBUTION OF WHOLE WEIGHTS BY WEIGHT (100g DIVISIONS).

Weight-divisions	Type A	B	C	D	X	Total	%
under 100	2	0	0	0	0	2	0.36
100.01-200	10	1	2	2	2	17	3.06
200.01-300	20	10	5	5	4	44	7.93
300.01-400	23	22	21	15	4	85	15.32
400.01-500	14	30	22	10	1	77	13.87
500.01-600	5	48	18	9	6	86	15.50
600.01-700	0	17	20	5	3	75	13.51
700.01-800	4	36	19	2	2	63	11.35
800.01-900	2	21	26	4	3	56	10.09
900.01-1000	0	8	9	0	0	17	3.06
1000.01-1100	0	12	6	2	1	21	3.78
1.100.01-1200	0	8	1	0	1	10	1.80
over 1300.01	0	0	2			2	0.36
Total	80	243	151	54	27	555	100

300 and 900g, although type B has a greater concentration between 400 and 800g with 20% lying between 500 and 600g, whereas type C is more evenly spread. The miscellaneous group of atypical and unidentifiable types is too small to show any definite trends in the distribution pattern.

There is great variation in the way the weights have been finished, ranging from a very finely smoothed surface to a surface which has been left completely untouched.

Nearly 90% of all the types have been smoothly finished, but to differing degrees of fineness. 65% have a smooth surface, while about 25% are only roughly smoothed. On 7.3% the surface has not been worked at all and has a generally coarse appearance. A few (1%) have a grooved or furrowed surface, while the remainder are parts of other objects re-used as weights, such as fragments of stone griddles and stone bowls (1%). The unworked group contains most of the weights which have not been made from steatite. Group X which comprises atypical or unidentifiable types has, together with group A, the relatively greatest number of unworked weights, whereas types B and C on the other hand have the relatively greatest number of weights with a smoothly polished surface.

As already mentioned, it is not certain that all the weights have been used as warp-weights. We shall attempt to approach this question in three ways:

1) by taking a closer look at the weights with marks or decoration
2) by examining particularly the weights which have been found together and which may be the remains of looms
3) by comparing them with other archaeological finds which definitely are warp-weights.

The Bryggen finds include 149 weights with simple forms of decoration: incised symbols or marks. This represents 18.8% of the total number of weights. Usually the marks consist of one or more incised crosses (133 examples), but there are also other simple patterns: pits (7), grooves (5), ticks (3) and a triangle (1) either alone or combined with a cross. There are many examples of similarly decorated weights definitely being used as loom-weights and this may indicate that all weights with marks of decoration are loom-weights.

In more recent times stones have been used for weighing and the weight was calculated in units of a mark (now standardised to 250g) (Hoffmann 1964, 42). It may therefore be worth while examining the relation between types, weight groups and decoration.

It is especially type B (86 examples or 25.5% of all B-type weights) and to some extent type C (43 examples or 21.6%) which are marked, but decoration is also found on types A (7=6.6%) and D (8=11.8%). In the miscellaneous group there are only four with decoration. All the decorated weights are smoothly finished but to differing degrees. The majority (107) have a very smooth surface and thirteen of these are extremely well finished. Twenty weights are roughly smoothed.

Tables III.7.1 and 7.2 show that the decorated weights as a group are relatively heavy compared with the total distribution given in tables III.6.1 and 6.2. The majority of the decorated weights are between 400 and 900g, with a peak at 600-700g, but there does not seem to be any pattern or connection between particular weight-groups and decoration.

TABLE III.7.1 WEIGHTS FROM BRYGGEN: WEIGHT (g) OF DECORATED WHOLE EXAMPLES (N=116)

Type	N	Min	Max	Mean	SD
A	4	207	786		
B	75	316	1180	704.7	193.7
C	31	378	1320	723.0	209.5
D	6	304	634	495.3	108.4

TABLE III.7.2 WEIGHTS FROM BRYGGEN: DISTRIBUTION OF DECORATED WHOLE WEIGHTS (N=116)

Weight groups of 100g	A	B	C	D	Total
under 300	2				2
300-400	1	2	3	1	7
400.01-500		8	2	2	12
500.01-600		10	3	2	15
600.01-700		26	7	1	34
700.01-800	1	9	6		16
800.01-900		9	5		14
900.01-1000		2	2		4
1000.01-1100		6	2		8
1100.01-1200		3			3
over 1200.01			1		1
Total	4	75	31	6	116

The weights were often found together within a limited area. Larger concentrations which may indicate the remains of a loom are therefore of particular interest. Table III.8.1 shows groups of five or more weights. Emphasis has been given to examining how the weights are divided by weight and type, and to what extent they are decorated. The table also gives the relationship to constructions and the dating (see also Part II, chap. VII, p 119). From the table it can be seen that all types are present in these groups. A comparison with the total distribution given in table III.1 shows that type A is markedly less represented in the concentrated groups than should be expected (3.5% compared with 13.2% of the total distribution). To some extent this also applies to type D. Types B and C on the other hand are more strongly represented in the concentrations. Taking the groups found in association with burnt buildings, it will be seen that this trend is even more marked: there are only two weights each of types A and D.

In every concentration there are weights with incised crosses, and with a total of 25% these occur more frequently than they do in the total population (18%).

Table III.8.2 gives the distribution in 100 gram weight-divisions of all weights whose weight could be calculated. Comparing this table with table III.6.2 we can see that there are fewer weights under 400g in the concentrated groups than in the total population. The majority of weights in these groups weigh between 400 and 900g (71% compared with 65% in the total population).

An examination of the weights found in concentrated groups does not provide any clear criteria for distinguishing features which may reflect particular areas of use. Every type is present and there is a relatively wide range of weights within the individual concentrations. Incised crosses are also found in every group.

On the upright loom it is important that the weight is balanced between the front and back warp-threads. It would therefore be interesting to examine if there is any particular distribution pattern within any of the groups that may give such indications, if the groups eg contain pairs of stones of equal weight or there are combinations which give more or less paired weights.

Diagram III.1 which shows the distribution of weights in the better represented concentrations, groups I-IV, does not give the sequence of weights as found, but graded according to heaviness in order to see whether there are pairs of weights or paired weight-combinations.

The diagram suggests that in the best represented groups there is a tendency to systematic grouping by weight. Moreover, two light weights together are more or less equal to one heavy weight. This may show that these actually are warp-weights.

It is possible that the finds-location can provide further information with regard to the

TABLE III 8.1. GROUPS OF WEIGHTS

IDENTIFICATION NO.		NO IN GROUP	COMPLETE	WITH MARKS	WEIGHT IN GRAMME. COMPLETE WEIGHT			TYPE DISTRIBUTION					FINDS.LOCATION	PERIOD
					min	max	x	A	B	C	D	X		
I	6509–6510	30	24	2	285	1064	660,96	1	10	12	3	4	Buildings 333	5
II	31713	26	17	8	439	1110	846	–	18	7	–	1	149	4
III	89060–89071 89081–89094	26	10	9	304	1032	698,8	1	13	7	1	4	236	3
IV	44329,44671 44687,44692 44705,44707 44763–64 44771–44805 44891–44894 44899–44900 44902–44936	23	21	6	393	1120	753,2	–	14	9	–	–	484	2
V	52828–52829 53129,53304, 53632–53639, 54893a–c	15	11	7	291	888	550,60	–	4	7	2	2	135	3
VI	22447	15	12	3	158	700	454,6	1	7	5	2	–	passage	5
VII	83395–83398 83416–25	14	7	2	239	588	473,9	–	4	4	–	7	building 193	5
VIII	72684,72691–93,72716–17, 72757–58, and 74493–795 74497	13	12	2	282	1115	621	–	10	1	2	–	building 31	4
IX	6288	11	6	3	295	1027	665,3	1	3	4	1	2	unclear	6
X	54171	9	7	4	240	1120	705,9	1	3	4	–	1	quay	4
XI	88387–88395	8	7	1	522	1102	692,1	1	6	–	–	1	n/building 201	5
XII	42867	8	5	1	290	1070	734,6	1	4	2	1	–	quay	undated
XIII	37114	7	4	1	488	1103	743,8	–	3	–	1	3	unclear	5
XIV	37148	7	7	2	239	1045	614,9	–	2	4	1	–	foundations	4
XV	64278–82	5	5	2	688	1130	876,8	–	3	2	–	–	building 37	3
XVI	73226, 74979, 74982–84	5	5	2	246	433	360	–	–	1	2	2	building 63	3
XVII	59615, 59741, 60040, 60094, 60511	5	3	–	361	617	452,7	1	–	–	3	–	building 10	5
XVIII	64395, 64000, 02	5	4	3	307	823	575,4	–	3	2	–	–	building 42	2
Total		232	167	58				8	107	71	19	27		

TABLE III. 8.2 WEIGHT-DISTRIBUTION OF WEIGHTS, FOUND IN GROUPS

weights group	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	Total	%
< 300	1	–	–	-	1	2	1	2	1	–	–	1	–	1	–	1	–	11	5,9
300.01-400	-	–	2	1	1	4	–	1	-	–	–	-	–	-	–	2	2	13	6,9
400.01-500	5	2	3	3	4	-	2	3	1	1	–	-	1	2	–	2	–	29	15,4
500.01.600	3	1	4	1	2	5	4	2	1	1	3	1	–	1	–	–	-	29	15,4
600.01-700	4	5	1	4	2	1	–	1	2	–	1	–	1	–	1	–	1	24	12,8
700.01-800	5	2	6	2	2	1	–	2	-	1	2	3	1	1	1	–	-	29	15,4
800.01-900	5	6	1	4	1	1	–	–	1	1	–	2	–	-	1	–	-	23	12,2
900.01-1000	1	3	-	3	-	-	–	–	–	2	–	-	–	1	1	–	-	11	5,9
1000.01-1100	1	2	2	2	-	-	–	–	1	–	1	1	–	1	–	–	-	11	5,9
1100.01-1200	–	2	-	1	-	-	–	2	-	1	–	-	1	–	1	–	-	8	4,2
Total	25	23	19	21	13	14	7	13	7	7	7	8	4	7	5	5	3	188	100

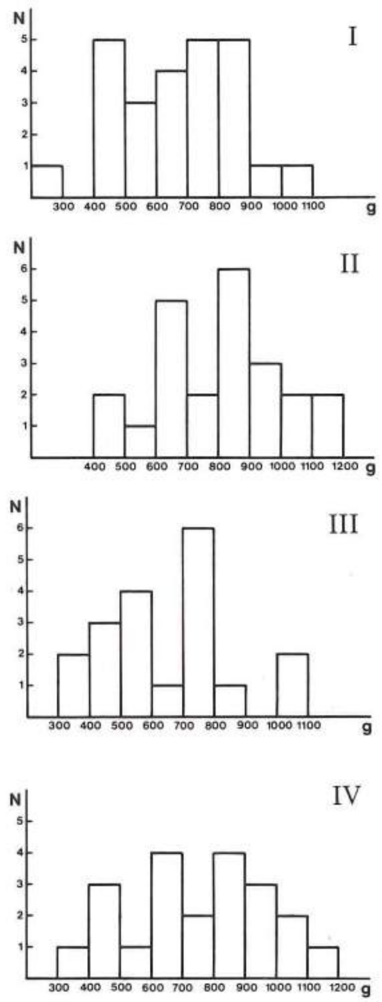


Diagram III.1 Weight-distribution of weights, groups I-IV

question of function. Twelve of the concentrated groups of weights were found in association with burnt buildings (groups I, II, III, IV, V, VII, VIII, XIV, XV, XVI, XVII and XVIII). These were probably in situ, ie in the original position where they had been used or stored. An association with other finds connected with textile production could indicate that the weights have belonged to a loom; otherwise they could be fishing-weights. In part II, chapter VII the location and combination of finds is treated in detail (see p 119). There does seem to be a clear connection between the concentrations of weights and finds of other textile equipment in the burnt buildings. This applies to ten of the twelve groups, the exceptions being groups III and XV. The commonest combinations are spindle-whorls of inorganic material (7 instances), while objects of organic material, such as wooden or bone needles, naturally occur less often. These associations of finds suggest that the weights found in the concentrated groups have been used as warp-weights for upright looms and not as fishing-weights.

Group VI containing fifteen weights is of special interest in that it was found in a fire-layer in a passage. If this find really is in situ in the passage, it should represent the remains of a fishing-net which was hanging on or lying by the outer wall of a building adjoining the passage and incidentally quite near the waterfront. Unfortunately it is difficult to ascertain whether these weights may have come from one of the neighbouring burnt buildings (see p 124). Since group VI contains the same types as the other groups, including weights with marks, but differs by being slightly lighter on the average, it is very uncertain if this weight difference indicates a different area of use.

The remaining concentrated groups of weights cannot throw any further light on the question of function.

1.2.2 Dating

Can any definite patterns be recognised in the frequency of the finds in time or space which may tell us when and where the weights were used at Bryggen?

TABLE III.9 WEIGHTS FROM BRYGGEN: DATING

			Type				
Period	A	B	C	D	X	Total	% of all
8		7	5			12	1
7	2	12	7	3	3	27	3
6	7	41	22	17	5	92	12
5	38	70	51	17	27	203	26
4	22	80	34	11	12	159	20
3	16	72	47	12	17	164	21
2	5	29	17	3	9	63	8
undated	15	21	15	4	17	72	9
Total	105	332	198	67	90	792	100

Table III.9 shows that all types of weights are present from the earliest period, period 2 (before 1170) up to period 7 (1413-1476), while in the latest period only types B and C occur. The majority of the material – 75% – is from the High Medieval period, prior to 1332. In the earliest periods, 2 and 3, types B and C occur relatively more frequently than the other types. The peak occurrence of these two types is also rather earlier. All types, however, have their peak occurrence both numerically and relatively in periods 4 and 5, 1198-1332, but when the length of the periods is taken into consideration, the picture changes. When the frequency per year is calculated, the peak occurrence comes in period 3, 1170-1198, decreasing evenly in the following periods.

1.2.3 Comparative material

On the deserted medieval farm of Høybøen at Vindenes in Fjell, Hordaland, 74 weights were found in house-sites from the Early (ie post-11th century) and High Medieval period (Randers 1981, 47 and 70). These finds can throw some light on the question of function. Two of the rooms (1b and 2a) contained collections of weights which may be from one or more upright looms. The other finds would suggest that these weights are most probably loom-weights and not fishing-weights. As they were found spread around the room, it is difficult to say whether one or more looms are represented. The remaining weights from the site are too few and lay too scattered to be of interest in the present context.

Most of the weights are described as pear-shaped, ie type B, but a small unspecified number of rectangular ones, type C, and elliptical ones, type D, were also found. Room 2a also contained seven weights of type A. Some of them were damaged and their weight can only be estimated. Three of them have no hole but have a construction which enabled them to be suspended.

The weights vary from c 250g to over 1kg and show two clusters, one around 200-400g and the other around 500-700g. The group concentrated within a distance of 1m in room 1b and presumably representing a loom includes weights of between 575 and 960g. The remainder along the south wall are on the whole lighter, between 240 and 600g. The only one with an incised cross weighs c 350g.

As already described in chapter II a relatively large number of spindle-whorls (25 in all) was also found in these two rooms, as well as four scissors or parts of scissors. From the situation and make-up of the finds, it can be fairly safely assumed that the weights from Høybøen have belonged to at least three or four upright looms. The finds also show that the loom-weights on an upright loom did not need to be of equal weight.

In his review of medieval urban finds from Bergen and Oslo, Grieg describes weaving equipment found to date in these two towns (Grieg 1933, 335-6), while Lunde presents the loom-weights found in medieval Trondheim prior to the extensive excavations which began in 1970 (Lunde 1977, 130). Neither of them go into any detail concerning this group of objects, and do not therefore help to answer the questions that have been raised. They do, however, show that the weights are the same types as those found at Bryggen, and often with incised crosses or other symbols such as a double circle, ownership marks or capital letters. The weights were not found *in situ*.

The finds of textile equipment from more recent medieval excavations in Oslo, Tønsberg and Trondheim have not been published.

From the Merovingian/Viking periods (c 600-1050) there is a relatively rich material where the context can throw some light on the question of use. Petersen in his study of Viking tools and equipment examined two types of weights from this period in Norway, those made in stone and those in fired clay. He investigated 449 weights in all from the whole country, representing 82 sites. Most of the finds are from graves, but there are also some from settlement-sites as well as loose finds (Petersen 1952, 296-7). The stone weights are most often made from steatite but schist also occurs. Other types of stone occur only rarely. It is not uncommon for them to have an incised mark on one of the sides, usually a simple cross, but there are also circles, either alone or combined with a cross (*ibid* 295).

As at Bryggen, shape and size vary. The usual length of the stone weights is 8-13cm and the width of the majority is between 5 and 8cm with 6-7cm as the commonest. The thickest is 11cm and the thinnest 3-4cm (*ibid* 296). Petersen does not give the weight, nor has he attempted any division into types.

Hoffmann, however, has investigated the question of weight more closely, also on foreign loom-weights, and found that it varies greatly from 150g, as in the smallest loom-weights from Greece, to 1000g or more, with the majority being around 500-700g (Hoffmann 1964, 20).

By far the greatest majority of weights from the Viking period in Norway have been found in women's graves. Only seven are from graves containing males, and only 1 or 2 weights were found in six of these graves, so that the possibility of them being fishing-weights cannot be excluded (Petersen 1952, 296). In twenty-two sites the finds included sword-beaters and in four cases other finds connected with weaving, which together with the fact that the majority of the weights were found with female burials, makes it extremely likely that they have been used as loom-weights.

Only in a few cases have all the weights from a loom survived. In one grave there were 48 loom-weights (B 7731 V) and more than twenty were found in five other graves. It is more usual that only a few are found in an individual grave and they are probably to be regarded as a symbolic representation of a loom (*ibid*, 259-60).

The weights of fired clay, including 24 items, are usually circular with convex surfaces and are most often symmetrical with the two sides of equal convexity (*ibid*, 298). In diameter they measure between 5 and 12cm, most of them being around 8-10cm. The thickness varies from 2.2 to 4.1cm (*ibid* 300). Their weights have not been recorded.

Several suggestions have been made concerning the function of these weights, including drilling-stones and parts of smelting-ovens, as well as loom-weights. Being found in such contexts as female graves or settlement-sites with other textile equipment, it would suggest that they functioned as loom-weights, perhaps, as Petersen emphasises, «of a lighter variety» (*ibid*, 299).

In the other Nordic countries loom-weights from the medieval period are usually made of fired clay. The commonest form is circular with a central hole but weights in the shape of a pyramid also occur (cf Stjernquist 1951, 102-3; Blomquist 1961, 174-76; Andersen *et al* 1971, 250-52). They do not therefore allow a direct comparison with the Norwegian finds and there is little point in going into detail concerning the various sites where they have been found. Information about the weights from complete looms is, however, of interest in the present context, especially weight and number.

On the Thule site in Lund, Sweden, 23 circular clay weights were found and these were interpreted as the remains of a complete loom. They measured 12-13cm in diameter and were 4-5cm thick (Blomquist 1961, 174-76). A similar group of about the same size was found in medieval layers at Vä, Sweden (Stjernquist 1951, 102-3). Unfortunately their weight is not given.

Of nearly a hundred weights excavated on the Søndervold site in Århus, Denmark, 17 are from a group of finds associated with a building and they have been interpreted as the remains of a loom. The weights which are circular and made of clay are fairly homogeneous, both in shape and size. Nine are complete and weigh between 560 and 810g. While there is essentially no variation in shape, the variation in their actual dimensions is relatively great, the diameter ranging from 7.5 to 13cm and the thickness from 2.5 to 7cm. However, there is no clear relationship between diameter and thickness. The weight varies from 130 to 810g (Andersen *et al* 1971, 250-52).

During the excavations at Hedeby, more than 4000 whole or fragmentary warp-weights made from fired or unfired clay were recovered. Most of them were round, like those from Denmark and Sweden, but there were also oblong (prolate) and oval or pear-shaped examples present. In size they were also similar to the Danish and Swedish examples, with an average diameter of 10.2cm. The mean weight for the complete examples was 452g. One-third of the weights were marked with a stamp or impression and these were generally lighter, with a mean weight of 420g. Some had marks from the cord to which the warp-threads were attached and these were even lighter, usually weighing between 350 and 400g. In this group of finds it was possible to separate 16 closed groups, which have been interpreted as the remains of upright looms *in situ*. The largest group comprised 28 complete weights and 1 fragment, while the other groups varied between 5 and 10 weights (F Metzger-Krahe, unpubl ms 1979).

On the deserted sites in Dalem and Midum-Northum in the salt marsh areas of Lower Saxony near Cuxhaven, the German archaeologist W Haio Zimmermann has examined several Grubenhäuser, ie pit-dwellings with earth walls (Zimmermann 1981, 109-134). They have been dated to the period from the 7th to the 14th centuries. Regular alignments of loom-weights indicated the position of three upright looms which Zimmermann suggested had been used for weaving linen. There were variations in the weights for the three looms. At Dalem 10 they weighed between 250 and 420g, at Dalem 9 they were heavier, weighing between 400 and 820g and they were heaviest at Midum with 800-1160g. As comparative material Zimmermann has used similar finds from the Early Migration period site at Feddersen Wierde. Compared with the Bryggen finds these groups are more evenly spread in weight, the distribution pattern from Dalem 9 and Feddersen Wierde being most comparable with the Bryggen groups.

On upright looms from more recent times, the warp is held very taut and the loom-weights can weigh as much as 3000g or more (Hoffmann 1964, 21). This may be because the warp threads were to be completely covered by the weft. In the Faeroes weights of 3-4kg have been used on looms for weaving fine linen, showing that heavy loom-weights do not necessarily imply coarse fabric made from thick yarn.

In recent times in Norway there were rules about the weight of loom-weights. Hoffmann's study of living traditions concerning the upright loom has shown that on the island of Stord, south of Bergen, the weights could vary from 750g to 4500g. The weights were weighed and it was important that the front warp-threads balanced the back threads. It was often necessary to have two stones on a group of warp-threads to counterbalance a single heavy stone (Hoffmann 1964, 42).

1.2.4 Fishing-weights

In his work on Viking tools and equipment, Jan Petersen has also dealt with fishing equipment. He describes six types of fishing-weights from the Later Post-Roman Iron Age: 1) weights with medial, lateral and transverse grooves, 2) grooved weights without transverse grooves, 3) weights with medial and lateral grooves, 4) elongated weights with two holes for threading longitudinally, 5) long asymmetrical weights with two holes, 6) boat-shaped weights. In addition come lead weights (Petersen 1952, 263-64). The weights are often found in graves and where the sex can be identified it is usually a male burial (*ibid* 275).

Weights of these types have also been found at Bryggen, but have been omitted from the present study as their field of use is more or less clearly determined. These are fishing-weights shaped in particular ways so that they could move as required in water. For fishing-weights that did not have to move, the shape was probably of less importance. One type which Petersen does not deal with is the circular weight with a central hole, corresponding to our type A. Weights like these have been used as fishing-weights in recent times (Nordgaard 1908, 81). They could be relatively small – Olaf Nordgaard describes examples of 185g. He does not, however, mention weights corresponding to our types B, C and D.

From this it can be concluded that the light type A weights may have been used as fishing-weights. In addition to their shape, they have several other features which distinguish them from the other types: they are lighter, generally have a larger hole, are more coarsely made, are seldom decorated and are rarely found in groups containing the other types and interpreted as loom-weights *in situ*. The type nevertheless has been found at Bryggen in find-contexts indicating weaving and it is therefore probable that type A has been used both as a loom-weight and a fishing-weight. It is most likely the lightest weights that have been used for the latter purpose.

The comparison with other finds of loom-weights and net and line sinkers confirms that the other types have most likely been used as loom-weights, but their use as fishing-weights cannot be ruled out entirely.

1.2.5 Conclusions

A comparison shows remarkable similarity between other Migration period and Medieval finds of loom-weights in Norway and those from Bryggen in form, size and weight (cf tables III.2.1, 2.2 and 6.1). The forms of decoration are also similar.

The finds of groups of loom-weights from looms correspond well in weight: between 575 and 960g at Høybøen and 560 and 810g at Søndervold. The probable loom-weights from looms *in situ* at Bryggen have a somewhat wider distribution in weight (table III.8.1) but have the same average weight as the other finds.

The comparative material shows that the loom-weights on a single loom did not need to be of equal weight. It is reasonable to assume that the number of threads per weight would be varied and two or even more weights would be used to counterbalance a heavier weight. The distribution of weights in the larger groups at Bryggen indicates that this has been the case. On the basis of weight alone it is therefore difficult to determine whether a stone has been used as a loom-weight or a fishing-weight. From this it can be deduced that all the weights from Bryggen dealt with here may have been loom-weights. But this does not preclude their use as net-weights or line-sinkers.

1.3 Equipment for beating up the weft in an upright loom

1.3.1 Sword-beaters

For all types of weaving some kind of instrument is needed to beat up the weft. The weaving-sword or sword-beater (Norw *vevskje)* and the pin-beater were among the equipment belonging to the upright loom, but were also used in other simple types of looms, both vertical and horizontal. The sword-beater which could be up to 1m long was made of iron, bone or wood and usually had a long handle which could be grasped with both hands.

Iron sword-beaters from the Roman and Migration periods could vary in length from 25 to 50cm and usually had a tang for a wooden handle which was 10-12cm long. Sword-beaters from the Viking period, made in iron or bone, were longer. Iron ones are usually 60-80cm long, the majority between 70 and 80cm. The handle socket varies from 8.5 to 16cm in length. Bone sword-beaters are from at least 80cm and up to 107cm long, with a 20-28 cm long handle (Petersen 1951, 287-95).

There is presumably no direct connection between the length of the weaving-sword and the width of the fabric on the loom. Wide fabric does not necessarily require a long beater, as the beater can be inserted anywhere and the weft can be beaten up in sections across the fell of the cloth (Hoffmann 1964, 281). It is therefore difficult to establish whether the various types and lengths are determined by different functions or whether it is due to different traditions or fashions.

In order to identify an object or part of an object from the excavations as a sword-beater the following criteria have been used:

1) size and similarity of form with pre-medieval and post-medieval beaters
2) whether the handle could be used in a double grip.

1.3.2 Sword-beaters from Bryggen

Among the Bryggen finds there are twelve objects in all which from the criteria chosen could have been used as sword-beaters for an upright loom. Only three of these are complete. One is probably unfinished or else a very coarsely made example. They have been made from whale bone (6) and wood (6), including pine (4), juniper (1) and an unspecified softwood (1).

The section where the blade goes over to the handle can have various forms and provides the basis for classifying the objects into two types: A, a smooth transition in the form of an S-shaped curve; B (1 example), the base of the handle splays out to the shoulders of the blade.

The form may be symmetrical, A1 (5 examples) or asymmetrical A2 (2 examples). Four examples are unclassifiable.

The undamaged sword-beaters made of wood vary from 51 to 66cm. The length of the blade has been measured from the tip to the shoulder where it begins to swing inwards. The

TYPE	A1	A2	B	UNIDENT	TOTAL
TOTAL	5	2	1	4	12

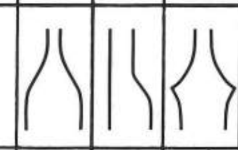


Fig III.5 Beaters from Bryggen: classification based on transition from blade to handle

part of the blade where it begins to narrow is therefore included with the handle or shaft. The width of the blade has been measured at this point of transition (cf fig III.6).

The lengths of the blades are from 20 to 50cm, but when the degree of damage is taken into account, it can be concluded that the commonest length has been between 30 and 50cm. The shaft is between 17 and 36cm in length, in most cases between 17 and 23cm.

The width of the blade can be measured on nine of them and varies from 2.8 to 6.4cm, five of them being between 5 and 6cm. Three are narrower than 5cm.

All the recordable shafts are elliptical in cross-section, with the exception of the possibly unfinished example which is almost triangular in section with one side flat.

In addition all the blades with one exception are double-sided. On only seven of them has the tip of the blade survived, being either a rounded oval, a rounded point or square end. In one case it is difficult to decide whether the end of the blade is square or whether it has been broken.

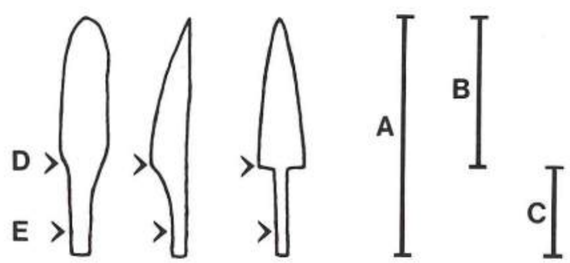


Fig III.6 Sword-beaters from Bryggen: points at which dimensions have been taken

Two fragments in whale bone are decorated (fig III.7.2). Of the twelve sword-beaters six are made of bone and thus analogous with the beaters from the Viking period. Among the European finds there is at least one made of wood (Wild 1970, 66), so that the Bryggen finds are not unique.

That the objects have been used as beaters is not entirely certain. As we have seen, three of them are markedly narrower than the rest and the question arises whether they have been strong enough to be sword-beaters. The one with a square end differs from the rest in its shape and the possibility that this is due to a different function cannot be excluded. The way some are damaged also adds to the uncertainity when identifying these objects. Other functions such as a spatula for use when cooking on a griddle, or even part of a ladle are possible. With these reservations I would regard seven of the whole or fragmentary sword-beaters as reasonably certain and the rest as less definite. Those regarded as certain include the six bone ones and one wooden one (66cm long).

The possible beaters from Bryggen have been dated from the periods 3-6, ie 1170-1413

Two were found in connection with buildings associated with other textile implements (see p 128). The context thus supports the interpretations as sword-beaters. The finds-location of the remainder gives no clues about function.

1.4 Pin-beaters

The pin-beater (Norw *ræl*, Old Norse *hræll*) is known in Iceland and on the Faeroes as an

TABLE III.10 BEATERS FROM BRYGGEN: DATING

Period	Certain	Uncertain	Total
7			
6	1		1
5	2	1	3
4	1	3	4
3	1	1	2
2			
Undated	2		2
Total	7	5	12

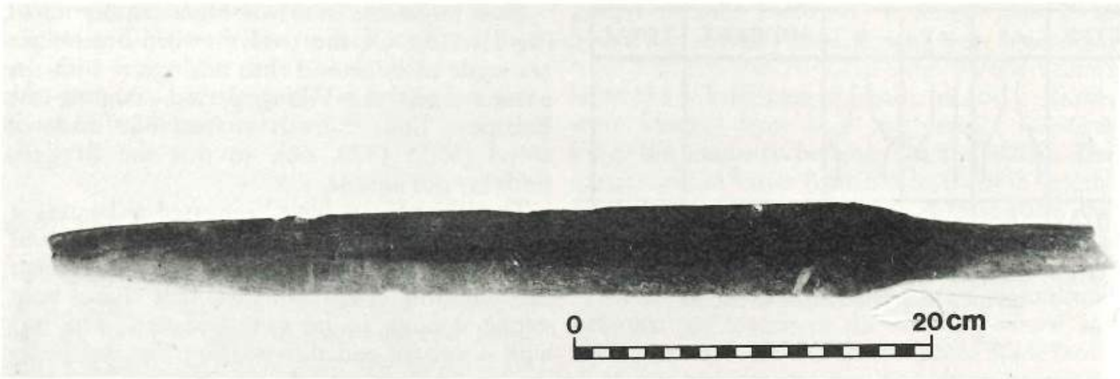


Fig III.7.1 Sword-beaters in bone from Bryggen (no.79244)

instrument for pushing up the weft. No definite evidence for its use in Norway has yet been found (Hoffmann 1964, 126-27). In England pin-beaters are known from Roman times (Wild 1970, 66), made from the tibia or metatarsal of the sheep or goat. The shaft of the bone is cut diagonally to produce a point and this is threaded between the warp in order to pack down the loose weft. Cigar-shaped pin-beaters, c 10cm long and pointed at both ends, are known from Roman and Saxon contexts. The Icelandic pin-beaters were of a similar type, but somewhat longer, c 20cm long. They had a wide range of uses, being used to arrange the warp threads, to push the weft up or down, clear the shed, etc (Hoffmann 1964, 126).

Definite evidence for pin-beaters has not been found among the Bryggen finds. A number of needles with a wide triangular head and a somewhat curved shaft (see p 87 and fig IV, 3.1) may possibly have had some such function, but this cannot be definitely confirmed.

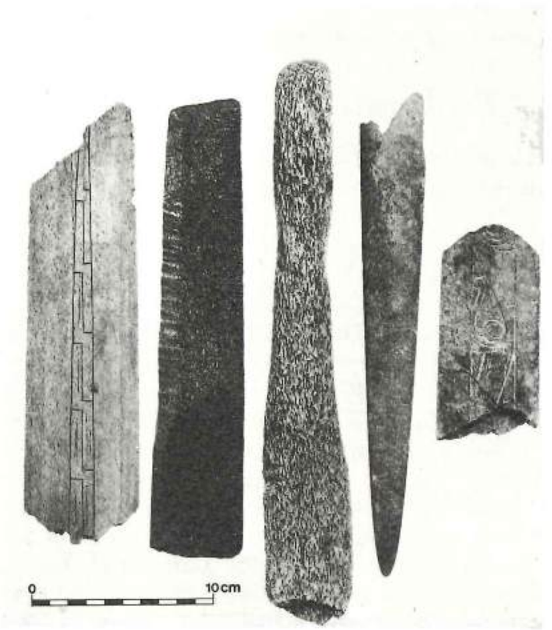


Fig III.7.2 Fragments of sword-beaters from Bryggen (nos 21905, 40557, 7097, 2542, 87598)

1.5 Summary

It is relatively difficult to identify the remains of an upright loom where the parts occur as fragments or as loose finds. With the help of concentrated groups of loom-weights, objects found in association with other pieces of textile production equipment and analogous finds from other places, we can nevertheless suggest that the majority of these 805 finds have been used as items of weaving equipment in Bergen, mainly during the period 1170-1413.

2 The horizontal loom

There are no surviving remains of a medieval horizontal loom from Norway, but illustrations in various European manuscripts from the thirteenth century onwards give a good impression of this type of loom, especially when compared with later models. However, it is important to remember that the illustrations

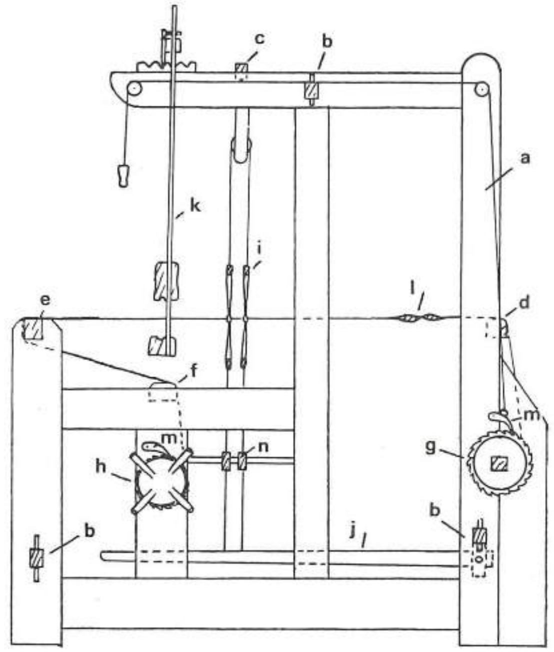


Fig III.8 Side-view of horizontal loom, shown diagrammatically (from Geijer 1972)

may be highly stylised, so that comparisons must be made with care. The main features correspond to the modern domestic loom. The warp was stretched horizontally between a revolving warp beam, on which a long warp had been wound, and a revolving cloth beam, on which the cloth was rolled as it was woven. There was no natural shed; all sheds were controlled by heddles, suspended between two bars.

The basic construction of the horizontal treadle looms is shown diagrammatically in fig III.8 (after Geijer 1972). Two pairs of vertical side-beams are held in place by cross-beams and support two bars which can be rotated, the warp-beam (g) and the cloth-beam (h). In addition there are two fixed beams, the stretcher or back-beam (e) and the breast-beam over which the cloth passes before being wound up on the cloth-beam. From an upper beam (c) hang heddle-horses or pulleys to which are connected the heddle-bars each holding a number of heddles which make up a «shaft». The heddles consist of three loops, and the warp-threads pass through the small central eye. Treadles (j) beneath the loom are attached to the base of the loom frame at the front near the weaver's seat or at the back. Or they might not be attached to the loom at all, except through the cord connecting them via the pulleys or heddle-horses with the heddle-bars. Groups of warp-threads can therefore be raised and lowered by operating the treadles. The weft is beaten with a beater or batten (k) attached to the loom. There is also a built-in temple to keep the warp-threads evenly spaced (Geijer 1972, 45-6 and Hoffmann 1978 b, 20).

Scholars are generally agreed that there was a marked change in the production of textiles from the mid-11th century onwards when the horizontal loom with treadles was introduced to North-West Europe (Hoffmann 1964, 258-65). It made it technically possible to weave long lengths of fabric in contrast to the shorter, fixed lengths on the upright loom. The horizontal loom also provided the basis for a professionalisation of the weaving industry. As already mentioned, men began to take over what had traditionally been a women's domestic handicraft.

Together with the horizontal loom other equipment was introduced. The spinning-wheel is mentioned in literary sources from about 1300 onwards. Wool cards, the warping frame, the warping board, the warping mill and spool-rack are all illustrated in medieval manuscripts and must be regarded as part of the reorganisation of the textile industry (Hoffmann 1964, 259). Various parts of the horizontal loom have been found in medieval urban excavations in other countries including Sweden, Germany, Poland, Romania and Russia. The finds from Sigtuna include a bone pulley-block, probably 12th century (Geijer & Anderbjörk 1939, 232-241). The excavations in Hedeby have moreover revealed a pulley-block from the early 11th century (Nyberg 1984, 145-150). From Gdansk there is an 11th century pulley-wheel as well as large parts of a 12th century loom including a beam, side-supports and parts of the structure *in situ* in the ground or earthen floor (Kaminska & Nahlik 1956, 94-6; 1958, 240; 93-6). A pulley-block, four shuttles and the remains of the posts from the loom itself were found at Oppeln in Poland (Endrei 1961, 127/128). Finds of pulleys, brackets and shuttles suggest that the loom had treadles and that the warp was stretched horizontally. The excavations in Novgorod have produced heddle-horses, heddle-rods, treadles, shuttles, pulley-blocks and warping paddles in layers from the 13th to 15th centuries (Kolĉin 1968, 70). Excavations in Romania have in fact revealed traces of horizontal looms from the tenth to the twelfth centuries (Endrei 1961, 127-28).

2.1 Possible remains of horizontal looms from Bryggen

As mentioned in the Introduction, there was a separate group of weavers among the groups of craftsmen in Bergen in the 1270s. As they probably used the horizontal loom, there may be evidence for this type of loom among the Bryggen finds.

2.1.1 Pulley-blocks

The pulleys are an integral part of looms with a horizontal warp, heddle-bars and treadles (fig III.9). The pulleys are fixed to or suspended from the top-beam and carry the cords connecting the treadles with the heddle-rods (Geijer and Anderbjörk 1939, 236). When the treadle is depressed, the heddle-rod is lifted and a shed is formed.

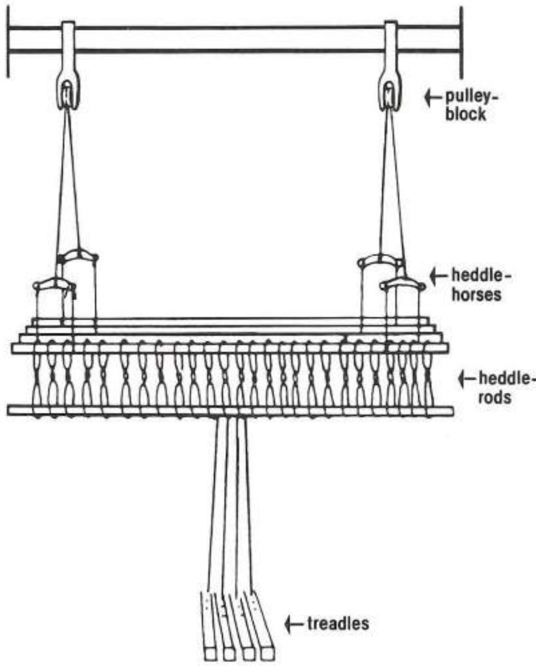


Fig III.9 Loom with a horizontal warp, heddle-bars and treadles

Fig III.10 Possible pulley-block (21972) and part of a possible casing for a pulley (27408) from Bryggen

The Bryggen finds include an almost complete little pulley-block (Norw *trinseblokk*) which may have belonged to a loom (fig III.10). The pulley-wheel is relatively small, 3.2cm in diameter and 1.8cm thick, and revolves on a wooden axle. It is made of pine and has a groove, perhaps for the heddle cord to run in. The casing which is complete is 15.5cm long. This is about the same size as the pulley from Sigtuna which was c 10cm long (Geijer & Anderbjörk 1939, 236). The Bryggen finds also include a small wheel in birch-wood which is very similar and may have had the same function. It is 3.4-4cm in diameter and 1.1cm thick.

In size these finds correspond quite well with the pulley from Hedeby, the wheel of which is 3.7cm in diameter, the fork-shaped block 5.7cm and the whole object 23.3cm in length (Nyberg 1984, 145). The Bryggen pulley must have been nailed to a cross-beam and not suspended like the pulley-blocks from Sigtuna and Hedeby.

The block was found in layers belonging to period 5, 1248-1332, and the second wheel comes from period 3, 1170-1198. If the block had been more complete and the other pulley of the pair had also been found, it would have been possible to be more certain about the interpretation. If correct, it means that the horizontal loom was used in Bergen in the last decades of the 12th century.

Among the Bryggen finds is an object which resembles the pulley-block from Hedeby (fig III.10) in both shape and size.

However, as the object is damaged, its identification is difficult and uncertain. One arm is broken and there is a piece missing from one side of the possible pulley casing. Due to the present stage of conservation it is difficult to distinguish between the broken and the original surfaces. There is no axle pin, nor the remains of a pulley-wheel, but the remains of a pair of semicircular notches directly opposite each other can be interpreted as the fixing points for the axle. The object is 16.8cm long, the fork-shaped arm is 6.4cm, and the possible suspension-hole is 1.4cm in diameter. It is made from an unidentified hardwood and was found in layers dated to Period 6, 1332-1413.

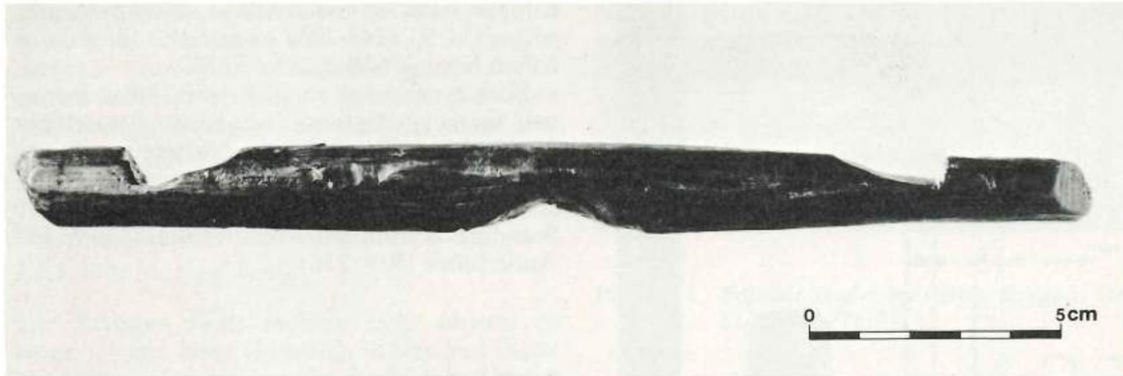


Fig III.11 Possible heddle-horse from Bryggen (no.8595)

2.1.2 Heddle-horses

The heddle-horse (Norw *bikkestikke*) had the same function as a pulley. It was a short rod suspended in the middle and had cords fastened to either end. One cord was connected to the treadle and the other to the end of the heddle-bar. There was another heddle-horse at the other end of the heddle-bar. When the treadle was depressed, the pair of heddle-horses pivoted and the bar was lifted. The system was often combined with shaft-wheels (Nyberg 1984, 147).

No definite remains of a heddle-horse has been found at Bryggen, but one object may from its shape have had this function. It is a juniper rod 22.5 cm long and round in section, with a semi-elliptical cut in the middle and two similar cuts on the other side at 2.5 and 3 cm respectively from either end (fig III.11).

The central cut could have been for the cord going up to the upper beam while the notches at either end could have held the cords to the treadle and the heddle-bar. Heddle-horses, shuttles and pulleys were generally made of harder wood than the loom itself (Nyberg 1976, 52), which strengthens the hypothesis that the juniper rod from Bryggen may have been a heddle-horse. The object was found in layers belonging to period 5, 1248-1332.

2.1.3 Winding pins

Winding pins were used to protect the fingers when handling rapidly running yarn, as in various winding or warping operations. Warping was a necessary process when weaving on

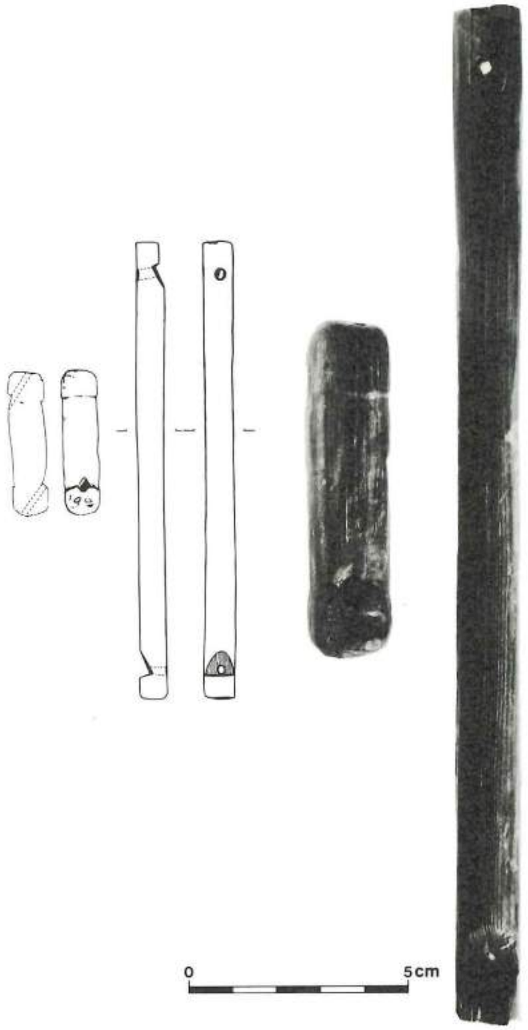


Fig III.12 Winding pins from Bryggen

the horizontal loom. The pins usually have a deep notch at the edge of the hole on the side of the pin. Two winding pins have been found at Bryggen (fig III.12). One is made of juniper (no. 54261) and is 23cm long and 1.4cm thick. A good centimetre from one end a cut has been made to the centre of the piece and there is a similar cut at the opposite end on the other side. Holes have been made in the flat ends through which the thread was passed. The other one (no. 11748) is made of hardwood, probably either bird-cherry or rowan. It is much shorter and somewhat thicker, 7.5cm long and 1.8cm thick. Instead of a slot it has a hole, but otherwise the principle for threading it is the same. It was found in layers belonging to period 5, 1248-1332, while the longer one comes from period 2, before 1170.

Both types have parallels from other medieval sites, eg Sigtuna (Geijer & Anderbjörk 1939, 236) and at Novgorod where they come from layers from the 13th-15th centuries (Kolĉcin 1968, 70). Similar objects are also known in Scandinavia from more recent times (Geijer and Anderbjörk 1939, 236).

2.1.4 *Paddles*

Another type of warping device which was used when warping several threads simultaneously is the paddle (Norw *rennestikke*). It consists of a handled board with a series of holes for the warp-threads, which can thus be kept under control during warping (NTT 96).

From Bryggen there are nine objects which could have been used for this purpose (fig III.13). They are made in one piece and consist of a shaft or handle and a flat part with several holes. Two are unidentified; the others are made from pine (4), juniper (2) and another unspecified softwood (1) and vary from 7 to 12.5mm thick. None of them is particularly well-made, but they have all been smoothed off and have a smooth, even surface. One of them (no. 8977) is decorated with a faintly incised pattern of leaves.

Only three of the objects are complete, the remainder being more or less fragmentary, but it can be seen that they vary a good deal in size and shape. Total length varies from 16.8 to 32cm, the length of the flat part from 8.6 to 24cm and the width from 2.25 to 9.1cm. The number of holes ranges from 3 to 9.

Similar finds have been made at Gamlebyen in Oslo, and apparently also in Greenland (pers comm from research ass B Weber, Medieval Dept, Oslo University Museum). The function of these objects is, however, not quite certain. From ethnological sources we know of almost similar handled boards from Greenland and Sweden made of bone or wood and with series of holes. Lines, sinews and guts were pulled through the holes to make them smooth and even (Keyland 1920, 148). The ethnological collections also contain a rich variety of this type of object used as warping paddles and they are also known from medieval illustrations.

The possible paddles from Bryggen were found in back-fill in the wharf-foundations.

Those which have been dated are from period 3 to 6, ie 1170 to 1413 (see table III. 11). The damaged ones must be regarded simply as discarded rubbish, while the whole ones may have been lost or mislaid. The finds-location does not throw any clearer light on the question of function.

2.1.5 *Possible reed-hooks*

The Bryggen finds include eight objects of wood (7) and bone (1) which in size and shape are almost identical to the reed-hook (Norw *skjekrok*) which was used to help pull the warp-threads between the teeth of the reed (fig III.14). Six are complete while the other three are slightly damaged. The length of the undamaged ones varies from 8.7 to 13.2cm and the damaged ones have also originally been within this range. They are 0.4 to 2.2cm thick in the middle and the thickness at the point varies from 0.35 to 0.8cm.

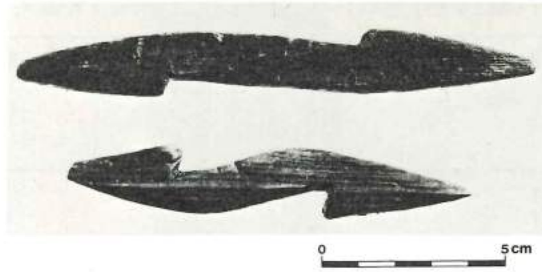


Fig III.14 Possible reed-hooks from Bryggen (nos 53765 and 77810)

There is a runic inscription on four of the objects and these have consequently been interpreted as labels to be attached to goods indicating ownership or perhaps buyer or seller (cf Herteig 1969 pl 44). Two of them show that they have belonged to men, «Runulfr» (no.31771) and «Eirikr» (no.18095). The other two inscriptions do not preclude that they have been used in weaving, in which case they would preferably have been used by men as we have mentioned previously. However, if they have been reed-hooks they are particularly coarse and thick examples and it is therefore most likely that they have been used as labels indicating ownership.

The eight objects are dated to periods 2 to 5, ie before 1170 to 1332. The finds-location does not throw any further light on the question of function.

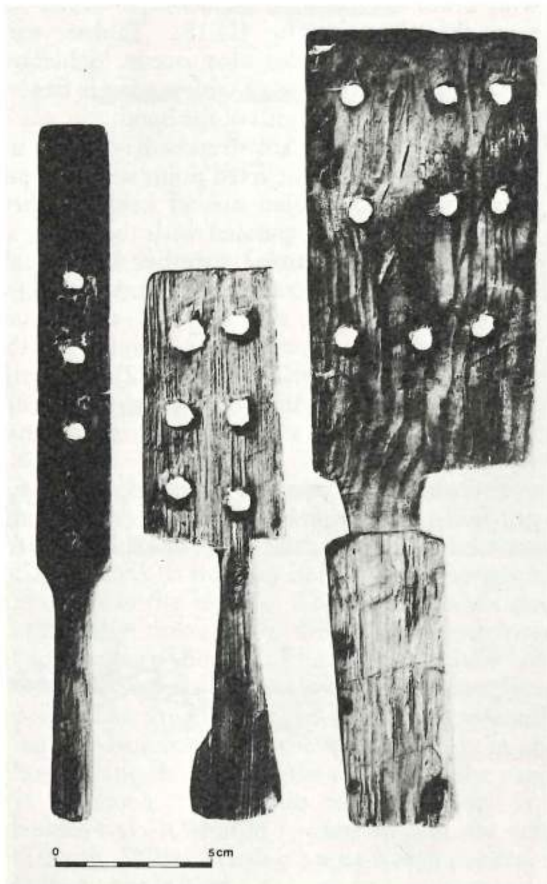


Fig III.13 Possible warping paddles from Bryggen (nos 32419, 32530, 28790)

2.1.6 *Summary*

All of the items discussed here which may have been connected with weaving on the horizontal loom, such as the heddle-horse, pulley-block, winding pins, paddles and reed-hooks are very insecurely identified. It cannot, therefore, be definitely proved that there are remains of horizontal looms at Bryggen, but the possibility, on the other hand, cannot be entirely excluded.

The possible remains of items connected with the horizontal loom cover the period 2 (before 1170) to period 6 (1332-1413) and would therefore be approximately contemporary with the earliest accounts of the horizontal loom in other North European towns.

TABLE III.11 DATING OF ITEMS POSSIBLY ASSOCIATED WITH THE HORIZONTAL LOOM

Period	Pulley-block and wheel	Heddle horse	Winding pins	Paddles	Reed-hooks	Total
8						
7						
6	1			1		2
5	1	1	1	4	2	9
4				2	1	3
3	1			2	4	7
2			1		1	2
undated						
Total	3	1	2	9	8	23

3 Equipment for weaving bands and cords

Besides the big looms for weaving fabrics, there also were simple band-weaving devices. At that time bands played an important role as fasteners, decorative and simple edgings, belts, hairbands, etc. Evidence for two of the band-weaving techniques has been found among the archaeological finds at Bryggen, tablet weaving and the use of the rigid heddle or heddle-frame.

3.1 Tablet weaving

Tablet weaving is known long before the Medieval period. Judging from all the finds that have been made, the weaving of bands with tablets seems to have been the usual method throughout Scandinavia in prehistoric times (Laquist 1947, 123). In tablet weaving there is both a warp and a weft plus tablets (Norw *brikker*) for changing the shed. The tablets are flat, usually square plates of wood, bone etc, with a hole in each corner through which the warp-threads pass (fig III.15). Tablets with two, five or six holes also occur (Schlabow 1957, 23). The number of tablets used is dependent on the desired width of the band.

The warp-threads are stretched between the weaver's belt and some fixed point such as a peg in the wall. The tablets are all held together, like a pack of cards, parallel with the warp, so that they can be turned together in a single movement, thus altering the relative positions of the warp-thread and forming a series of sheds. The weft is completely covered by the warp threads (Hoffmann 1978 b, 22). A shuttle is usually used and the weft is also beaten up with this or with a knife-beater or a small sword-beater.

There are only two tablets among the Bryggen finds, one in pine with no accession number and one in leather (no. 4848). They are square with a hole in each corner (fig III.15). One is from period 4, 1198-1248, the other is undated.

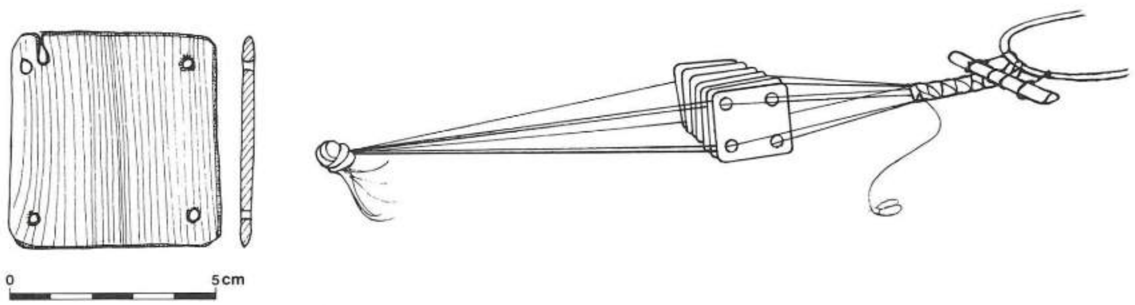


Fig III.15 Tablet weaving and weaving tablet from Bryggen

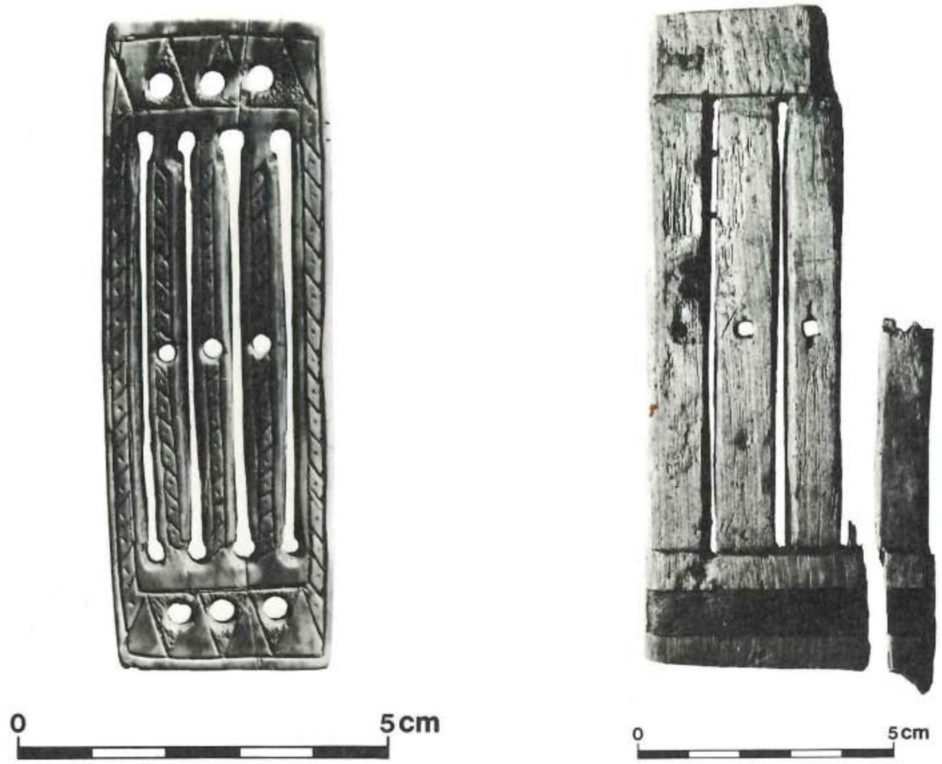


Fig III.16 - 17 Rigid heddles or heddle-frames from Bryggen made from pine (right: 87650) and elk-antler (left: 19126)

3.2 Rigid heddles

A rigid heddle or heddle-frame (Norw *båndgrind, båndspjeld*) consists of a frame holding a number of narrow slats. There is a hole in the middle of each slat and the frame is constructed so that the holes form a horizontal line across the middle. The warp-threads pass alternately through the holes and the narrow gaps between the slats. The warp is usually held taut between the weaver's belt and some fixed point. The shed is changed by raising or lowering the heddle-frame, the warp-threads in the holes being drawn past the threads in the gaps. It functions therefore in the same way as a heddle-rod. A shuttle is used to pull the weft through. When weaving bands with a pattern, a knife-beater is used.

The origin and distribution of the rigid heddle is uncertain. Three very small examples are known from Classical times, all Roman: from Italy, Hungary and Roman Britain. The first known picture of the implement in Europe is from the 14th century (Hoffmann 1978 b, 22-23), although according to M Hald the implement is known from German sources from the 13th and 14th centuries (Hald 1942, 17).

There are two heddle-frames among the Bryggen finds, one of antler fig III.16 and one in wood (fig III.17). These are perhaps the most interesting finds of textile equipment among the Bryggen material, being the oldest of this kind hitherto found in Scandinavia and Northern Europe. The antler heddle-frame is 8.6cm high and 3cm wide. Slots have been cut so that there are three central slats and two end-pieces. The holes in the three slats are 2-3mm in diameter. There are also three holes at the top and bottom of the heddle-frame parallel with the central holes, showing that this narrow heddle-frame may have been used in pattern weaving. The weaver could use seven threads close to each other, of which four could be lifted or lowered in one operation when making the shed. By threading six threads through the holes in the

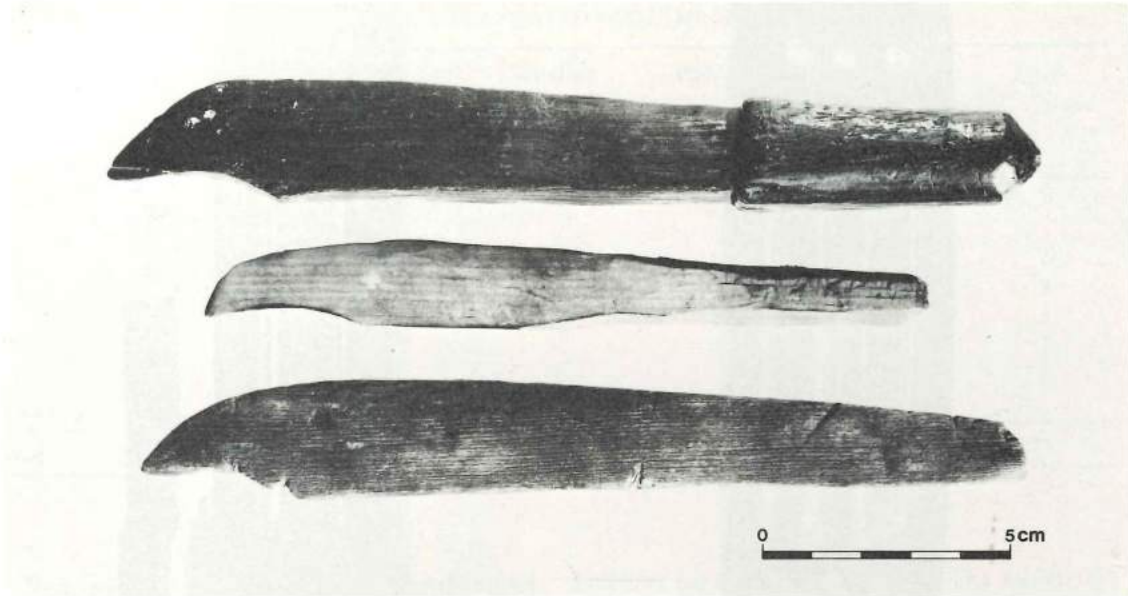


Fig III.18 Knife-beaters from Bryggen (nos 19942, 21256, 63488)

upper and lower edges of the heddle-frame, it is possible to weave in more varied patterns (cfr figure, front cover).

The heddle-frame is made of elk-antler and is finely polished and decorated with a geometric design. It is from period 5, 1248-1332. Rigid heddles with a similar arrangement of holes are known from the Lappish area from later times (Nyberg 1976, 82).

The rigid heddle made of wood is no longer complete. One end-piece has survived with three and a half slats. It has been made from a single piece of pine and is 13cm high, suggesting that it has originally been relatively large and certainly wide. The slats are 9cm high with 2-4mm gaps between them and the holes are 3-4mm in diameter. It is from period 3, 1170-1198.

3.3 The frame band loom

The band loom with a frame also goes back to the Middle Ages. It consists usually of a small frame with two rollers, one for the warp-threads and the other for the finished band. There is no mechanism for separating the sheds. The weft is picked through manually with the help of a flat, sharpened wooden needle. One needle is needed for each colour (Geijer 1972, 52). There are no certain traces of the frame band loom at Bryggen.

A somewhat damaged needle of unidentified hardwood has approximately the same shape and size as the needles or shuttles used with modern band looms. The end is sharpened and has a U-shaped cut with a central tongue. It is 10.8cm long. It belongs to period 5, 1248-1332.

Two other needles of the same shape have also been found at Bryggen, but these are too long for shuttles and were probably intended for netting (see fig IV.7, p 101).

3.4 Equipment for shooting or beating up the weft

With the vertical types of loom and the band looms, it is strictly speaking unnecessary to use an implement to carry the weft through the warp-threads. The thread wound into a ball or dolly could be picked by hand between the warp-threads. Various tools were, however, used, such as a forked shuttle and different types of needles.

3.4.1 Knife-beaters

The knife-beater (Norw *båndkniv*) used in connection with band weaving as a rule is relatively small and single-edged. At the point of the blade it has a characteristic notch with which to catch the weft as it is fed through.

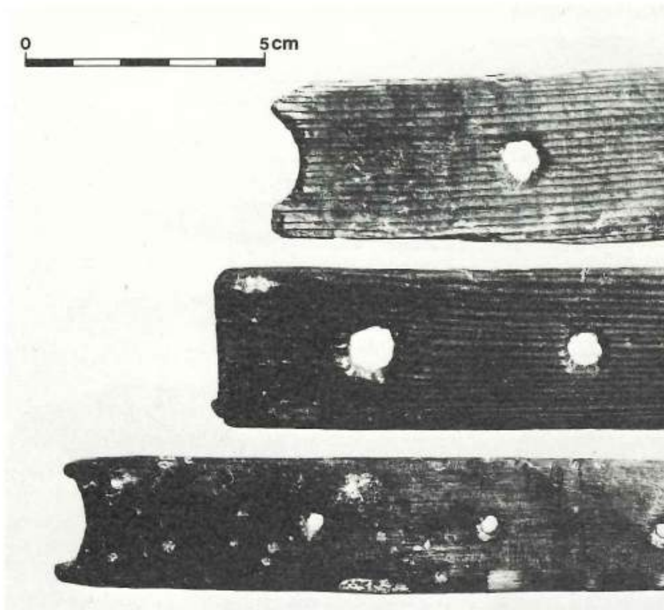


Fig III.19 Possible shuttles in wood from Bryggen (nos 30907, 40364, 19251)

Similar knife-beaters are known in Norway from later times.

Among the Bryggen finds there are five knife-beaters made of juniper with this characteristic shape (fig III.18) and it is very likely that they have been used in connection with band weaving. A sixth knife lacks the notch but is otherwise similar in shape and size. Two of the knife-beaters have had handles, while the others simply have a thickening for the grip. They are from 14.5 to 19cm long. They come from periods 3-5, ie 1170-1332 (see table III.14). One of them (no. 43163) has a runic inscription, indicating that it was owned by a man (Arni: katu: leia), which weakens the interpretation as a knife-beater. Other possible uses include a toy knife or an implement associated with tool preparation, for spreading, etc.

3.4.2 Possible shuttles from Bryggen

There are eight wooden objects which have possibly been used as a shuttle (Norw *skyttel*) for band looms. They are long flat fillets of wood with concave ends giving them a slightly forked shape (fig III. 19). Similar shuttles are known from more recent times in connection with frame looms and for weaving coarser fabrics, such as the traditional rag or shag rugs. The objects from Bryggen have three or four small holes equally spaced along the length, a feature not found on shuttles from more recent times, nor in the comparative archaeological material. The identification is therefore rather uncertain.

The possible shuttles are from 15.2 to 21.5cm long, between 2.7 and 4cm wide and 0.6 to 1cm thick. The holes are from 3 to 8mm in diameter. One of the shuttles (no.16698) has one slanting and one straight edge instead of the curved edges. Pine has been used for two of them, five are made from juniper and one from oak.

Two of them were found in buildings, nos 35 and 135, both of which are interpreted as being associated with textile production (see pp 121, 127). This strengthens their interpretation as shuttles. They have been dated to period 3 to period 6, ie from 1170 to 1413.

3.4.3 Small sword-beaters or knife-beaters from Bryggen

The knife-beaters with the curved blade-tip and the forked shuttles with a straight sharp edge could also be used to beat up the weft. Small sword-beaters and simple knife-beaters in wood, bone or antler could also be used.

Among the Bryggen material are twenty objects which may have been used as small sword-beaters or simple knife-beaters (Norw

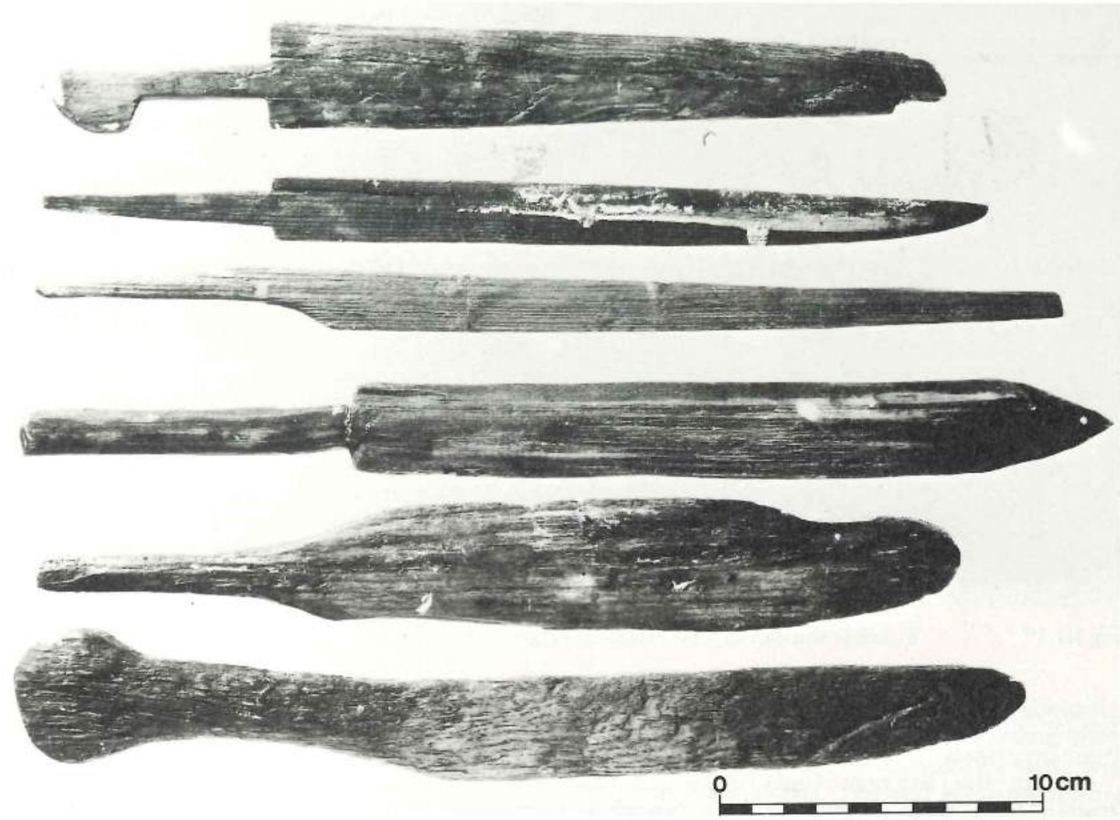


Fig III.20 Possible simple knife-beaters from Bryggen (nos 21731, 54205, 77896, 10779, 10574, 43194)

vevskje, båndkniver). They have been grouped together as small beaters since they resemble identified beaters in the ethnological material and in their shape and proportions they resemble the larger weaving-swords with their pointed or rounded tip and at least one sharp edge. Their identification has also been based on the size of a definite knife-beater made in bone with a blade-width of 4.2cm. The maximum width of the blade has therefore been arbitrarily fixed at 4.5cm.

Only nine of the possible simple knife-beaters are complete or nearly so. Two have been made from whale bone, nine from pine, seven from juniper, one from oak and one is unidentified.

As on the large weaving swords, the shoulders have been cut in various ways and this has provided the basis for dividing them into three groups:

a) evenly rounded shoulders (S-curve)
b) the base of the handle splays out to the shoulders which are angular
c) square shoulders

In each group there are two sub-types depending on whether they are symmetrical or not (table III.12).

Table III.12 shows that the single-edged beaters are most common and especially the asymmetrical sub-types.

The nine complete ones vary from 17.5 to 32.5cm in total length. Three of the damaged ones are distinctively longer and have been as much as 54cm. The majority are between 20 and 30cm long.

There is a relatively wide variation in the length of the blade, from 9.5 to 23.5cm, while the width varies from 1.9 to 4.1cm. There is no definite connection between type and size, although the three longest are all type C.

In cross section the handle is either square with rounded edges or oval and the end is either squared off (9 examples) or slightly splayed like a sword-hilt. One is broken.

The length of the handle varies from 5.2 to 14.5cm. When the widening at the end is subtracted, the actual grip for this type is reduced to 3.7-8cm, with an average of 6cm. The widened end, however, could easily be part of the grip, or support the back edge of the palm. The handles can only have been used by one hand.

The possible small beaters with the hilt-like end have been described in the archaeological

Table III.12 Possible small sword-beaters or knife-beaters: types

TYPE	A1	A2	B1	B2	C1	C2	ATYPICAL	NOT DEFINABLE	Σ
BLADE-EDGE									
SINGLE-EDGED	1	3	1	2	4	1	2	2	16
DOUBLE-EDGED					1		2		3
EDGE NOT CLEAR		1							1
Σ	1	4	1	2	5	1	4	2	20

TABLE III.13 POSSIBLE SMALL BEATERS FROM BRYGGEN: DATING

Period	A1	A2	B1	B2	C1	C2	Atypical	Unident	Total
7									
6					2		1		3
5		1	1		1		1	2	6
4		1		1	1	1			4
3	1	2		1	1		1		6
2									
1									
undated							1		1
Total	1	4	1	2	5	1	4	2	20

TABLE III.14 EQUIPMENT FOR BAND-WEAVING, DATING

Period	Weaving tablet	Heddle-frames	Shuttle for band-weaving	Knife beaters	Possible shuttles	Possible knife-beaters	Total
8							
7							
6					1	3	4
5		1	1	2	2	6	12
4	1			1	1	4	7
3		1		3	3	6	13
2							
Undated	1				1	1	3
Total	2	2	1	6	8	20	39

literature as toy swords (eg Herteig 1970, pl 58). It is possible that some of them were used for this purpose, particularly the three longest and two of the atypical ones. Their similarity with small beaters from more recent times, however, leads me to regard their use as small beaters as equally viable. One of them was found together with a possible shuttle and this may strengthen the case for interpreting it as a small sword-beater. Furthermore, four of them were found in or by buildings and one of them (no. 85115) was found together with several other items of weaving equipment by building 196 (see p 127).

The possible small beaters cover the periods 3-6, from c 1170 to 1413 (table III.13). There seems to be no difference in the various types over the course of time.

3.5 *Summary*

As with the other items of weaving equipment, the objects used for various types of band weaving can be divided into a definite group and an uncertain group. The definite objects – the rigid heddles, weaving-tablets and knife-beaters – are relatively few and cover the period 1170–1332. The less certain objects including shuttles and small beaters cover the same period but continue until 1413.

4 Conclusions

The Bryggen finds include 867 objects or parts of objects which may be the remains of various items of weaving equipment. The decidedly largest group are connected with the warp-weighted loom: one possible upright from a loom itself, 792 possible loom-weights and 12 possible sword beaters. However, it has not been entirely possible to discount other areas of use for some of this material.

Twenty-three objects have been discussed in connection with horizontal looms but these are less securely identified.

Parts of equipment connected with various forms of band weaving comprise a maximum of 39 items of various categories.

Only the loom-weights are found in every period, with an emphasis on the period 1170-1413. It is also within this period that the other weaving equipment is dated, with the majority from the period 1198-1332.

CHAPTER IV
BONE, ANTLER AND WOODEN NEEDLES AND PINS

1 Definition and limits

The needles and pins found at Bryggen are very varied with regard to raw material, form and size, and these variations naturally reflect a wide area of use: needles for many kinds of stitching and binding, needles for carrying the weft between the warp threads in weaving, needles used as bodkins for making holes, needles and pins used to pin things together. One function all needles and pins have in common is their ability to pierce, and one common characteristic therefore is a relatively slim shaft ending in a point. A needle can be divided into three parts: point, shaft and head. The shape and size of the head is adapted to the area of use. Needles for sewing and for binding must have a relatively narrow head with an eye, and the point where the shaft goes over to the head must be smoothly contoured so that the needle can pass through textile. The width of the head must be adapted to the fineness and gauge of the fabric. Needles and pins with some kind of a stop, such as a wide head, can be used for pinning. A shaft with variations in thickness is also an effective object for pinning. This kind of needle or pin does not need to have an eye, nor does a needle which is to be used as a pin-beater or a shuttle.

To identify which needles and pins have been used in textile working is a difficult task. Other fields of use are also feasible for some of the types: as a stylus, as a brooch, for fastening up the hair, for keeping a head scarf in place, as part of a locking device, etc.

In the following presentation of finds, all the needles from Bryggen have been included regardless of function. The analysis of the finds will provide the basis for a more detailed discussion about the function of the various types. Because of the difficulty in differentiation, the term needle is used throughout to cover both pins and needles.

2 The needles from Bryggen

Among the Bryggen finds there are in all 342 non-metallic needles, 127 made from bone or antler and 215 made in wood. The metal needles form a distinctively separate group. They are small and easily identifiable as sewing-needles and straight pins with heads. They will therefore be discussed in a separate chapter dealing with other sewing equipment.

2.1 *Typology*

The form and size of the head and the way the head and shaft merge are very important functional features. The form of the head and of the transition head/shaft have therefore been chosen as the basis for division into types. It is also clear that the size – length, width and thickness of head, and thickness of shaft – is also adapted to the function. In recording the needles the following measurements have been taken (cf fig IV.1): length (A-A), greatest width of head (B-B), greatest thickness of head (B), thickness of shaft at the mid-point (C-C). The distance of the eye from the end gives some indication of the size of the head in relation to

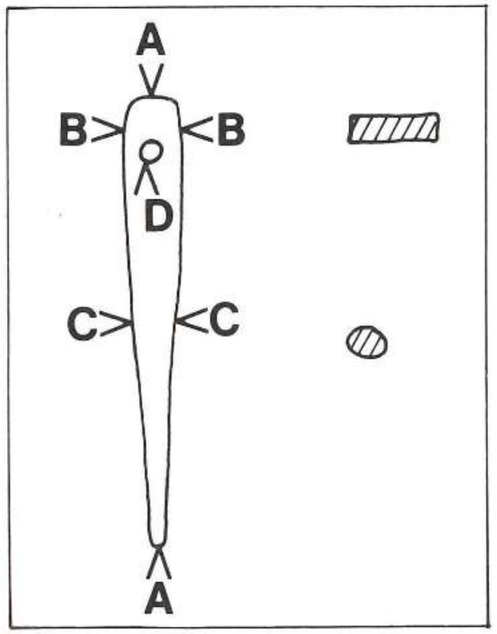


Fig IV.1 System for measuring needles

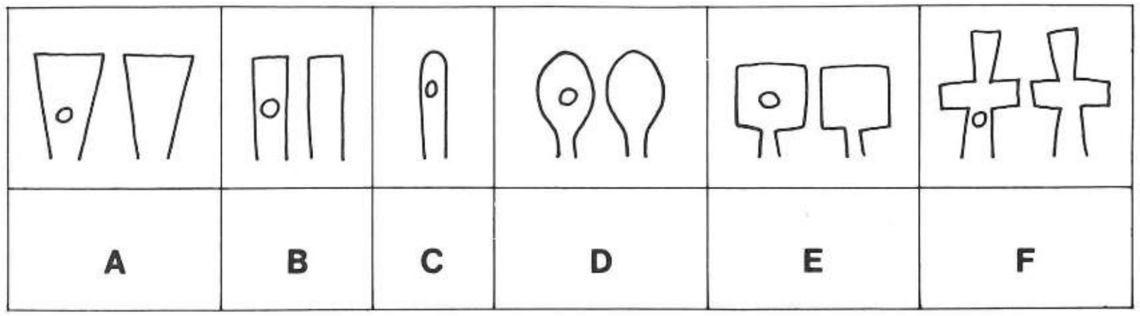


Fig IV.2 Typology of needles from Bryggen, based on the form and size of the head

the shaft. This has been recorded as the distance between the top edge of the head and the upper edge of the eye (A-D).

Using the above criteria, the needles may be divided into six main groups, lettered alphabetically from A to F. They are shown in fig IV.2.

Type A has a spatulate, triangular head, with the greatest width at the upper edge. The head is rectangular in section. The transition from head to shaft is without any sharp contours.

Type B has a rectangular or almost rectangular head. The width of the needle at the eye is the same as the top edge. The head is rectangular in section and the transition from head to shaft can be straight or slightly curved.

Type C has a relatively small, rounded head with an oval cross-section and the head runs straight down into the shaft.

Type D has a wide head, either rounded or rhomboid. The widest point is at the eye. The head curves into the shaft.

Type E has a marked contour where the head joins the shaft, often in the form of a sharp angle or a bead-roll. The type includes several forms of head: round, rectangular and triangular.

Type F has a large symmetrical ornamentally carved head.

Table IV.1 shows the needles from Bryggen in wood and bone or antler, with or without eyes, divided according to type. In all there are 234 needles with an eye, 87 without and 21 which are broken so that it is not possible to see whether they originally had an eye or not. Type A is the largest group both in bone/antler and wood. Types B, C and F are about equal when both eyed and eyeless are included, and these types contain few bone or antler needles. Types D and E are the smallest groups, and are also the most heterogeneous.

Even though the different types include both bone/antler and wood, there are distinctions in the types with regard to the raw material. The relative sizes are also affected by choice of raw material. The two categories are therefore treated separately, but compared in each case.

2.2 *Variations in form. Sub-types*

Within type A the variations concern the width of the head.

Where this exceeds 3cm, the needle is classified as sub-type A2 (cf fig IV.3.1). As the difference between A1 and A2 probably has functional implications, the sub-types are shown separately in the tables.

TABLE IV.1 NEEDLES FROM BRYGGEN: MAIN TYPES WITH (o) / WITHOUT (–) EYES (N=342)

Type	A		B		C		D		E		F		unide frag	Total
	o	–	o	–	o	–	o	–	o	–	o	–		
Material														
Wood	59	13	15	19	31	2	17	–	11	5	17	22	4	215
Bone/antler	56	23	5	–	14	–	6	3	–	–	3	–	17	127
Total	115	36	20	19	45	2	23	3	11	5	20	22	21	342

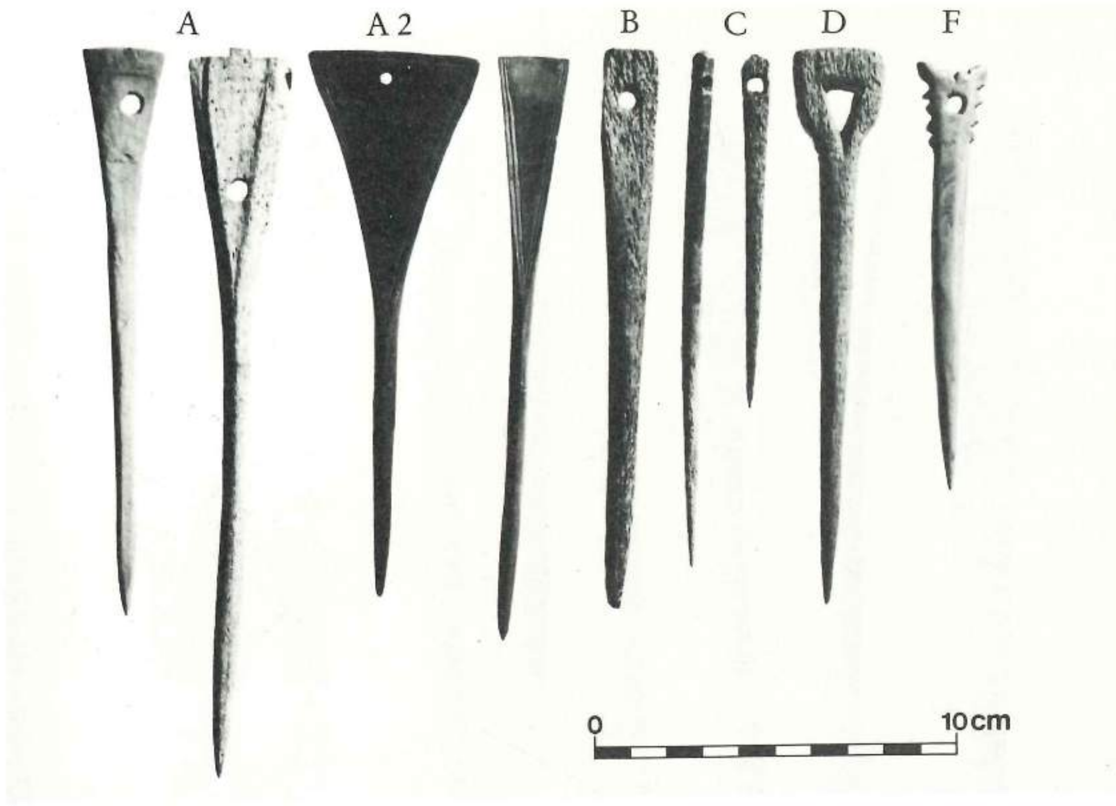


Fig IV.3.1 Needles of bone, arranged according to type: A (nos 19882, 9361, 44564,1 without no.), B (no.46671), C (nos 52726, 52237), D (no.25876), F (no.42874)

Type B and C are relatively homogeneous and not subdivided.

Within type D there is a variant of wooden needles whith a long and pointed head and a relatively lowplaced head. It has been separated as sub-type D2 (fig IV.4.1).

Type E is relatively heterogeneous but not further subdivided due to the small size of the group.

Type F occurs in many variations but these are hardly functionally determined (fig IV.4.2). In the tables, type F is therefore treated as an undivided group. There are eight variations of type F with an eye, shown in fig IV.4.2.

In the commonest form F1 the eye is placed under a symmetrically carved head (9 examples), while the rest are represented with only single examples and the sub-types have therefore not been further numbered. There are even more variations of type F needles without an eye, as shown in figure IV.4.2. F1 is also here the commonest variation (6 examples), while the remainder are represented with only 1-3 examples each and therefore not further numbered.

2.3 *Raw material*

Tables IV.2.1 and 2.2 show the raw materials of the needles. Among those made from wood there is a strong preference for using softwood, and more than 90% of those where the wood has been identified are made from one of the coniferous varieties, particularly yew and juniper, both of which are characteristically firm, heavy, smooth and hard-wearing (Høeg 1974, 631-3, 395-6). Pine is similarly known as a strong and durable material (*ibid* 493-5). The same qualities are also found in birch and oak, both of which are hard, strong and long-lasting

Fig IV.3.2 Needles of wood, arranged according to type: A (1 without no., 63887), B (nos. 43857, 12086), C (no.54266, D (no.77487), E (no.4330), F (no2444)

Fig IV.4.1 Subtype D.2 (nos 22216, 30373)

(*ibid* 238-40, 538-9). Willow and aspen on the other hand give a light, soft and finely-grained but nevertheless smooth wood (*ibid* 572, 518-20). In other words it is nearly exclusively the hard, smooth varieties which were used for the wooden needles. Of bone and antler the majority are made from various long bones and from antler and whale bone.

2.4 State of preservation

Table IV.3.1 and IV.3.2 show that 226 of the needles are complete. The remaining 116 are damaged in some way. The tables indicate where they are damaged, and for this purpose the needles have been divided into

1) head with eye
2) head and upper part of shaft
3) lower part of shaft and point
4) point.

In this way an impression can be gained of which part of the needle has been particularly subject to use.

A surprisingly large proportion of the needles are complete: 67% of the bone/antler needles and 66% of the wooden ones (tables IV.3.1 and IV.3.2). The point and shaft have suffered most damage. Particularly and not unexpectedly the long wooden needles are damaged. Of these only 31% of type F are complete. Among the F-needles, are also the most frequent occurrences of broken or split heads and breaks in the upper part of the shaft.

TABLE IV.2.1 RAW MATERIAL, NEEDLES OF BONE/ANTLER WITH (o) / WITHOUT (–) EYES (N=127)

	Types										
Raw materials	A		A2		B	C	D	F	Unclassi-fiable	Total	%
	o	–	o	–	o	o	o	o			
Whale	14	3	1		4	4	4	1	3	34	27
Pig fibula	2	1							1	4	3
Long bone	16	13	1	3		2	1	1	7	44	35
Cattle							1			1	1
Unident mammal	1					1				2	2
Antler reindeer?	10		1	1	1	3	2	1	4	23	18
Antler, red deer?	2	1		1		3	1		2	10	8
Antler elk	1		2							3	2
Unident	4			1		1				6	4
Total	50	18	5	6	5	14	9	3	17	127	100

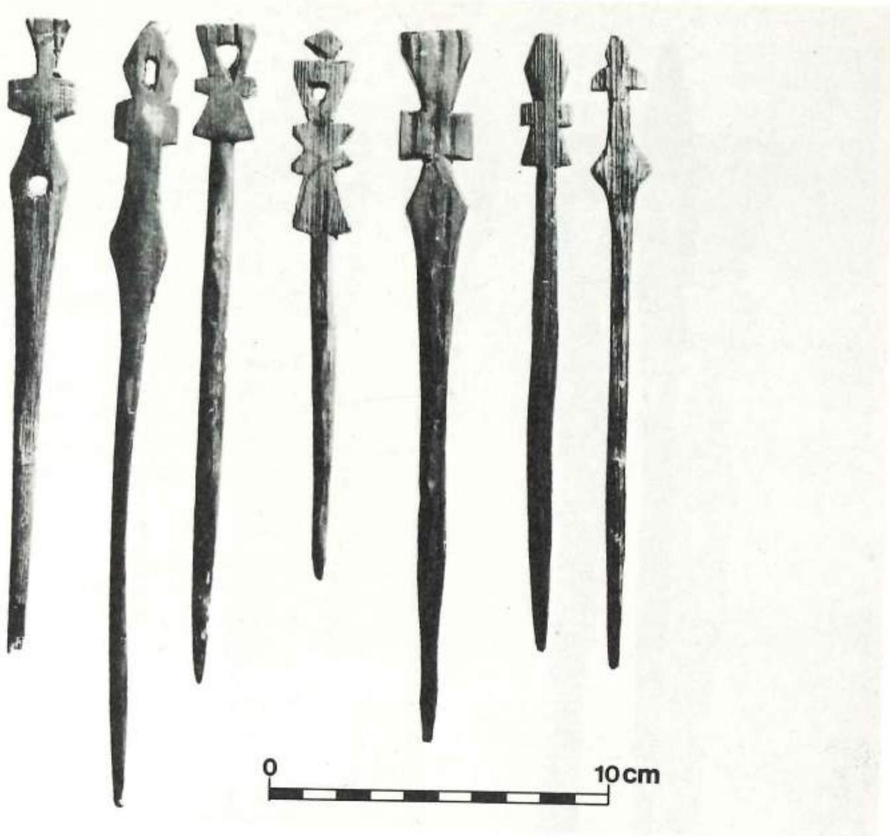


Fig IV.4.2 Variations of type F with/without eyes

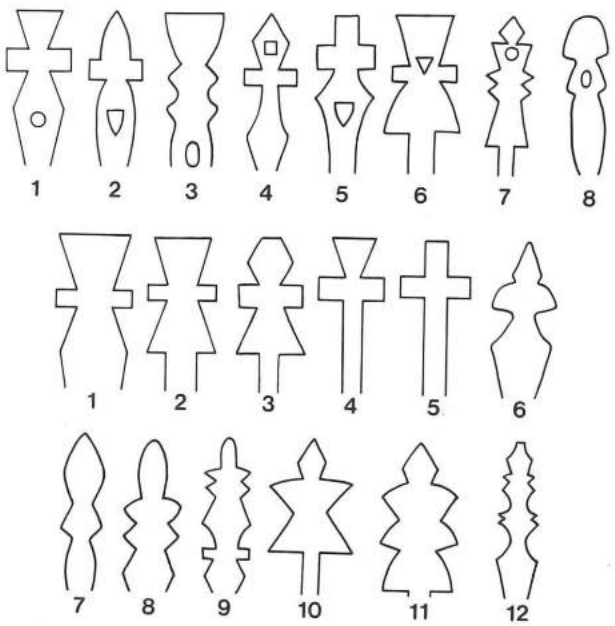


TABLE IV.2.2 RAW MATERIAL. WOODEN NEEDLES WITH (o)/WITHOUT (-)EYES

Raw-materials	A o	A –	B o	B -	C o	C –	D o	D2	E o	E –	F o	F –	Unident	Total	%
yew	35	10	10	9	15	2	7		7	2	4	4	4	109	51
juniper	4	2	1	8	4		1	1	1	3	2	10		37	17
pine	11	1	4	1	7		2	4	2		8	6		46	21
willow/ aspen											1			1	0,5
birch	1				2						1			4	2
oak	2			1	1				1					5	2,5
other hardwood	2													2	1
Unident	4				2		2				1	2		11	5
	59	13	15	19	31	2	12	5	11	5	17	22	4	215	100

TABLE IV.3.1 NEEDLES OF BONE FROM BRYGGEN, WITH (o) / WITHOUT (–) EYES: STATE OF PRESERVATION (N=127)

State of pre-servation	Type A1 o	A1 –	A2 o	A2 –	B o	C o	D o	D –	F o	Uncla-ssifi-able	Total	%
Complete	40	13	5	4	3	13	4	1	2		85	67
Point broken	4				1						5	4
Point and lower shaft damaged	3	4		1	1		1	1			11	9
Upper part damaged				1							1	1
Lower part missing	3						1	1			5	4
Upper part missing										17	17	13
Head damaged		1				1			1		3	2
Total	50	18	5	6	5	14	6	3	3	17	127	100

2.5 Size

Table IV.4.1. shows the minimum and maximum lengths of the various types, while table IV.4.2 gives the distribution of needles in divisions of 3cm within these outer limits.

The tables (IV.4.1 and IV 4.2) show that with regard to length there is great agreement within the type-groups between

1) needles with and without eyes and
2) wood and bone/antler needles. Group F, however, is an exception, with the bone/antler needles markedly shorter than those in wood. Within every type-group there is a relatively large difference between the shortest and the longest, so great that it must have functional implications. We shall therefore examine how the needles are distributed with regard to length.

If the needles are divided into three broad groups:

1) short (under 13cm)
2) medium (13-19cm) and
3) long (over 19cm),

TABLE IV.3.2 WOODEN NEEDLES FROM BRYGGEN, WITH (o)/WITHOUT (-) EYES: STATE OF PRESERVATION (N=215)

State of preser-vation	Type A o	A –	B o	B -	C o	C –	D o	D2	E o	E –	F o	F –	Unident	Total	%
Complete	44	11	11	18	21	2	7	3	9	3	6	6		141	66
Point broken	4	1		1	4		2		1		6	1		20	9
Point and lower-shaft damaged	4		4		6		2	2		2	2	3		25	12
Upper part damaged															
Lower part missing	4						1		1		1	10		17	8
Upper part missing													3	3	1
Head damaged	3	1									1			5	2
Head and point damaged											1	2	1	4	2
Total	59	13	15	19	31	2	12	5	11	5	17	22	4	215	100

then a third of all needles (34%) are short, half (50%) are medium and 16% are long. There are relatively more bone/antler needles in the short category, whereas only a quarter of the wooden needles are less than 13cm. The very shortest examples (under 10cm) in both wood and bone/antler are in group C. Bone/antler needles of type A are generally shorter than the wooden needles of this type.

The medium group contains the largest number of wooden needles (55%) but only 43% of the bone/antler needles. This group also contains the largest number of all types except C and F. Type A contains the most medium needles, particularly in wood. Type C, as already noted, has more short than medium needles, while type F has more long ones. The bone antler needles of type F belong to the medium group.

The most usual width of the head for both bone/antler and wooden needles lies between 10 and 20mm. It is essentially type C which have heads narrower than 10mm and practically all the needles of this type have heads less than 15mm. About half of type A and a large number of types D and E have heads narrower than 15mm. Because of the great variation within the A-type bone/antler needles, these have been further subdivided with a sub-group A2. The wooden needles of type F have heads broader than 25mm.

From the tables above it is evident that type C is different from the others, with both bone/antler and wooden needles being shorter and narrower. Type F wooden needles are the opposite, being generally longer and having a wider head than the other types. Needles between 13 and 19cm in length and whose

TABLE IV.4.1 NEEDLES FROM BRYGGEN: MINIMUM AND MAXIMUM LENGTHS OF WHOLE NEEDLES OF BONE/ANTLER WITH (o) / WITHOUT (-) EYES (N=85)

Type	Min	Max	N
A o	9.3	21	40
–	8.8	21.5	13
A 2 o	8.8	19.9	5
–	11.8	18	4
B o	15	21	3
C o	7.8	16.7	13
D o	12.3	13.5	4
–			1
F o	11.5	13.5	2

TABLE IV.4.2 WOOD (N=141)

Type	Min	Max	N
A o	7.8	23	44
–	10.7	19.6	11
B o	10.1	23.6	11
–	8	27	18
C o	8.4	18.5	21
–	13.2	15.2	2
D o	9.1	16.2	7
D 2 o	16.7	27.7	3
E o	13	29	9
–	11.5	19	3
F o	14.8	22.6	6
–	18	29.3	6

heads are between 10 and 20m form the largest group within type F although there is nevertheless a wide variation in both length and breadth.

A pattern can be discerned in the relationship between length of needle and width of head. The short needles are relatively thin (with the exception of sub-type A2). The medium group contains the greatest variation in width of head and includes narrow, medium and broad needles. The longest needles are all wider than 10mm and as a rule narrower than 30mm. The variations within the type-groups are so great that they may indicate different areas of use. We shall return to the question of function later in this chapter.

2.6 *The shaft*

The shape and thickness of the shaft may also give indications about the area of use. Two-thirds of the measurable needles have round shafts, whereas 28% are oval or slightly oval and a small group (6%) have rectangular shafts. It is especially type A and wooden needles of type F which have a larger representation of oval and rectangular shafts.

The shape of the shaft in long-section can be straight, gently curving either inwards (waisted) or outwards (convex) or have a noticeable thickening between the shaft and the point, rather like a spear-head. The shaft is usually straight (78%). A narrowing of the shaft occurs on 16% of the measurable needles and is a particularly common feature of both

TABLE IV 4.2.1 NEEDLES OF BONE/ANTLER FROM BRYGGEN: DISTRIBUTION BY LENGTH OF MEASURABLE NEEDLES, WITH (o) WITHOUT (–) EYES (N=96).

Lenght in cm	Type A o	A –	A2 o	A2 –	B o	C o	D o	D –	F o	Total	%
< 10	3	2				6				11	11.5
10.01-13	22	2	2	1		4	1	1	2	35	36.5
13.01-16	10	4	1	1	3	3	3		1	26	27
16.01-19	8	4	1	1		1				15	16
19.01-22	2	3			2					7	7
22.01-25											
25.01 <		1		1						2	2
Total	45	16	4	4	5	14	4	1	3	96	100

TABLE IV 4.2.2 NEEDLES OF WOOD FROM BRYGGEN: DISTRIBUTION BY LENGTH OF WHOLE NEEDLES, WITH (o) AND WITHOUT (–) EYE, WHERE MEASURABLE (N=171)

Length in cm	Type A o	A –	B o	B –	C o	C –	D o	D2 o	E o	E –	F o	F –	Total	%
< 10	2			1	5		1						9	5
10.01-13	10	3	5	5	9		2			1			35	21
13.01-16	13	2	4	7	9	2	2		3	2	2		46	27
16.01-19	21	6	2	3	4		3	1	1		3	3	47	28
19.01-22	4	1		1				1	2	1	4	2	16	9
22.01-25	1			1					2		3	2	9	5
25.1 <				1				1	2	1	2	2	9	5
Total	51	12	11	19	27	2	8	3	10	5	14	9	171	100

TABLE IV 4.3.1 NEEDLES OF BONE AND ANTLER FROM BRYGGEN WITH (o) / WITHOUT (-) EYES: WIDTH OF HEAD, DISTRIBUTION (N=108)

Width in cm	Type A o	A –	A2 o	A2 –	B o	B –	C o	D o	F o	Total	%
< 5						1				1	1
0.51-1	4	1				7				12	11
1.01-1.5	24	4			4	6	3	1	1	43	40
1.51-2	14	5			1			2	1	23	21
2.01-2.5	6	6					2			14	13
2.51-3	2	1								3	3
3.01-3.5			1	1			1			3	3
3.51 <			5	4						9	8
Total	50	17	6	5	5	14	6	3	2	108	100

TABLE IV 4.3.2 NEEDLES OF WOOD FROM BRYGGEN WITH (o) / WITHOUT (-) EYES: WIDTH OF HEAD, DISTRIBUTION (N=208)

Width in cm	Type A o	A –	B o	B –	C o	C –	D o	D2 –	E o	E –	o	F	Total	%
0.51-1		1	1	1	12	1	1					1	18	9
1.01-1.5	29	3	8	12	16	1	3	1	1			2	76	36.5
1.51-2	24	7	5	4	3		8	4	4	4	11	7	81	39
2.01-2.5	4	1		1					5	1	2	9	23	11
2.51-3			1	1					1		3	1	7	3
3.01-3.5											1	1	2	1
3.51 <												1	1	0.5
Total	57	12	15	19	31	2	12	5	11	5	17	22	208	100

wooden and bone/antler A-type needles, where it occurs especially on those which are very well made (3 examples). But it also occurs sporadically among the other types. A thickening at the point occurs on 11 examples, all of type A (including A2), but only one of which is of wood.

In order to obtain a comparative measurement of the thickness of the shaft, the diameter of the shaft has been measured at its mid-point.

There is great variation in the thickness, the maximum thickness varying between 3 and 17mm. The most usual thickness is 5-8mm (80%) with 6mm as the absolutely commonest. The bone/antler needles are generally slimmer than the wooden ones.

The most slender needles occur in the A and C categories, both in wood and in bone/antler. Needles where the cross-section of the shaft is either oval or rectangular are generally thicker.

2.7 *The point*

The point of the needle may have one of four forms:

1) sharp with a smooth straight transition between point and shaft
2) blunt or rounded with a straight transition between point and shaft
3) sharp point but thickening immediately to the shaft
4) blunt point thickening immediately to the shaft

Sixty-nine per cent of the needles have a sharp point and most of these (48%) are smoothly pointed. More of the bone/antler needles have a sharp point than the wooden needles (81% as against 62%). The points with a rounded transition to the shaft occur most often on needles with a relatively thick shaft and most commonly on those with shafts whose thickness varies.

2.8 *The eye*

There are 234 needles with an eye (cf table IV.1). Has this been used for threading or has it had something to do with fastening? The shape, size, position and occurrence per type will probably throw some light on this question.

The eye may have one of four shapes: round, elliptical, rectangular and triangular or half an ellipse. The round eye is commonest, especially on the bone/antler needles (83%), whereas the wooden needles include a relatively large number with eyes which are rectangular, triangular or half an ellipse (44%).

The minimum diameter of the eye varies from 1 to 8mm, with 4mm as the most usual. Bone and antler needles generally have a smaller eye than wooden needles with 3-4mm as the commonest against the wooden needles' 4-5mm. For most of the needles it has therefore been possible to thread them with a relatively thick thread. Needles of types A and C generally have the smallest eyes. Type A has the widest variation. The triangular, elliptical or rectangular eyes are usually larger than the round ones.

The position of the eye is also a functional feature. The greater the distance from the end of the needle, the less probable that the eye has been used for stitching and the more likely that it has been used for fastening. There is great variation in the position from less than 5mm to more than 40mm from the end. The greatest variation occurs in type A, both in the wooden needles and the bone/antler ones, and type F wooden needles also have great variation. Type F needles in particular have the eye placed furthest from the end, being more than 40mm in 47% of the group. The eye is also well down on type D2, being more than 30mm from the end of the needle. On most of the needles (73%) the eye is between 5 and 20mm from the end. In general needles of types A, C and D have the eye closer to the end than the other types.

2.9 *Decoration*

As we have already seen, some of the types have ornamentally carved heads. These are types E and F. Incised patterns and facetted contours also occur sporadically on type A and on sub-type A2.

Of the 50 bone/antler needles of type A, sixteen are decorated, eleven of which have an eye, the other five being without. Three have incised decoration on the head. On one there is an area of incised lattice-work over the eye, the second has a single groove enclosing a triangular area with a St Andrew's cross in the centre, and the third which has no eye has a similar triangular area beginning and ending in a border with incised lattice-work.

TABLE IV.5.1 NEEDLES OF BONE WITH (o)/WITHOUT (-) EYES V: DATING (N=127)

Period	A		A2		Type B	C	D		F	Unclas-. sifiable	Total	%
	o	–	o	–	o	o	o	–				
8		2									2	2
7	1				1			1		1	4	3
6	3	4	1		1		1			1	11	9
5	12	5	2	2	1	4		1		2	29	23
4	7	1		1	1	3				7	20	16
3	17	2	2	1	1	3	2		1	3	32	25
2	8	1		1		3	2	1	2		18	14
Undated	2	3	1			1	1			3	11	8
Total	50	18	6	5	5	14	6	3	3	17	127	100

TABLE IV.5.2 NEEDLES OF WOOD WITH (o)/WITHOUT (-) EYES: DATING (N=215)

Period	A		B		C		D	D2	E		F		Unident	Total	%
	o	–	o	–	o	–			o	–	o	-			
8															
7	2	1	1		1									5	2
6	2	1	1	2	2		2					5	1	16	7
5	14		4	7	7	1	3	2	2	2	7	6	2	57	27
4	8	2	5	3	5	1	4	1	3	2	5	2		41	19
3	19	4	4	6	9		3	2	3		4	7	1	62	29
2	11	5			6				3	1		1		27	13
Undated	3			1	1						1	1		7	3
Total	59	13	15	19	31	2	12	5	11	5	17	22	4	215	100

Nine of the needles with an eye and four without have a single or double facetted groove in a V-shape with the two arms beginning at the top of the needle and ending in a point beneath the eye (cfr fig IV.3.1). This form of decoration occurs on both wide-headed and narrow-headed needles. One needle (no. 44945) has several uninterpretable rune-like symbols on the head.

Twenty wooden needles of type A also have a facetted groove forming a triangle around the edge of the head. Three of these wooden needles have a special pointed end to the head and on 11 needles the head narrows symmetrically in some way (cfr fig IV.3.2). Two unfacetted needles have very similar headpoints.

Of the needles of sub-type A2, as many as eight are decorated. Three have a facetted groove around the edge of the head, two have interlaced triangles, two have a leafscroll pattern and one has lattice-work and large perforations which in themselves form a pattern.

2.10 Dating

Of the total of 342 needles, 18 lack information about dating which means that 95% of the total have been dated. This can be considered a representative sample. The tables IV.5.1 and IV.5.2 show that the majority (87% of the bone/antler & 95% of the wooden needles) come from periods 2-6, from before 1170 to 1413. After 1413 there are only a few sporadic occurrences.

All types, both in wood and bone/antler, are represented from period 3 to period 5, ie 1170-1332. Types A, C, D, E and F are also present in period 2, before 1170, but it is not possible to say with certainty whether these types are generally older than the other types. The same is true of the latest period which is only represented with type A.

3 Function

As the needles are so different in shape, size and raw material, they probably had different functions. On the basis of the preceding analysis of the material we shall examine the possibility for separating various areas of use. It has already been pointed out that these bone, antler and wooden needles and pins can have been used in other connections than textile work.

Stitching covers a wide area of work from embroidery to sewing clothes, as well as the sewing of coarser textiles such as hessian. It also includes mending and darning. This wide range is reflected in the equipment, from fine, thin, metal needles for embroidery and sewing clothes to coarser needles for darning. This function is treated more fully in the next chapter.

In the Middle Ages and later single-needle knitting or knotless needling (Norw *nålebinding*) was a common technique for making mittens, stockings, socks, hairnets, strainers, etc. A coarse needle of wood, bone, antler or metal was used with an eye either at one end or in the middle and a suitable length of yarn was threaded through the eye. A loop was formed with the thread, through which the needle was passed three or four times in a special way (fig IV.5). Thus an interlocked chain of loops was made, and these were joined to form a row on which a new row of interlocked loops was stitched. The yarn was lengthened as and when necessary (Hoffmann KLNM XII 426). There are no examples of the finished product among the textiles found at Bryggen, but they have been found in a number of other medieval excavations (cf Hald 1950, 309), and more recently at York (Hall 1984, 99).

Fig IV.5 Needle for single-needle knitting

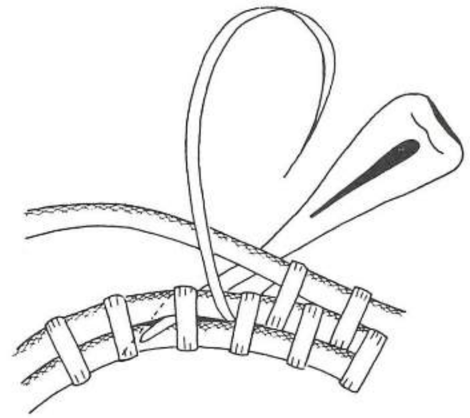


Fig IV.6 Bodkin used in basketry

Recent studies of single-needle knitting have shown that a c 6cm long bone needle was used to make the loops which measured 2.5cm (Nordland 1961, 26). Alternatively a c 10cm long needle with an elongated eye was used (Brodén 1973, 34). Needles as long as 14 or 15cm may be used for this technique and the needles may be of wood, bone, antler or metal (Gauslaa 1976, 6). But this type of needle may also be used for many different functions. M Hald suggests that as well as being suitable for single-needle knitting, it could be used for simple stitching and for netting. She emphasises that it is difficult to determine the technique simply from the archaeological finds of the needles themselves (Hald 1950, 283).

It is also known that needles have been used as shuttles for sending the weft through the warp in weaving, especially in tapestry-weaving. In more recent times it is nevertheless more usual to feed the dolly through the warp by hand and not use any special instrument.

Needles are also used for making nets. The commonest netting-needle (cf fig IV.7) was nevertheless of quite a different shape from the needles discussed here and will be treated separately at the end of this chapter.

Needles or pins could also be used as wimbles (cf p 55) when used for twisting various materials into ropes (Sauce 1939, 160-197).

A sharp needle may also be used as a bodkin or awl for making holes. A bodkin may also be used in basketry and other forms of weaving involving roots or stems (fig IV.6).

Its use as a stylus must also not be omitted.

As items of personal equipment needles can be used for fastening clothing or in the hair.

Before discussing these areas of use with regard to the needles found at Bryggen, it is appropriate to consider whether other archaeological finds or ethnological examples have already proved any connections between type, form, size and function.

4 Comparative material

The comparative material for medieval needles in Norway is very limited and cannot contribute much to the discussion. Grieg summarises the finds of bone, antler and wooden needles from earlier excavations in the medieval towns but without any discussion of function (Grieg 1933, 241 & 338). The finds comprise types A and F. Grieg regards both types as pins for fastening up the hair but gives no specific reasons for this interpretation (*ibid* 243). Type A is also known from Iron Age graves from the fourth century AD onwards.

Of the material from more recent urban excavations only the bone and antler needles from the Mindet site in Gamlebyen, the medieval area of Oslo, have been published (Wiberg 1976, 209-10). Thirty-one were found, of our types A, B, C and D. The question of function is not discussed. The remaining finds are in the process of being studied and are at present not available for comparative purposes.

The needles from Bryggen are not unique. There is a relatively extensive amount of comparative material from medieval sites in the other Nordic and North European countries. This material differs, however, from the Bryggen finds on one essential point: there are practically no wooden needles.

Information useful for comparative purposes is often widely spread and there are relatively few comprehensive studies of this group of finds. The following comparative analysis can therefore hardly be regarded as exhaustive, but it will include those studies which at the present moment can provide most information concerning the question of function.

As in Norway bone needles of type A in Frisia and England can be traced back to the Migration period and are dated to the seventh century AD onwards. In the Middle Ages the type was widely spread. It is known, for example, in Denmark, Sweden and the Baltic countries, at Hedeby, in Frisia, England, Orkney, Shetland, the Faeroes etc.

This type, then, has been fairly common in the Middle Ages, but its function has been a matter of some debate among many scholars, including a.o. Poul Nörlund (1948), Agnes Geijer (1938), Berta Stjernquist (1951), Ragnar Blomquist (1963), Märta Lindström (1976), R J C Hamilton (1956), Anna Roes (1963) and Gesine Schwarz-Mackensen (1976), Ingrid Ulbricht (1984), as well as the afore-mentioned Grieg (1933). Various functions have been suggested, including fastening pins, hairpins, bodkins, awls, shuttles and needles for single-needle knitting.

Nörlund assumes that the needle was used instead of a brooch to fasten clothing, or for holding the hair, headdress or linen head-scarf in place (Nörlund 1948, 142). Grieg (1933, 241) and Roes (1963) share this view. Nörlund maintains that such needles could not be used for sewing because of the wide head, but they may have been used as netting-needles and as bodkins or awls (Nörlund 1948, 143). Hamilton and Ulbricht tend to prefer the interpretation as a bodkin, particularly in connection with basketry (Hamilton 1956, Ulbrecht 1984). Geijer has suggested that this type of needle may have been used in weaving and stitching (Geijer 1938, 57) and has since been supported in this interpretation by Stjernquist (1951, 105-7), Blomquist (1961, 176) and Lindström (1976, 275). The use of such a needle as a pin for fastening garments, headcloths or the hair has been rejected on grounds of its size and thickness. Examples with plastic features may have served as decorative personal objects of some kind (Ulbricht 1984).

Schwarz-Mackensen (1976), in her study of the needles from Hedeby, has investigated the question of function thoroughly. She has not been able to prove any definite function for group A from the contexts of finds in graves and settlement-sites in Northern Europe. On the basis of the Hedeby finds, she claims to be able to prove that needles with a wide head were not used for stitching (*ibid*, Abb.26). The point is often rounded and the frequent occurrence of a broken point shows that it was subject to demanding use. She maintains that it was probably used for pricking or perforating resistant material such as leather. She also suggests that these needles have been common objects in various handicrafts, most probably for picking the weft between the warp-threads in weaving, or in band-weaving. She bases this on comparative material. She also points out that some of the larger needles are reminiscent of the heads of distaffs used right up to the twentieth century (*ibid*, 73-74).

Needles shaped like the Bryggen type B needles are also found in the comparative material from Hedeby, Schleswig, Lund, Sigtuna, etc (Schwarz-Mackensen 1976, 40), but with regard to function they are most often discussed together with type A needles.

Needles of our type C have been found in several places in the Nordic area, including Lund, Århus, Hedeby and Schleswig. Similar needles made of wood are, however, not mentioned in the literature. In many cases the needles have been associated with single-needle knitting (Blomquist 1961, 176-78, Lindström 1976, 275). Blomquist adds further weight to this interpretation by correlating a needle with a runic inscription with the terminology from more recent times. A needle of bone found in Lund has the runic inscription *tofana skefnig*, interpreted as «the needle belonging to Anna Tove». According to Blomqvist, the Swedish term *skävning* or *skämling* was applied to needles used in single-needle knitting, but he also suggests that it could mean any polished needle (Blomquist 1961, 176). Another needle of bone has been uncovered in Ålborg with the inscription *skefninger*. It is 11cm long with a wide triangular head and is therefore similar to a Bryggen type A needle.

Other interpretations for type C needles have been suggested. Roes regards it as a cheaper version of a sewing-needle (Roes 1963, 70). A find which clearly places this type of needle in a textile context is from Memel in Eastern Prussia. In a grave from the Viking period a needle of our type C was found tied through the eye into a bundle with several weaving tablets and a knife beater (Gaerte 1929, 335-338).

Needles corresponding to Bryggen's type D are also found over a wide geographical area, including Frisia, York, Hedeby, Birka, Lund and Sigtuna (Schwarz-Mackensen 1976, 35).

Type E at Bryggen is a small and heterogeneous group but in the comparative material it is often divided into several types. Needles with forms parallel to type E have been found at Hedeby, Schleswig, Århus, Lund, Sigtuna, etc (Schwarz-Mackensen 1976, 34-35). Such needles have been found with a small ring through the hole (e.g.Arbman 1940, Tafel 170, 171), indicating that they were not used for sewing. In the ring there may have been fastened a cord which was wound around the pinshaft in order to »secure« the pin. Type E has parallel forms in metal pins. However, these are often smaller with lengths varying from 6.2 to 8 cm. They are interpreted as dress-pins to keep the wearer's dress together. Found in graves they are generally encountered in pairs, and in cases where the position is given, each pin by one shoulder of the corpse (Waller 1972, 62).

The question of function for the bone needles of types D and E, however, has not been much discussed. Bone or antler needles of type E are in fact known from more recent times, being used in connection with embroidered linen. After the linen had been laundered and pressed, the decorative holes were gone over with a needle of this type (Noss 1976, 3, fig 4). Their function as textile equipment can thus not be excluded.

Bone needles of type F can be matched in places such as Hedeby, Birka, Schleswig, Sigtuna and Lund (Schwarz-Mackensen 1976, 37). In the Frisian area bone needles have been found with the same main form as sub-types F1 and F2 but with markedly shorter shafts (Roes 1963, 65). I have been unable to find any references to wooden needles of this type, but these have been found during medieval urban excavations in Sweden and Denmark and are exhibited at Statens historiska museum in Stockholm and the National Museum in Copenhagen.

Various interpretations have been suggested with regard to function. Blomquist and Lundström regard this type as a shuttle for a tapestry loom, maintaining that the needle could have been used for the coloured thread, the head being suitable for winding the weft thread on (Blomquist 1961, 176, Lundström 1976, 275). Roes on the other hand interprets the short bone/antler needles with symmetrically carved heads as bodkins or awls. She regards them as being too thick to be used for fastening garments (Roes 1963, 65-).

5 Function of the needles from Bryggen

Is it possible to strengthen or weaken any of the interpretations mentioned above by means of information drawn from the Bryggen material of needles? Let us first consider to what extent the site-context can shed light on this question.

A large number of the needles are complete (table IV.3.1 & 3.2). It is therefore probable that they have been mislaid or lost and not deliberately discarded. The damaged needles must be regarded to a greater extent as refuse, even though we cannot reject the possibility that the damage has occurred after the needle was lost.

Unfortunately, the information about the finds-context provide few clues concerning the function of the needles. A large number – about 1/5 – were found in association with buildings, but it is often difficult to prove any specific area of use. Only occasionally were needles found in contexts which indicate directly the place where they were originally used. Taking firstly burnt buildings where textile equipment has been found and secondly buildings containing several finds of textile equipment, we find that 28 wooden, bone/antler needles occur in such contexts. All types are present, but wooden needles of type F and wooden needles of type A have the greatest representation with six and five finds respectively. The remainder are found more scattered without clear connection to constructions. We shall return to the question of buildings used for textile working in more detail in Part II, chapter VII.

The majority of the undamaged and presumably lost needles were found in the wharf and harbour area at the front of the site where one would not expect that textile equipment was used. Finds in the roads and passages (14%) indicate that the needles were carried along, presumably as personal equipment, but this does not exclude the possibility that they were used as tools.

What functions, then, may the needles from Bryggen have had? It is quite clear that none of the bone, antler or wooden needles have been used for fine stitching, such as embroidery or sewing delicate fabrics. But there is, as we have seen, a group of relatively short and slender needles with a narrow head and small eye usable for coarser sewing. However, only 13 type C and 33 type A needles belong to the group of short needles (less than 13cm) with a head narrower than 10mm. They have a straight shaft and a straight, sharp point. Even though longer and coarser needles may in theory have been used to sew very coarse materials such as hessian, it can be assumed that more suitable equipment was used for such regular work.

It has already been mentioned that needles between 6 and 15 cm in length with forms such as types C and D2 have been used for single-needle knitting in recent times. This implies that almost all the C-type needles may have had this function, even the smallest which have just been discussed in connection with sewing. The biggest C-type wooden needles generally have a larger elongated or triangular eye and have thus been suitable for thicker yarn. The width of the head which mostly lies between 10 and 20mm for these needles gives the minimum size of loop which could be made. But the gauge is also dependent on the thickness of the yarn and the tension.

Needles of types A, B and D may also have been used for single-needle knitting. Since stitches up to 2.5cm in length were usual in single-needle knitting it would be possible to use needles with a correspondingly wide head. Tables IV.4.2.1 and 4.2.2 show that there are altogether 99 needles among the Bryggen finds with lengths of between 10 and 16cm and heads between 10 and 25mm wide and that 67 of these belong to types A, B and D and have eyes. But this is not the maximum feasible number for single-needle knitting, since the dimensions of the gauge are not fixed: stitches both larger and smaller than 2.5cm are feasible, as well as products with a very open weave. It is thus possible that a larger number of needles may have been used for single-needle knitting.

On the basis of the types of needles and the sizes mentioned, examples have been selected and copies made to be used in a practical attempt at single-needle knitting. Torbjørg Gauslaa, consultant in domestic handicrafts, has discovered in this way that examples of types A, B and D may well have been used for this purpose but she will not exclude other possible functions (pers comm T Gauslaa 16-08-82). It should also be pointed out that no examples of single-needle knitting have survived among the finds of fabric from Bryggen (pers comm E Schjølberg), which ought to argue against an extensive use of this technique at Bryggen.

The needles mentioned above are in fact also usable for making fishing-nets. In more recent times needles corresponding to types C and D have been used to tie the floats into the net, but also types D2, B and the narrower versions of A may be used (pers comm T Gauslaa, using information from A Walla (born 1908) who has been shown illustrations of several of the needles from Bryggen). Netting was often done in a macramé-technique. Needles were available in many different sizes depending on the gauge. As a rule they were made of wood – often bird-cherry, juniper or birch. A needle was quite indispensable; it was not possible to get the soft end of the yarn through the previous loop without some kind of needle. However, such floats were not used in the Middle Ages, but a

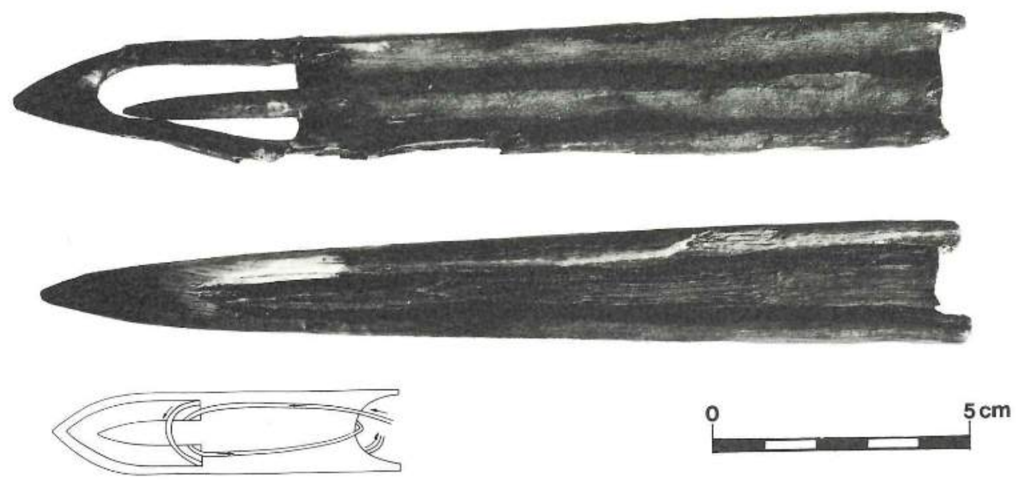


Fig IV.7 Netting-needle and an unfinished netting-needle from Bryggen

similar technique can have been suitable for different types of fishing-nets.

Incidentally, the Bryggen finds include two netting-needles of the same type as known in more recent times (fig IV.7). They are quite different in form from the rest of the needle material. They are long and narrow with a thin flat shaft which is cut through by an elongated U-shaped perforation, leaving a central tongue. One end of the needle is pointed, the other fork-shaped. The type is known all over Europe and also in Asia and may be traced back to prehistoric times. The Bryggen examples are made of birchwood and their length varies from 18 to 18.5cm, their width from 2.35 to 2.5cm. They are dated to period 5 (1248-1332) and period 8 (1476-1702).

On the basis of the shape of the head, needles of types E and F cannot have been used for sewing, single-needle knitting or netting. In textile work they might be suitable as shuttles, bodkins, distaffs or pin beaters. We have already pointed out that all these different possible uses have been suggested, but as long as there is no direct evidence for any of these functions, the interpretation of the needles must remain rather uncertain. The occurrence of an equally large, if not larger, number of needles of these types without an eye (table IV. 1) may, however, support the suggested uses. The hypothesis that wooden needles of type F may have such functioned as pin beaters or distaffs is further supported by their relatively great length, the shape and the thickness of the shaft and the frequent occurrence of a blunt point. The large ornamental heads must, however, have made them unsuitable as shuttles, since it would be difficult to get them between the warp.

The relatively frequent occurrence of type F needles in buildings with clear traces of textile working (see p 134), particularly weaving equipment, may indicate a textile function. A couple of the largest may have been used as distaffs. The symmetrical carving on the head would have been effective in holding the wool. In this connection it is worth noting that the needle has been particularly subject to stress in the upper part of the shaft and not at the end (table IV.3.2).

The relatively great length and the blunt end argue against the use of such needles as bodkins. The same applies to such uses as hairpins and pins for fastening garments. The extra weight at the head would also make them rather unsuitable for these functions. It is more likely that the three small bone needles of type F may have been used in this way.

As with type F needles, types A, B, D and E include a varying proportion of needles with no eye (see table IV.1) which cannot have been used for sewing and stitching, and it is reasonable to assume that they have been used either as shuttles, pin-beaters, fastening-pins or bodkins. Both needles with and without an eye within each group are very similar in form, size and raw-material. Presumably they had the same function, and the eye was not a necessarily functional feature.

Needles without eyes vary a great deal in length but most occur in the range 13-19cm (table IV.4.1 & 4.2) and have heads from 10 to 25mm in width. Most of the needles are complete, and of the damaged ones it is usually the lower part of the shaft which is broken (tables IV.3.1 & 3.2). The often slender point otherwise shows remarkably few signs of wear and can hardly have been subject to the hard, regular pressure which a bodkin will suffer. Quite possibly the needles have been used to pass through material that offers little resistance, such as warp-threads and loops or open stitches. On the other hand there would hardly be the need for such fine sharp points on a shuttle. It is also an open question whether the form of the head on types A, B and E was particulary suitable for winding yarn on and for going between the warp. The interpretation as a shuttle must therefore be uncertain for these types. It is also worth noting that these types were found in buildings with finds of several textile implements.

The possibility cannot be discounted that needles of different lengths and with heads of different widths within the same type-group may have had different uses.

As mentioned in chapter III some of the needles may have served as pin-beaters for the weft in an upright loom, but they would have to be relatively sturdy types which would not easily be subject to breakage. From the ethnographical material we know that beaters could be made of horn, but also straight or slightly curved polished wooden pins were often used (Crowfoot 1940, 44-45). We do, however, lack clear criteria for identifying any of the needles as pin beaters.

All the pointed needles may in theory have been used as bodkins. Nevertheless it is the bone and antler needles which would best be suited to this work because of their extra strength. For basketry it has been usual in more recent times to use a 10-12cm long bone bodkin to make the holes (Walla 1968, 19) (fig IV. 6). It is quite possible that several of the bone needles of types A and B both with and without an eye may have had this function. Nor can we discount the use of wooden needles as bodkins inasmuch as hard, resistant wood has been used to a great extent as the raw material (table IV.2.2). A bodkin is particularly subject to wear and damage at the tip but as mentioned several times already there is little wear on the points of the needles from Bryggen, and there are relatively few cases of broken points or breaks at the lower end of the shaft. Nevertheless this occurs relatively more often on bone needles of types A and B (22%) than for the wooden needles of the same types (13%) (cf tables IV 3.1 & 3.2).

As we have seen in section 2.9 above, a number of type A and A2 needles are decorated and may therefore have been used with garments or head-cloths. The frequent combination of a shaft with slight thickening and thinning at the end (like a spearhead) and a facetted head may suggest that these were used as pins for fastening, since the shape of the shaft could have contributed to its gripping quality. A large number of these needles have also had a large wide head which would have acted as a stop. In the group of unclassifiable broken needles, those where the head is missing and which have a shaft and point in this form are often broken at the upper end of the shaft. This might imply that they have been used for fastening, as the shaft nearest the head would be subject to greatest strain.

As we have seen, there is in fact a greater number of needles with this form of shaft than there are decorated needles. It is possible but not certain that all the needles with this form have been used as fastening-pins. Decoration occurs most often on type A needles but is also found sporadically among the other types. The heavy head and the relatively thick shaft correspond poorly to the modern conception of an object suitable for pinning, but such an interpretation should not be denied or rejected on these grounds. Another possibility is that these needles were used as styli, for writing on waxed tablets. Even though we cannot point to any definite or particular use, it must be regarded as most unlikely that the needles with the extremely wide heads, such as the bone A2 needles, have been used as textile equipment. That they could belong to a woman's possessions is shown by the fact that one of them has the inscription «Sigrid owns me» in runes.

The analysis of the needles from Bryggen does not provide a final answer to the question of functions, but it has pointed out probable connections between different areas of use and certain types of needles or their features. There is, however, hardly ever any definite connection between a certain type and a certain function. As we have seen, one type may cover several areas of use, depending on the size and details of its shape. Similarly one kind of use may be covered by several types of needles.

We may conclude that the larger part of the bone/antler and wooden needles are probably connected with textile working such as sewing, single-needle knitting, netting, weaving and spinning. Moreover some of the needles may have been used as bodkins or awls and a lesser number as fastening-pins. There is little point in trying to arrive at an exact number for the needles used in one particular way or other, since the areas of use may overlap both with regard to size and type.

CHAPTER V
EQUIPMENT FOR SEWING

All types of equipment necessary for ordinary stitching and sewing are represented among the Bryggen finds: sewing-needles and pins made of metal, thimbles and scissors of various shapes and sizes. In addition there are groups of objects functionally associated with these items: needle-cases, scissor-cases and hones or whetstones for sharpening needles and scissors.

1 Metal pins and needles from Bryggen

Among the Bryggen finds there are in all 59 complete and incomplete pins and needles made of metal which can be associated with textile work. There are sewing-needles of various degrees of fineness and pins with heads (fig V. 1). Garment fastening pins are not included.

This group of objects includes a high proportion of fragments. In nineteen cases only the shaft has survived and it is not possible to determine whether these have been needles or pins. Sewing-needles, nevertheless, are in the majority with 33 examples (table V.1).

1.1 Sewing-needles

The group is small and the variations in shape are so few that there is little point in dividing the material into types (fig V. 1). The variations in shape concern the head-end, which may be evenly rounded, straight or have sloping corners. Common for them all is that the end is flattened. The length, the thickness, the width of the head and the shape of the eye are the most important features for diagnosing the function.

The length of the complete sewing-needles varies from 47 to 105mm and the width of the head from 2 to 3.5mm.

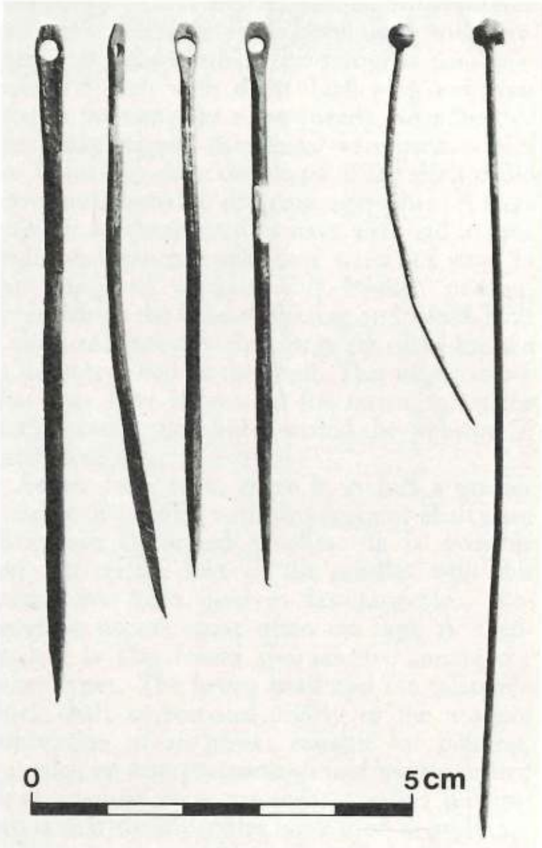


Fig V.1 Metal pins and needles from Bryggen (nos 1691/01-04, 1692/01-02)

TABLE V.1 METAL PINS AND NEEDLES FROM BRYGGEN: DISTRIBUTION ACCORDING TO FUNCTION AND CONDITION

Condition	Sewing-needles	Pins	Annular-headed pins	Unident. pins/needles	Total
Complete	15	5	1		21
Head broken but eye present	17				17
Point broken	1		1		2
Head and point broken				19	19
Total	33	5	2	19	59

TABLE V.2 METAL PINS AND NEEDLES FROM BRYGGEN: SIZE OF COMPLETE EXAMPLES (in mm)

Width of head	Round eye				Elongated eye				Total
	2–	2.5	3	–3.5	2–	2.5	3	–3.5	
Length									
< 50	1								1
0.01-60	1	3							4
60.01-70	1		1				1		3
70.01-80									
80.01-90		2	1			1		1	5
90.01-100							1		1
100.01-1100						1			1
Total	3	5	2	0	0	2	2	1	15

Although the group is small, it appears that the needles with an elongated eye tend to be somewhat longer with a wider head than needles with a round eye.

The needles with broken heads have had a similar distribution with regard to length. The surviving lengths range from 39 to 85mm. Most of these needles (13 in all) have originally been between 55 and 75mm long.

The round eyes measure between 1 and 2mm in diameter, the most frequent being 1.5-2mm. The elongated eyes range from a minimum of 2mm across to a maximum of 7mm.

The needles are made of brass (29 examples) and copper/bronze (1).

They are either solid (27 examples) or made by beating and soldering thin sheets of brass or copper (5). The eye has been made in a flattened end of the shaft. The cross-section of the point as a rule is triangular (27 examples) and sometimes round (5).

1.2 Pins

The five pins which were found vary in length from 43 to 85mm. The upper part of the shaft measures between 0.5 and 1.5mm in diameter. The head is most often small and round, between 2 and 3mm in diameter. One pin, however, has a large facetted head 8-9mm across. The shaft of the pins is either solid (4 examples) or a soldered tube (1). The point is round in section.

The pins are made of brass (4) and bronze (1). The method of production is the same as that used for the needles. The method of making pins and needles from thin sheets of brass or copper rolled into a sylinder and the edges beaten together under heat, was apparently common in the Middle Ages. It is known for example from the site of a medieval needle maker's workshop in Ålborg (Riismøller 1960, 126).

1.3 Pins with annular heads

Two pins were found at Bryggen with heads fashioned as a small open ring. Both are 7.5cm long, but one is slightly damaged at the point. The diameter of the head is 6mm. One pin has small spiral rings around the shaft. They are both made of brass.

1.4 Indeterminate pins and needles

Of the incomplete pins and needles so little has survived that it is not possible to determine the length. The diameter of the shaft corresponds to the sewing-needles, ranging from 1 to 3mm, the commonest being 1.5-2mm. They are made of brass (18 examples), copper (2) and iron (1). Nearly all of them (20) have been manufactured as soldered tubes.

1.5 Function

It is reasonable to assume that the needles with a round eye have been used as ordinary sewing-needles for use with finer thread, while the somewhat larger needles with the elongated eye

TABLE V.3 METAL NEEDLES AND PINS FROM BRYGGEN: DATING (N=59)

Period	Sewing needles	Pins	Annular-headed pins	Indeterterminate pins	Total	%
8	5			9	14	24
7	8			1	9	15
6	5	2	1		8	14
5	1	1			2	3
4	1				1	2
3	2				2	3
2						
Undated	11	2	1	9	23	39
Total	33	5	2	19	59	100

have been used for darning with a coarser thread.

Compared with modern examples the needles from Bryggen lack the finest varieties for sewing and embroidery. Most of the needles have lengths which correspond in size to modern darning and tapestry needles. The pins from Bryggen are also longer than modern pins which range from 22 to 50mm in length and from 0.7 to 1.2mm in thickness.

The function of the pins with annular heads is not known. They may be used as ordinary fastening pins or for stitching coarse textiles. Similar objects have been used in recent times as tapestry needles.

1.6 Dating

The needles and pins were found in layers dated to periods 3-8, ie between 1170 and 1700 (table V.3.).

A large number of the needles and pins (78%) were found in the front part of the northern Bugården tenement. They are remarkably often found together in concentrated groups, but the details of the find-situation are too vague to be able to determine the reasons for this.

2 Scissors and shears from Bryggen

In all 24 complete or parts of iron shears and scissors have been found: 21 shears and 3 scissors with crossing blades pivoted in the middle. Half of them are incomplete with often a half of the object missing. They contain several types and sizes which may reflect different periods and different areas of use.

2.1 Shears

The shears may be divided into three parts:

1) blade or cutting edge 2) handle 3) spring (fig V.2.1). The shape of the blade, particularly at its junction with the handle, has proved to be the most effective criterion for dating the shears (Medieval Catalogue 1940, 153-158) and is therefore used together with the spring for dividing the group into types.

On this basis shears may be divided into two main types. Type A has a flattened, nearly circular spring and an even concave line along the inner side of the junction between blade and handle (9 examples). Type B has a circular spring and a concave inner edge between blade and handle but differs from type A in that the curve ends in a little point at the base of the handle (12 examples).

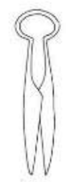
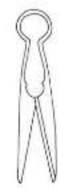
N	TYPE A	TYPE B
		
Complete objects	4	5
Fragments	5	7
∑	9	12

Fig V.2.1 Shears from Bryggen: typology

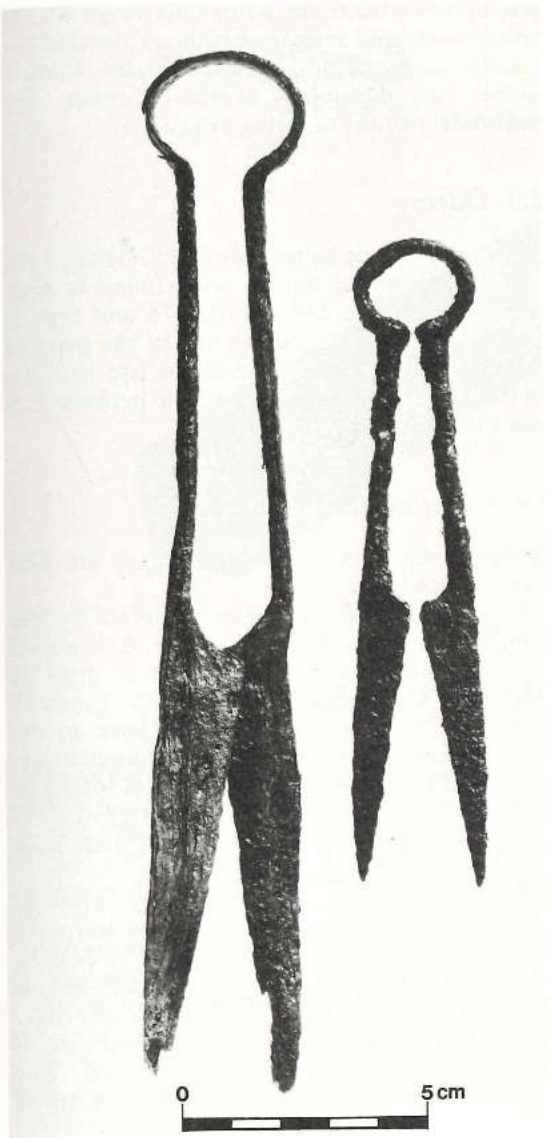


Fig V.2.2 Shears from Bryggen (no. 44961, 1 without no.)

The shears vary in length from 9.3 to 29.5cm, and type B is generally shorter than type A. For all the shears, the handle is somewhat longer than the blade, representing between 51 and 58% of the total. The length of the blade varies from 4.5 to 13.5cm. The width of the blade measured at its widest point is between 1 and 2.5cm. It is usually about one-fifth of the blade-length but both narrower and wider blades occur.

Shears of type A have an oval spring with the longer diameter at right-angles to the shears. Type B on the other hand has a round spring. The size of the spring depends on the size of the shears. The type A shears have springs with external diameters of between 2-2.4 and 4-4.8cm and on type B this varies from 1.7 to 4cm.

The metal band from which the spring is made is rectangular in cross-section, the width varying from 4 to 15mm and the thickness from 2 to 4mm.

With two exceptions the cross-section of the handle is round, between 3 and 7mm in diameter with 4mm as the commonest. The other two have handles with rectangular and trapezoidal cross-sections. Another pair of shears has a small open brass ring fastened round the handle, presumably used for fastening it to a belt for example. Among the Bryggen finds there are four other open brass rings of about the same size and it is therefore likely that these have also once been attached to shears.

2.2 Scissors

There are three examples of scissors with the handles pivotted in the middle. Only one pair is complete, the second pair lacks one of the handles, and only one half of the third pair is present. One pair of scissors (no.3953) has had loop-handles formed by bending the end of each handle in a ring. The others have closed oval rings in the same form and position as modern scissors (fig V.3).

It has been usual to associate medieval scissors of the centrally pivotted type with the textile trade and tailoring (Medieval Catalogue 1940, 151). In England they did not become common in a domestic context until the sixteenth century. There is very little information about them in Norway that early and perhaps shears were the most common.

Scissors were not only used for textile work but also for cutting the hair and beard, for example. In England shears were also used for this purpose (*ibid* 151).

As discussed in chapter 1 (p 25), sheep-shears were rather large, rarely being shorter than

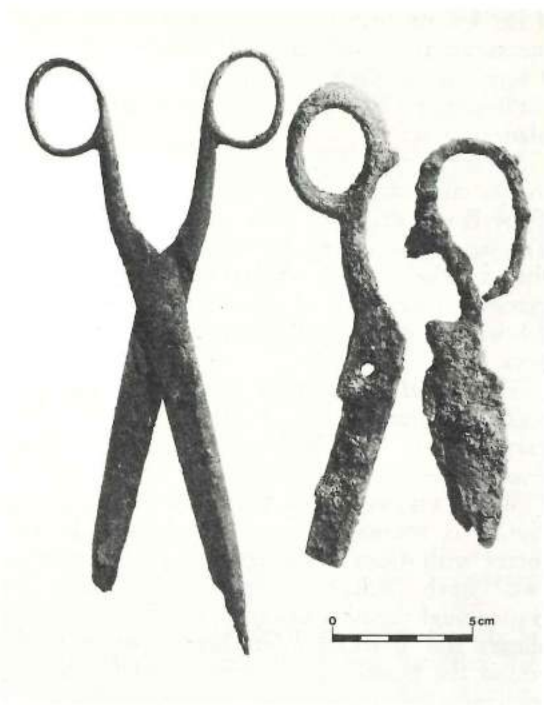


Fig V.3 Scissors from Bryggen (nos 3958, 11706, 5297)

30cm. Among the Bryggen finds there is only one pair large enough to have had this function.

The various sizes probably reflect different areas of use, in more or less the same way as today. Scissors today are categorised according to length. Embroidery scissors for example are 11cm long, household scissors 14 and 16cm, general purpose scissors 21cm, and tailor's scissors 25cm long.

If we compare these categories with the length of the scissors from Bryggen, we will see that most of them are within the range of so-called household scissors which are suitable for a wide variety of non-specialised uses. Only a couple of examples approach either the embroidery or the tailoring categories.

2.3 *Dating*

The shears belong to periods 2 to 8, before 1170 to 1702. Shears of type A were found in contexts from before 1170 until 1476 and type B from 1248 to c 1700. Only one of the pairs of scissors is dated, being found in fire level II, 1476. The brass rings stem from periods 3, 6 and 8 (table V.4).

2.4 *Comparative material*

Shears of the type found at Bryggen are also known elsewhere.

In the Medieval Catalogue published by the London Museum, Bryggen's type A is called type IB and type B corresponds to type II (Medieval Catalogue 1940, 153-57). Types A and B in Norway may be traced back to the tenth century, but type B very seldom occurs so early. In a medieval context type A is known in Europe from the twelfth and thirteenth centuries and type B from c 1250 until c 1500 (*ibid* 155).

Pairs of scissors with centrally pivotted handles are not a medieval invention but were already in use in the Classical World. In Scandinavia the earliest dates from AD 800-850 at Tuna in Sweden, but it is not until the thirteenth and fourteenth centuries that scissors of this kind become rather more common. The comparative material shows that the handles of medieval scissors ended in circular rings placed symmetrically on the axis of the arm, not oval asymmetrical rings like the Bryggen examples. Scissors with loop handles are first recorded in Europe in the early sixteenth century (*ibid* 151-52).

The shears and scissors from Bryggen fit in chronologically with the material from other medieval sites, but may also be extended further forward in time. In the comparative material I have not found anything which compares with the modern type scissors found at Bryggen.

TABLE V.4 SHEARS AND SCISSORS FROM BRYGGEN: DATING (N=28)

Period	Shears A	Shears B	Scissors	Shears-ring	Total
8		1		2	3
7	1		1		2
6	1	2		1	4
5	4	6			10
4		2			2
3				1	1
2	2				2
Undated	1	1	2		4
Total	9	12	3	4	28

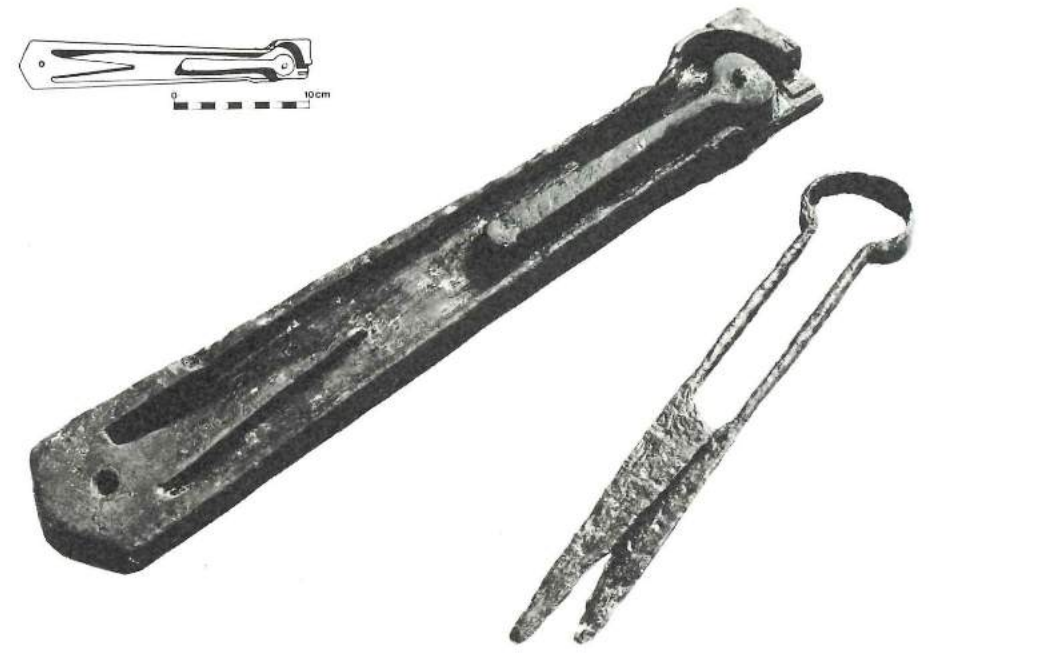


Fig V.4 Shears and shears-case from Bryggen (no. 53438)

3 Shears-case

The Bryggen finds also include a wooden case for holding a pair of shears (fig V.4). It is 25.5cm long, 4.2cm wide at the widest point and 1.3cm thick. The piece of wood has been hollowed out to hold a pair of shears which was 22cm long with a c 4cm wide spring. There is a slight widening in the shape made for the arms which may possibly indicate that it has been made for shears of type B. But as the space for the spring is in the form of a somewhat flattened ring, it is most likely that it held shears of type A. At the upper end of the case, beyond the points of the blade, there is a little hole which may indicate that it could be suspended.

The case belongs to period 3, c 1170-1198 and was found in a building together with other textile implements (see p 121).

4 Thimbles

Among the equipment used for sewing there are four brass thimbles. Three of the thimbles are complete or nearly so, the fourth is broken at the top (fig V.5).

The diameter varies from 1.3 to 1.5cm and the height from 1.4 to 2.3cm. The metal is between 0.5 and 1mm thick.

The Bryggen thimbles correspond more or less to the smallest sizes of modern thimbles whose diameter varies from 1.4 to 1.8cm.

It has been possible to date only two of them and these are both from period 8, ie 1476-1702.

5 Needle-cases with lids

Among the Bryggen finds are a group of small rectangular or sub-oval wooden boxes, hollowed out of a solid piece of wood. The boxes have had lids, usually sliding lids. The shape and size would suggest that they have been used

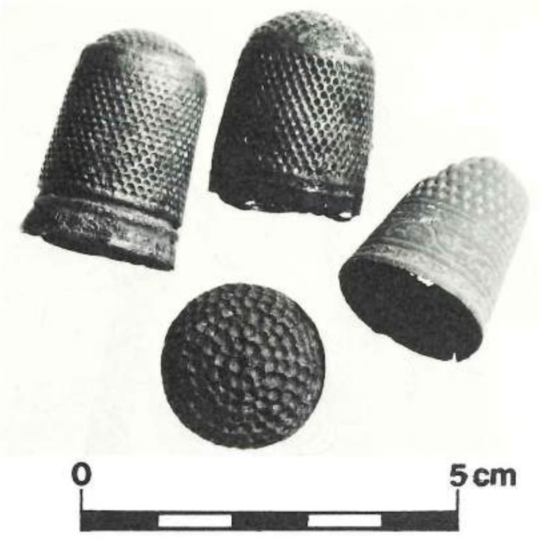


Fig V.5 Thimbles from Bryggen (nos 17684 & 33685 and 2 without nos)

as needle-cases. There are twelve in all, one of which still has its lid (no.30421). In addition there are some lids which must have belonged to similar cases, as well as a wooden cylinder which may also be a needle-case (fig V.6).

5.1 *Needle-cases*

The cases vary somewhat in shape. Ten of them have a single compartment (fig V.6). Two of these are shaped like a hollow trough, one with a rectangular cross-section, the other rounded. Five are oblong with a rectangular cross-section and the other three are rounded at one end. One is decorated with an incised arc and the runic inscription *p b h,* possibly an abbreviation or the initials of a name. Two boxes have two small compartments but as they are very short, it is uncertain whether they have been used as needle-cases.

The single-compartment cases are from 5.7 to 13cm long externally. The two trough-shaped boxes are the largest. There is little difference in size among the remainder, either externally or internally. They may have held objects between 4.2 and 11.7cm in length – between 4.2 and 5.9cm in the majority of cases. The internal lengths of the boxes with two compartments are only 1.5, 2.3 and 3.1cm. The wooden cylinder is also markedly smaller, measuring 3.8 x 2.3 x 1.5cm.

Seven lids were also found, two of which are damaged. Five are rectangular, one has a rounded end and one is so damaged that its original shape cannot be determined. In length they correspond more or less to the boxes or cases, from 5.2cm to 8.1cm in length and 2.4-4.8cm in width.

The cases and lids are made of pine (4), yew (2), birch (2), juniper (2) and bird-cherry (2). Two are in an unspecified hardwood and five are unidentified.

Both the cases and the lids show that they may have held objects matching the sizes of the metal needles and pins which have been found at Bryggen. As we have seen they vary between 4.3 and 10.5cm in length. It is therefore likely that these wooden containers have been used as needle-cases. The smallest have probably held small sewing-needles and pins, while the largest could have been used for the larger needles with an elongated eye.

The cases and lids come from layers which may be associated with periods 2 to 6, ie c 1170 to c 1413 (table V.5).

The needle-cases which have been found in graves of the Late Post-Roman Iron Age have a different shape and are made from different material than the Bryggen examples. They are often in bronze, occasionally iron or bone. As a rule they are cylindrical with a lid at one end

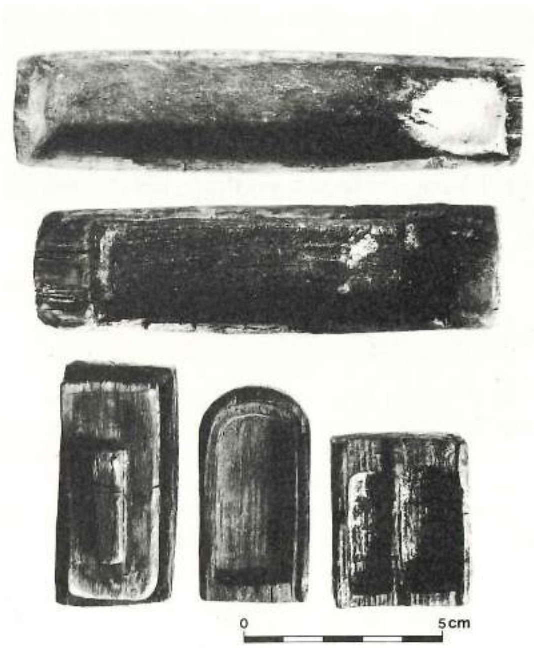


Fig V.6 Needle-cases from Bryggen (nos 30816, 11707, 11723, 1 without no., 10576)

TABLE V.5 POSSIBLE NEEDLE-CASES FROM BRYGGEN: DATING (N=19)

Period	Cases	Lids	Total
8			
7			
6	1	1	2
5	4	2	6
4	1	1	2
3	2	2	4
2	4		4
Undated		1	1
Total	12	7	19

and often have a ring on the lid or in the middle of the case so that they could hang (Slomann, KLNM XII 423-24).

5.2 *Cylindrical needle-cases*

Three lathe-turned cylindrical objects found at Bryggen have probably been used as needle-cases (fig V.7). Similar objects found in Sweden and in the Germanic area have also been interpreted in this way (Geijer 1938, Tafel 39, Hensel 1965, 209).

None of the possible needle-cases from Bryggen are complete, since they all lack lids. The length varies from 6.8 to 9.6cm, externally and 4.5 to 6.8cm internally. The internal diameter varies from 0.5 to 0.65cm. Two of them have been made of box-wood (Buxus) and the third is unidentified. They were found in layers dated to Periods 3, 4 and 8, ie 1170-1248 and 1476-1762.

6 Whetstones for needles and scissors

For sharpening metal needles, shear-blades, etc, small schist hones are used, often with a hole at the end so that they may be suspended. They may be rectangular or rounded and may vary from 5 to 13.4cm in length and from 0.7 to 3cm in width (Slomann, KLNM XII, 424).

Of the 1295 complete or broken whetstones found at Bryggen, 46 or 3.5% stand out by reason of their small size, less than 15cm long originally and under 2.2cm wide. These hones must therefore have been used to sharpen relatively small objects, such as needles, shears and scissors, and possibly other objects such as small knives, fishing equipment, etc. It has

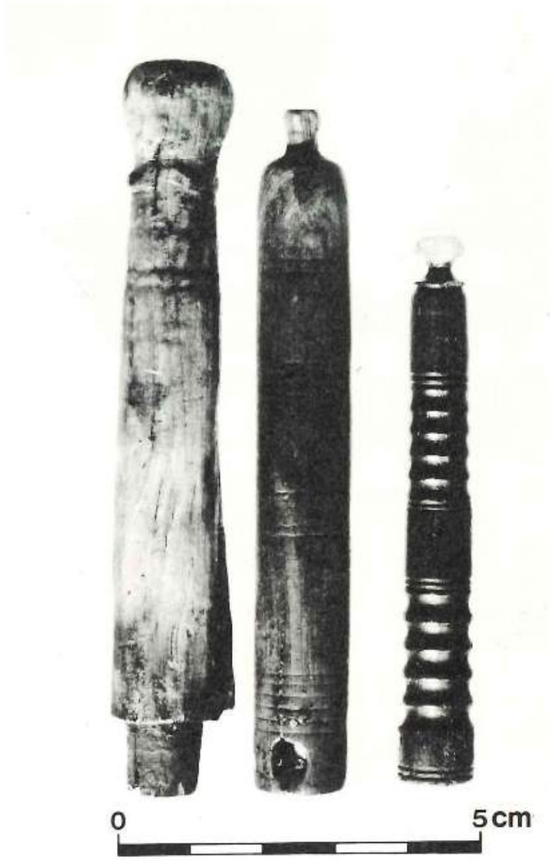


Fig V.7 Possible needle-cases from Bryggen (nos 33375, 31807, 44817)

been usual to classify the smallest whetstones as needle-hones (Norw *nålebryne*), but strictly speaking this should only be the case when there are obvious traces of wear from needle-points.

On the other hand it is impossible to distinguish between the marks left from sharpening knives and scissors or shears. The small hones may therefore have had a wider area of use than just for the sharpening of needles and scissors. That they have at least been used in this way is the reason for including them here (fig V.8).

Seventeen of the 46 hones are complete or nearly so, at the most lacking a small chip at the end. Of the fragments, 21 are end-pieces, and 8 are from the middle part.

The hones are overwhelmingly made from two types of schist (90%). The commonest (28) is a blue-grey fine-grained schist with muscovite quartz. Reddish varieties also occur. A

Fig V.8 Small hones from Bryggen (nos 16481, 46625, 85542, 85245, 3032)

lighter type – a silver-grey fine-grained muscovite quartzite – has been used in fifteen cases. The two types may be distinguished on the basis of colour and fineness of grain.

In the 17 measurable cases the original length varies between 4.4 and 12cm with 8.4cm as the average. The fragments are from 2.1 to 14.5cm long, with 6.7 as the average. The commonest lengths have been between 6.6 and 9.5cm. It also shows that the broken fragments are relatively large.

The maximum widths vary from 0.8 to 2.2cm with an average of 1.4cm. The thickness varies from 0.4 to 1.3 with an average of 0.85cm.

In cross-section the majority (42 examples) are rectangular, either quite regular (29) or somewhat irregular (13). Three hones are triangular in cross-section and one is round.

In long-section about half the hones have two sides which converge or diverge and for slightly less than half they are straight and parallel. The rest have either curving sides (concave-convex or vice versa) or are flat. The other two long sides on the other hand are most often straight and parallel with flat surfaces.

The curving surfaces are due to the way the hones have been used, but also the hones with flat surfaces may have traces of wear, though less marked. Most usually the broad side shows such traces.

All the hones have a flattened sharpening face, showing that they have been used for sharpening a flat object, such as a knife or a pair of scissors or shears. Six of the hones have in addition small grooves which may be the result of sharpening needle-points or fishing-hooks.

Most of the hones have straight or slightly rounded ends and five of them have a little hole, 2-4mm in diameter, so that they may hang. In addition, three hones have unfinished holes which have been started from both sides.

Forty-three of the hones are dated and belong to all periods from 2 to 7, c 1170 to 1702 (see table X.1).

7 Summary

Altogether there are 159 objects or fragments of objects from Bryggen which bear witness to various forms of sewing. Metal needles and pins make up the largest group with 59 items. There are also shears and scissors (28 items), possible needle-cases (22), thimbles (4) and a case for holding a pair of shears. Less securely associated with this range of activities are the 46 small hones.

The dating of these items shows a rather different pattern from the other textile equipment analyzed with the later periods 6-8, 1413-1702, more strongly represented.

TABLE V.6 SMALL HONES FROM BRYGGEN: RAW MATERIAL (N=46)

Raw material	Whole	Frags	Total	Weight(g) Whole	Frags	Average wt(g) Whole	Frags
Dark schist	9	18	27	163	282	18.1	14.8
Light «		14	14		237		15.8
Other	2	3	5	66	64	33	21.8
Total	11	35	46	229	583	20.8	15.7

CHAPTER VI
EQUIPMENT FOR FINISHING AND MAINTENANCE OF TEXTILES

1 Types of equipment

The final stages in the production of textiles – that is the treatment of the cloth after weaving – involve various processes such as fulling, raising the nap, clipping the pile, dyeing, washing and smoothing the product. The different processes required different equipment, but evidence of these processes is almost entirely lacking in the archaeological material. Right from Classical times, woollen cloth was fulled or felted in large water-vats where it was subjected to treading with the feet. In this way particles of dirt were loosened, at the same time as the cloth shrank and became felted and thickened. The commonest cleansing agent was human urine, the ammonia content of which combined with the fatty substances in the wool and produced a soap-like compound (Wild 1970, 82-84). When the fulling process was completed, the cloth was washed in a vat or a stream and then beaten with sticks to increase the adhesion of the constituent fibres (Singer and Holmyard 1956, 215). The cloth was then hung up to dry. Linen was stretched out and allowed to bleach naturally.

Woollen cloth was then brushed to raise the nap. This was often achieved by hanging the still damp fabric over horizontal beams and brushing it either with a brush or with an object resembling a wool-carder, consisting of teazles mounted on a wooden frame. Uneven pile or nap was then trimmed off by clipping or cropping the cloth with wide-bladed shears leaving a smooth surface. The only pair of cropping shears known from prehistoric times are from the Roman period and were 132cm long (Wild 1972, 17). Similar shears were probably also used in the Middle Ages.

The subsequent care and treatment of the fabric, such as washing and smoothing also demanded special equipment to a certain extent.

For washing a beater or paddle (Norw *banketre)* was used to beat the fabric.

Ethnological records have shown that the old methods of smoothing fabric have been used in Norway right up to the last few years and that these methods have traditions in the prehistoric and medieval material.

Among the items which were used for smoothing cloth were cows' jawbones, boars' tusks and bone needles. The newly-washed fabric was laid directly on a plain wooden board. The cow's jawbone was used for large areas, the boar's tusk for the hems and finally the holes in the drawn-work were gone over with the bone needle (Noss 1965, 97). Finer linen and the seams in newly sewn clothes were pressed or smoothed with linensmoothers or linen-rubbers made of glass or stone. The result was a smooth, hard and shiny surface (*ibid*, 103).

2 Equipment for finishing and maintenance of textiles from Bryggen

As mentioned in the Introduction (p14), there was a group of craftsmen in medieval Bergen known as *klipparar* (shearmen or croppers). It is not clear whether they were employed in cropping the nap or whether they were clothiers and tailors, as some have suggested (Hoffmann, KLNM XIII, 61-62). Croppers or shearmen are known in both Denmark and Sweden in the Middle Ages (KLNM, 62-63), where they mostly handled imported unfinished cloth. In Sweden the documentary sources indicate that they were in fact cropper and clothier combined (Kjellberg 1943, 53). The shearmen in Bergen were to be paid according to how many ells of cloth they cut. This fact indicates that they were more than retailers selling small quantities of linen and cloth. The presence of shearmen in town indicates that also unfinished cloth was imported.

It is reasonable to assume that the shearmen in Bergen had a similar dual function, but unfortunately no evidence for this group of craftsmen has been found among the excavated material from Bryggen. There are in fact no identified remains of any equipment for finishing among the finds. The only items that have been found are those that might be con-

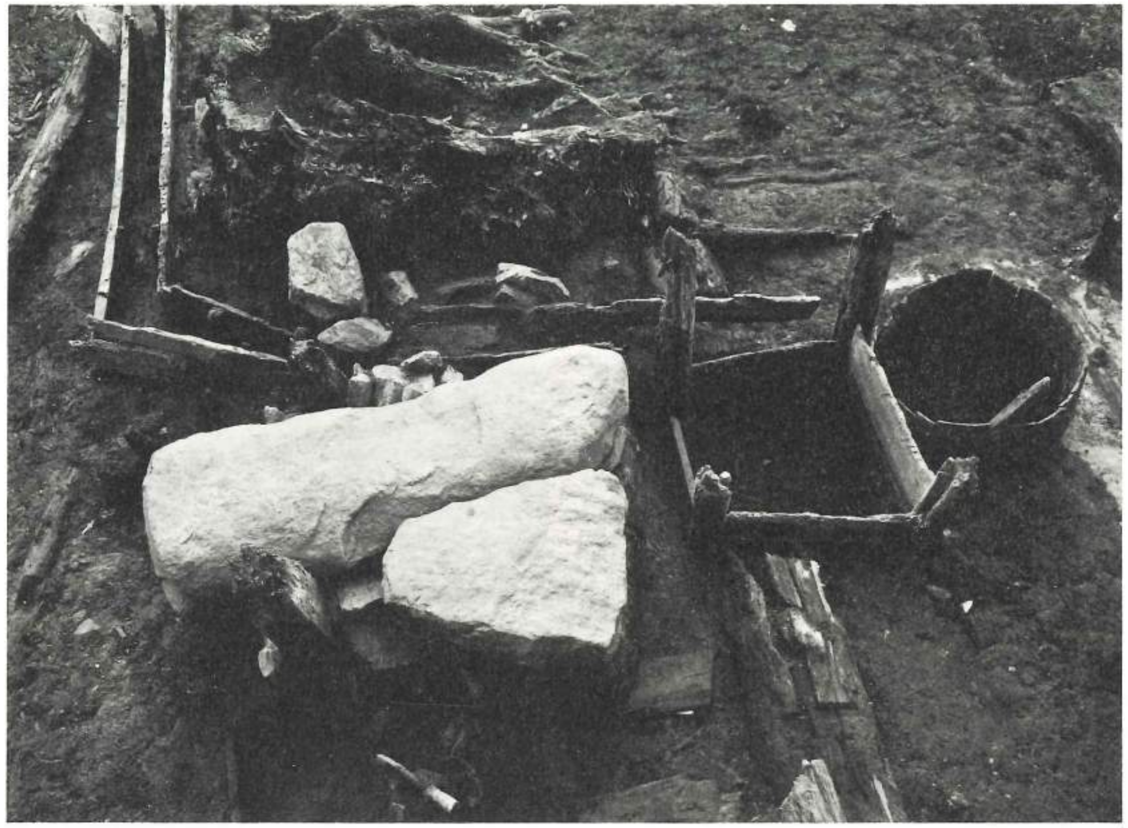


Fig VI.1 Washing place at Bryggen from the period 1476-1702

nected with the care and maintenance of textiles, such as washing paddles and linen-smoothers.

As discussed in chapter I, some of the beaters described as possible flax-beaters may have been used as paddles for laundering (cf p 29). During the excavations a special washing place was uncovered at Bryggen and some of the beaters or paddles may have been used here. It consisted of two wells, one of them a sunken barrel and a flagstone for washing or beating. A drain ran from one of the wells to the sewer in the adjacent passage and the trunk of a beech tree completes this vivid situation from the past (fig VI.1). The laundering place is dated to period VII, ie 1476-1702 (Herteig 1970, 123).

For smoothing the seams in linen, from at least the Merovingian period, spherical or hemispherical balls of glass or stone were used, often with a flat base and a high domed upper half. Glass linen-smoothers are between 6.5 and 7.8cm in diameter, but stone ones can be smaller, as little as 5.2cm (Petersen 1952, 228-29).

At Bryggen fifteen round flat stones of comparable size were found, which may therefore have been used as linen-smoothers (fig VI.2). They are of various shapes: 1) spherical 2) oval 3) a flattened sphere 4) a flattened oval. They have been made from various types of stone.

The stones are relatively similar with regard to their maximum diameter, from 6.4 to 10.6cm. They were found in layers which are dated to periods 3 to 7, 1170 to 1476. (See table X.1 p 140).

To what extent cows' jawbones and boars' tusks occur has not been especially investigated. Anne Karin Hufthammer's analysis of the osteological material from Bryggen will provide this information in due course (Hufthammer in prep). Bone needles of type E are more or less identical with the bone needles which were used to work over the holes in drawn-work and hemstitch (Noss 1976).

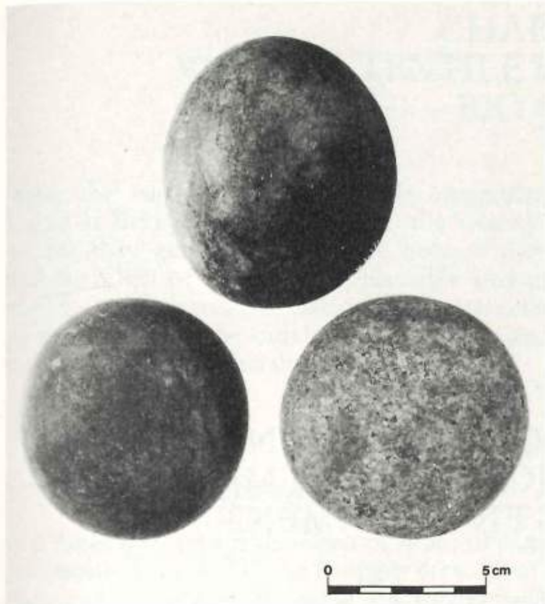


Fig VI.2 Possible linen-smoothers from Bryggen (nos 41983, 84966, 6042)

All in all the evidence at Bryggen for the finishing stages in textile production is extremely limited and insecure. As far as it goes it points to the more ordinary processes in the handling of cloth and linen, such as washing and smoothing, while equipment connected with the more complicated processes is lacking.

General conclusions, Part I

The main aim of the preceding analysis of objects has been to obtain a general view of the whole range of certain, probable and possible tools and items of equipment found at Bryggen connected with the production of textiles. With this in mind, we have attempted to identify objects as textile equipment and to record and classify types and sizes in order to be able to consider the question of function in greater detail. By help of the local fire chronology at Bryggen we have also considered the dating of the various categories and types of tools and pieces of equipment. To some extent attention has also been drawn to the location of the objects on the site in order to throw light on the question of function.

The analysis of finds has shown that the material from Bryggen includes a relatively rich and varied collection of items connected with the production of textiles, totalling 1928 objects or parts of objects. The largest group consists of spinning and weaving equipment (70%). Items connected with various types of sewing and stitching are fairly numerous. On the other hand the number of objects associated with the preparation of the raw material and with the finishing stages of production and treatment of the products is much more limited. It now remains to be seen where, when, how and to what extent the equipment has been used at Bryggen. These questions will be discussed in part II.

PART II
TEXTILE WORKING AT BRYGGEN
INTERPRETING THE EVIDENCE AS THE REMAINS OF A TEXTILE-WORKING ENVIRONMENT

CHAPTER VII
WAS THE TEXTILE EQUIPMENT USED AT BRYGGEN?

Were the various items of textile equipment found at Bryggen used there or in the vicinity, or did they get there by chance because they had been lost or discarded? A plausible answer to this question will increase our understanding of the nature of the buildings at Bryggen and the activities carried on there.

1 Complete and damaged objects

It is natural to regard damaged or worn objects as rubbish discarded in the Bryggen area. Complete and usable objects on the other hand have most likely been mislaid or lost by chance.

It may be admitted that it is not always possible to determine whether damage occurred during use or after the object was lost. Still, damaged objects are in general best explained as thrown away because they were no longer fit for use. This is particularly so with items made of organic material. In the case of objects made of stone, however, we must take into consideration the fact that the damage in many instances was caused by exposure to high temperatures. Finds in fire-layers form a separate category: objects might either become damaged or lost while still usable.

One third of the analysed material is damaged in some way or other. Table VII.1 shows that the wooden objects have suffered most. Damaged items within the different groups of wooden objects usually come to more than 50%. The table exclusively contains objects interpreted as possible textile implements or parts of such. Items discussed in Part I and found unconvincing as textile implements are not included.

The number of complete objects is quite high, 1247 in all or 65% (table VII.1). Particularly spindle-whorls, warp-weights and needles were found complete. These objects have probably been lost within the area. The nature of the finds-location may often provide further information about how this may have happened.

2 Nature of finds-location

2.1 *The relationship between the finds and structures*

In general far more objects made of organic than of inorganic material were found associated with the wharf-foundations in the front part of the site, in the thick layers of make-up which cannot be related to specific constructions. On the average about 2/3 of the organic objects associated with textile working were found in this sort of context. The objects of stone and other inorganic material have a different distribution. They were found more often in buildings or their foundations (a good 40%) and in roads, passages etc (c 15%).

The uneven distribution of organic and inorganic objects obviously has some connection with conditions of preservation as we have discussed earlier. Of the spindle-whorls, for example, 45% of those made from inorganic raw material were found in association with buildings, while of those made from organic material only 16% were found in this context. On the other hand 63% of all the wooden spindle-whorls were found among the timber foundations and unspecified back-fill. A large part of the material, particularly the organic objects, were in other words found in contexts which provide little direct information about the place where they had been used.

The much smaller number of finds of bone and wooden objects in buildings and roads, passages, etc must be ascribed due to the fact that such objects would have been destroyed in the fires, unlike those of stone and metal. But the natural processes of decay will also have contributed.

2.2 *Finds in fire-layers*

Finds in fire-layers very largely represent finds *in situ*. In other words they directly reflect a working environment and are consequently of particular interest. The types of objects found in the fire-layers will give a good indication of the function of the burnt buildings. Recon-

TABLE VII.1 CONDITION OF THE FINDS

Type	Complete	Damaged	Unfinished	Total
Possible flax beaters	21	1		22
Possible flax-combs	8	23	2	33
Distaffs	1	5		6
Drop-spindles	8	23		31
Possible drop-spindles	6	23		29
Spindle-whorls	284	79	47	410
Winding equipment	8	4		12
Possible loom-upright		1		1
Possible warp-weights	555	237		792
Possible sword-beaters	3	9		12
Possible heddle-horses	1			1
Possible pulleys	1	2		3
Possible winding pins	2			2
Paddles	3	6		9
Possible reed-hooks	6	2		8
Heddle-frames	1	1		2
Possible band-loom shuttle		1		1
Knife-beaters	6			6
Weaving tablets	2			2
Possible shuttles	8			8
Small beaters	9	11		20
Wooden/bone pins & needles, possibly used in textile work	226	116		342
Netting needles	1		1	2
Metal pins and needles	21	38		59
Shears, scissors, shearcases and rings	11	17		28
Thimbles	3	1		4
Needle-cases	15			15
Needle-case lids	5	2		7
Hones	17	29		46
Linen-smoothers	15			15
Total	1247	631	50	1928

struction work on the site following a fire has often led to disturbance of the deposits, and fire-damaged objects have ended up somewhat above or below the fire-layer itself. Accordingly the number of objects actually found in the fire-layer represents a minimum number of items present at the time of the fire.

Of the total number of objects or fragments of objects associated with textile working, 9% were found actually in a fire-layer. They are mostly objects made of inorganic material, but objects of organic material occasionally occur. Of the loom-weights, 171 or 22% of the total were found in fire-layers. Most of them bear the evidence for this, such as deposits of soot, exfoliation or shattering (see Askvik, Appendix, p 148).

A further 115 weights, not found in direct association with fire-layers, have also been exposed to heat. As a rule these were found just above or below a fire-layer and therefore probably belong to the disturbed fire-layer. In other words at least 286 weights or 36% have been affected by fire. Of the spindle-whorls only 25 were actually found in a fire-layer, 19 of stone, 4 of clay, 1 of metal and 1 of wood, representing only 6% of the total number of spindle-whorls or 9% of the stone spindle-whorls.

Most of the finds in the fire-layers were located in buildings. Furthermore, about 35%

of all the objects found in association with buildings came from fire-layers. We shall now consider whether definite patterns in space and time are discernible in the distribution.

2.3 *Burnt buildings containing finds associated with textile working*

As mentioned in the Introduction, the excavated site covered at least seven or eight medieval tenements: Gullskoen, Sveinsgard, Miklagard, Atlegard/Oddsgard(?), Søstergard, Engelgard and Bugard (see p 15). The lay-out of the tenements in the southern part of the site, Bugard, Engelgard and Søstergard, apparently remained quite stable throughout the different periods, each with a double row of buildings sharing a central passage. The area later occupied by the Gullskoen tenement, however, comprised as many as six building-rows, belonging to three to four in the Middle Ages: Gullskoen, Sveinsgard, Miklagard and Atlegard/Oddsgard (?) (Herteig, in prep). Over the whole site 413 individual buildings have been identified, among those 364 buildings between periods 2 and 8. It is possible to tie the majority of the buildings to one of the tenements mentioned, either as rooms or as separate buildings within the tenement.

When examining the remains of textile equipment found in buildings destroyed by fire it is important to establish which buildings are contemporary. I have been able to make use of Herteig's current work on the chronology of the site, including information about the various building phases. Of the 364 buildings from between period 2 and 8, 230 (63%) are burnt, and it is possible to establish contemporary situations from period to period.

By considering the various contexts where textile equipment has been found in association with burnt buildings period by period, it is possible to locate with greater certainty buildings and areas where textile working has been carried on. By doing this we shall also take into consideration the finds from above and below the fire-layers in the same buildings, even though these cannot to the same degree of certainty be associated with activities within the buildings, as one can never be sure that they were not introduced with material for levelling up the site. Nevertheless, there is a relatively good chance that they reflect activities carried on in the building itself, especially in the rear part of the site where the occupation layers are mostly due to accumulation. The greater the chronological conformity between finds in the fire-layer and objects found generally within the building, the greater the probability of being correct in interpreting them as the result of activities carried on there. Care must be taken not to draw over-confident conclusions, but the greater the number of secure finds of textile equipment of various types within a building, the more secure the conclusion. Too much significance should not be placed on single or a few finds from certain groups. Still, some types of objects are more suggestive than others. For instance a single find of a spindle-whorl must be considered more significant than a single warp-weight or a wooden or bone pin.

Period 2 (before 1170/71)

In the fire-layer of four of the 23 buildings recorded as burnt in fire VII (1170/71), nos 66, 42, 484 and 203, objects regarded as textile equipment were found (fig VII.1). In building 66, a stave construction with open corners, standing in the north-eastern part of the site, c

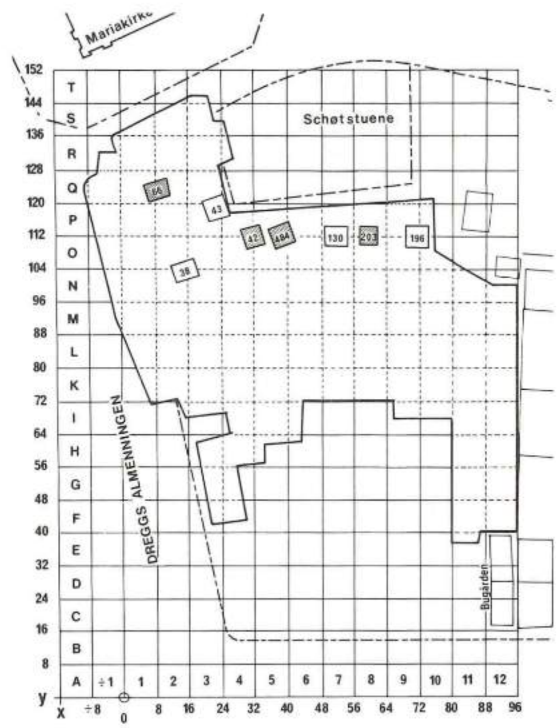


Fig VII.1 Buildings containing finds associated with textile working, period 2 (before 1170/71). Buildings with in situ-finds in five layers are hatched

Fig VII.2 Finds of textile equipment in the fire layers in building 42

30m behind the original shore-line, there were two weights of type B (nos 75280 and 75281), one of which was incised with a cross. In addition a large amount of pottery was found in the fire-layer. On account of the open corners this building has been interpreted as a store-shed (Herteig 1976, 15). It can hardly be associated with textile production, particularly as the weights could also have served as a net-weights.

In the south-west and south-east corners of building 42 in the Søstergard tenement a group of five weight (group XVIII, table III.8.1) and two spindle-whorls (no.64396 & 65009) were found. The fire-layer also contained sherds of coarse shelly ware and fragments of griddle-stones.

In the neighbouring building, no.484, on the southern side of the passage, 23 weights were found, 20 of which lay in a group (group IV, table III.8.1). Four of these lay just under the fire-layer, but from their position it is reasonable to conclude that they belonged to the others. The 20 weights were found in a relatively limited area, c 2x1.6m, in the western part of the building. The others lay more scattered, mainly in the north-eastern part of the building. By the north wall adjacent to the street was found a pair of shears (no.44653) and a stone spindle-whorl (no.44667). A possible linen-smoother (no. 44766) was also found in the fire layer. Among the other contemporary finds in the same building were sherds of an unglazed cooking-pot, a steatite cresset-lamp, keys and a twisted iron handle.

In building 203 in the Engelgard tenement three weights were found in the fire-layer in a line along the north wall, one type C, one type D and one too fragmentary to identify. One of them was decorated with a cross. Pottery was also found here as well as a wooden platter, wooden skewers and stone griddle fragments just underneath the fire layer. These finds no doubt belong to the period of use for this building.

Period 3 (1170/71-1198)

Of the 32 burnt buildings recorded in this period there are eight buildings containing items of textile equipment in the fire-layers from fire VI in 1198 (fig VII.3): Buildings 236 63, 37, 135, 64, 25, 28 and 137.

The largest collection was found in building 236 in the Bugard tenement, and comprised 26 weights (referred to as group III, see table III.8.1). The building contained a hearth. The weights were concentrated in an area c 90-70cm along what must have been the north wall (see fig VII.3). As discussed earlier (p 66) these are probably the weights from an upright loom *in situ*.

The other buildings containing textile equipment were situated in the northern part of the site, among what were back-buildings.

In building 63 in tenement row 5 in the later Gullskoen tenement five weights were found in the fire-layer in a line along the east wall (group XVI, table III.8.1), and in the same area were several large fragments of griddle-stones.

In the neighbouring building, no. 37, in the same row, lay fiwe weights in a group (group XV, table III.8.1). In addition a steatite spindle-whorl was found (no. 64270/89).

Building 135, in tenement 4 in Gullskoen, contained fifteen weights (group V, table III.8.1), lying partly in and partly under the fire-layer, but presumably all contemporary. Most of them were lying in the middle of the building just over the central floor joist. On the same level as the weights a steatite spindle-whorl (no. 53631) was found. Two bone needles (nos 52397 and 52726) in the fire-layer may also be associated with the activities carried on in this building. In the same area, but underneath the fire-layer, were found two long-toothed combs (nos 53544 and 54009), two wooden type D needles of yew (no. 52939) and juniper (no. 53466), a type F bone needle (no. 53391) and a wooden spindle-whorl (no. 54860). The wooden shears-case (no. 53438) and a possible shuttle (no. 53435) were also found a little below the fire-layer. These objects by all accounts belong to the period of use for this building. Other finds in the building included the top and bottom stones of a hand-quern lying partly over each other against the wall in the south-eastern corner.

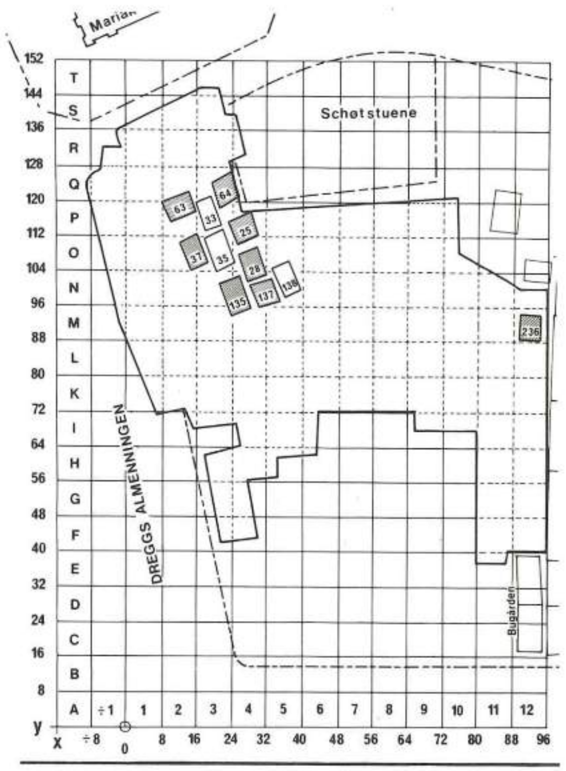


Fig VII.3 Buildings with textile equipment, period 3 (1170/71-1198). Those with in situ-finds in fire-layers are hatched

In the southern row of buildings in the same tenement three contemporary buildings, 64, 25 and 28, contained textile equipment.

Building 64 in the rear part of building-row 3 contained only one weight in the fire-layer (no.73172).

On a level with the remains of the floor in building 25 in the same row lay a steatite spindle-whorl (no.62674) and immediately under the fire-layer and the floor lay a small hone (no.62219) and a type C weight broken in two (nos 62703 and 62704). The building contained an earth-filled bench against all four walls, indicating that it had been a living-room.

Building 28, c 1m to the south in the same row, contained a greenstone spindle-whorl (no. 63860) and a type A wooden needle (no.63441).

Building no.137, in front of building 28, contained an incomplete weight (no. 53630), and a type F wooden needle (no.53624), and small hone (no. 63838) lay just below the fire-layer in the same building. Further back, four weights were found in fire-layer V (nos 63132 and 72733/01-03) and just over the fire-layer

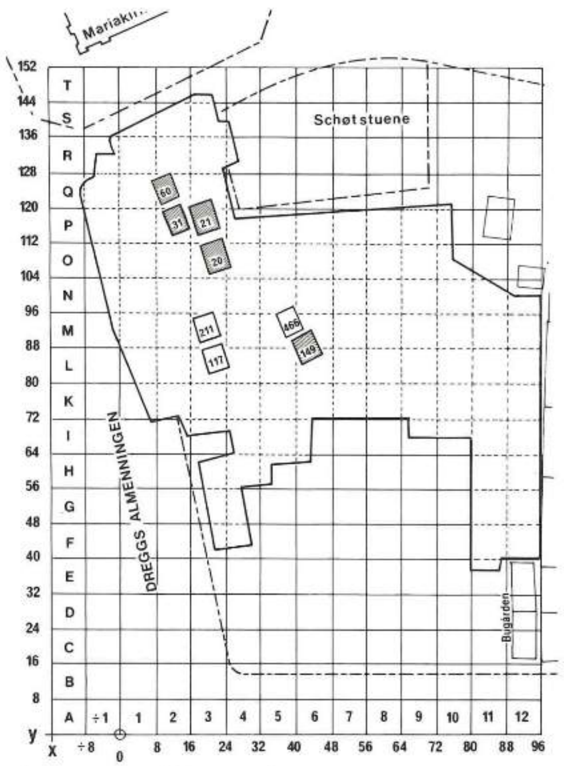


Fig VII.4 Buildings with textile equipment, period 4 (1198- 1248). Those with in site-finds in fire-layers are hatched

yet another weight (no.63437) Which from its position would seem to belong to the others.

Other items of textile equipment lay in fire-layer VI, but without clear association with defined buildings. Underneath building 35 from period 4, one weight of type B (no. 63816) and a spindle-whorl (no. 54592) was found.

Period 4 (1198-1248)

Of the 40 buildings recorded as destroyed in Fire V, the great fire in 1248, five contained items of textile equipment in situ (fig VII.4): buildings 149, 60, 31, 21 and 20.

The largest collection of weights (group II, table III.8.1) was found in building 149 in row 2. There are several indications that the building was in two storeys, possibly with a fire-place in the upper storey. In the south-western corner of the building, within an area c 65x70cm 25 weights were recovered (fig VII.5). They lay in an irregular heap with no clear order. Another weight was found in the northern part of the building. Immediately under the fire-layer lay a long-toothed comb (no. 31987) and a type A bone pin (no.31982).

The other buildings stood in two rows (nos 4 and 5) in what was later the Gullskoen tenement. Building 60 and building 31 stood one behind the other with just a small gap between them in row 5. Weights were found in the fire-layers of both buildings.

In the south-western corner of building 60 two weights (nos 74713 and 74860) were found together with a concentration of partly burnt stone, perhaps the remains of a fireplace, which may even have collapsed from an upper storey.

A single B-type weight (no. 74714) was found in the fire-layer in the south-eastern corner of building 31 which was erected on the site of the earlier building 37, itself containing textile equipment. In the gap between buildings 31 and 60 two more weights were found (nos 74711-12) and under the fire-layer in building 31 thirteen more weights were excavated (group VIII, table III.8.1), probably from the fire and accordingly from the same period. This concentrated group in an area c 1.8x1m in the south-eastern corner of the building would suggest that they have come from a loom in the building. Under the fire layer were two needles, one each of types A and B, made of yew and both 17cm long (nos 72316 and 72709). A type A needle in juniper, 18.2cm long (no. 73065), was found just to the south of the building.

In building 21, in the next row to the south (row 4), only a single weight (no.61674) was found in the fire-layer, but several objects associated with textiles were found immediately over and under the fire-layer and may be contemporary. They were all found in the southern part of the building. In the vicinity of a group of stones under the fire-layer lay two weights (nos 61494 and 61667) of types A and B and two spindle-whorls (nos 61555 & 62254). Over the fire-layer yet another spindle-whorl (no.61318) was found, as well as a fragment of a very worn wooden comb (no.61523) earlier discussed as a possible flax rippling-comb.

The adjacent building, no.20, which had a paved floor, contained one type A weight (no.60545) in the south-western corner of the building. Somewhat below the fire-layer a second weight of the same type (no. 61043) was found in the south-eastern corner and a steatite spindle-whorl of type C (no.61351) was found in about the centre of the room.

In fire-layer V further down in the same row, but in no clear context with defined buildings,

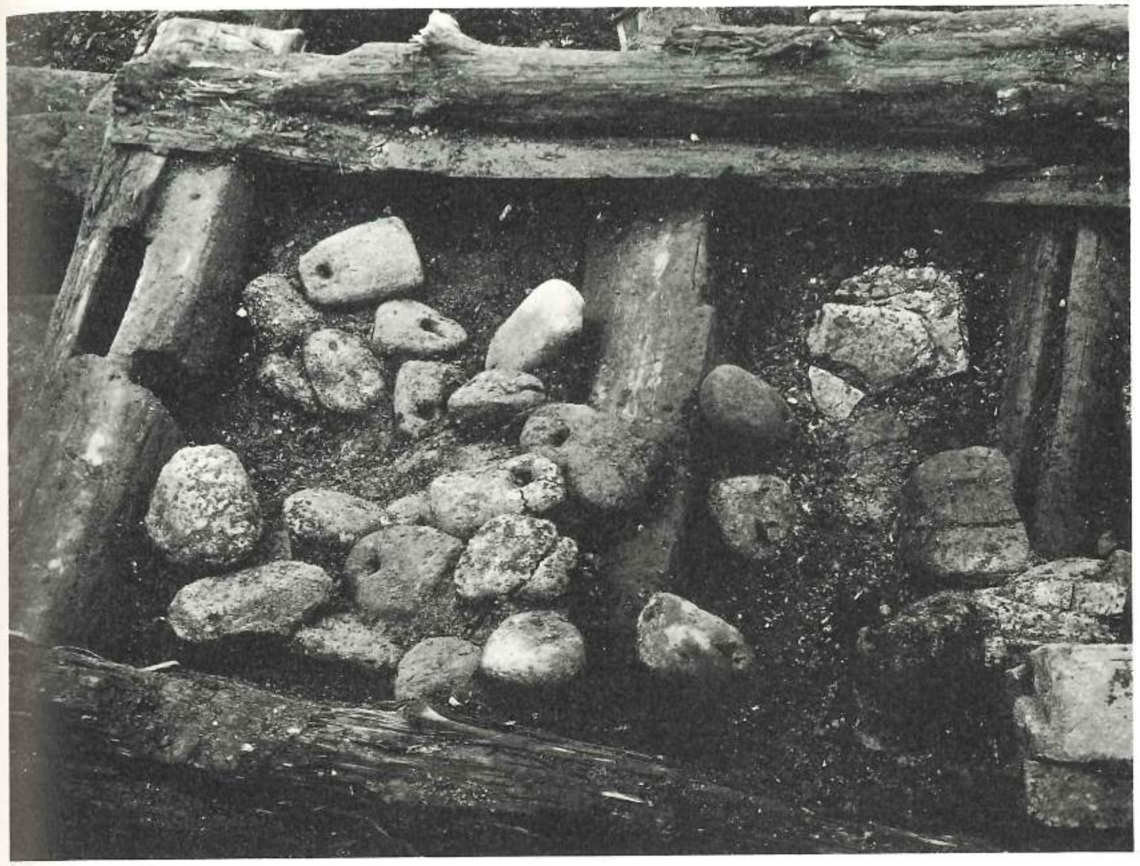


Fig VII.5 In the south-western corner of building 149 25 weights were recovered (group II)

were found a type A weight (no. 52312) with a spindle-whorl (no. 52320) just above it.

A steatite spindle-whorl of type B (no. 52399) was also found in this area but with no clear association with any building.

Period 5 (1248-1332)

Textile equipment was found in eight of the 38 buildings recorded as destroyed in fire IV in 1332: buildings 333, 193, 14, 183, 12, 10, 463 and 212, (fig VII.6). A large group of weights was also found in one of the passages and it is not impossible that these have come from a building (no. 86 or 87) which collapsed in the fire.

The largest collection of objects was found in building 333 in the Bugard tenement. Altogether thirty weights were found in the fire-layer in the northern part of the house, in a group lying north-south (group I, table III.8.1). A type A spindle-whorl (no.6516) and a small hone broken in two (no.6529) were also found here. In the passage just south of the building a wooden type F needle was recovered (no.8235).

In building 193, some 20m to the south in the Northern Engelgard tenement, fourteen weights were found (group VII, table III.8.1) some in and some just beneath the fire-layer. The position indicates that they were all contemporaneous. They were found scattered throughout the southern part of the building, but with the majority in the south-eastern corner. Also found were part of a pair of shears (no. 83383) in the fire-layer and a stone spindle-whorl (no. 83424). Other finds which may provide information about the use of this building include fragments of griddle-stones and sherds of pottery and steatite vessels.

Well forward in the passage of the Søstergard tenement between building 87 on the south side and building 86 on the north, 15 weights were

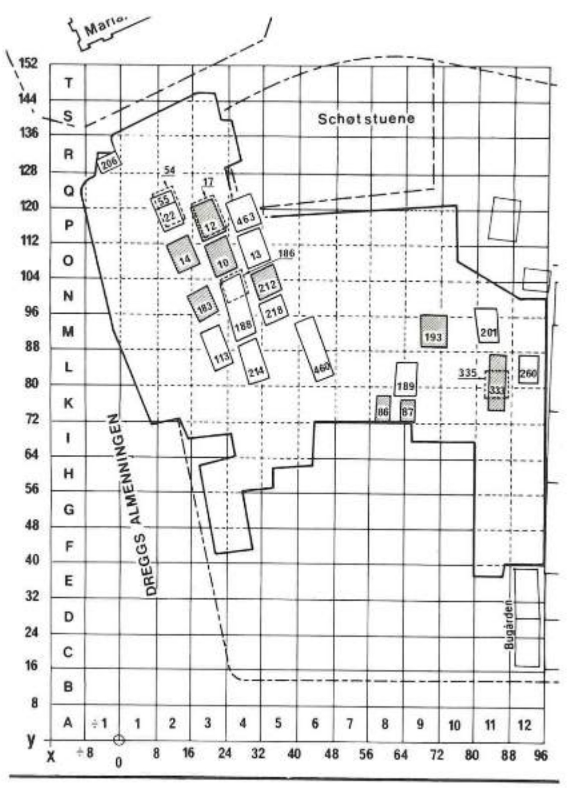


Fig VII.6 Buildings with textile equipment, period 5 (1248-1332). Buildings with in situ-finds in fire-layers are hatched

found (group VI, table III.8.1). Unfortunately the precise location of the finds is not available and it is therefore not possible to ascertain whether they may have come from one of the two burnt buildings here. We have suggested elsewhere (p 66) that it is more likely that the weights have come from a loom rather than a fishing-net.

Building 14, in row 5 in the north eastern part of the site, in what was later the Gullskoen tenement, is another building from this period with indications of weaving. In the northern part of the building a type B weight was found (no. 6050) and just to the east of the building immediately over the fire-layer a type C weight (no. 61826) was recovered. The building also contained two pits which have been placed in association with lime-burning (Herteig, in prep), and this may raise doubts about the building's connection with textile production.

In the fire-layer in building 183 in the same building row was found a greenstone spindle-whorl of type A, and immediately beneath the fire-layer two more spindle-whorls (nos 50375 & 50734) and a weight were recovered.

Building 12 in row 4 south of buildings 14 and 183 had a corner fireplace, surviving as a heap of fire-reddened stones, among which were several spindle-whorls, overlying a greyish, slightly clayey gravel layer against the south wall in the western half of the building. Just under the fire-layer a pair of shears (no.60036) was found and another pair (no.60293) lay in the fire-layer outside the north wall. Under the fire-layer within the building were a steatite spindle-whorl (no. 70924) and a weight (no. 70103) which may all have been connected with activities carried on in the building. It is less certain whether a clay spindle-whorl (no. 60082) found just south of the building could also have come from this house.

Building 10 stood wall-to-wall with building 12, and just inside its east wall a steatite spindle-whorl of type C (no.59739) was found in the fire-layer. In the southern part of the building

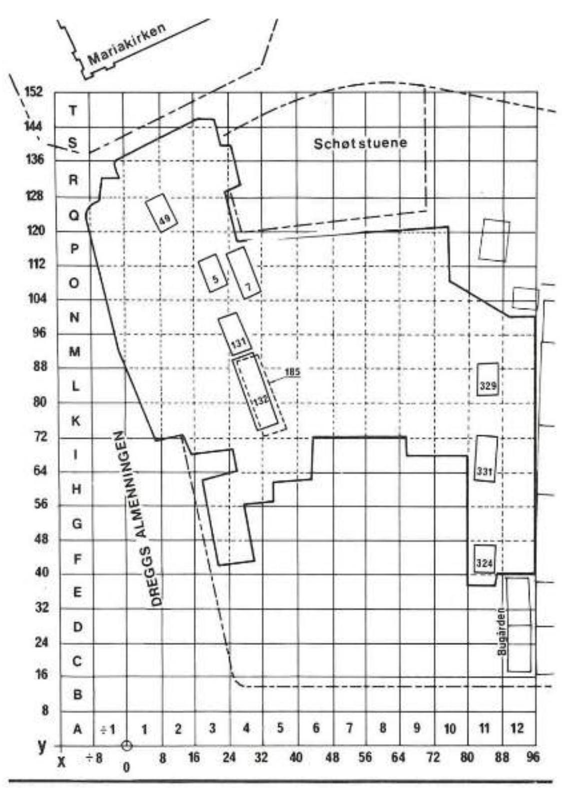


Fig VII.7 Buildings with textile equipment (period 6, 1332-1413), see 128

there was a large collection of stones which has been interpreted as the possible remains of a collapsed fireplace in the building's upper storey. Any objects from this floor can therefore be expected to be scattered over a wide area, even outside the limits of the building. In the gap along the east side of the building two more spindle-whorls were recovered, both type A (no.60512). A fourth spindle-whorl of type F (no. 60016) lay further west just under the fire-layer, while in the fire-layer itself on the north side of the building five weights were found, three at one end of the building and two at the other. They probably came from a loom which stood in an upstairs room (group XVII, table III.8.1).

In the neighbouring row 3 two other buildings also contained textile equipment, but limited to spindle-whorls. Two, one of which was an unfinished example, were found in building 463 south of building 12 (nos 59140 and 59147) and finally, in building 212, a possible spindle-whorl in steatite of type F was found.

Period 6 (1332-1413)

From fire-level III it has not been possible to demonstrate traces of textile working in the fire-damaged buildings.

Period 7 (1413-1476)

Only five items of textile equipment were found in Fire Level II, ie 1476, only one of which came from a building. A pair of centrally pivotted scissors (no.5297) was found in the western part of building 253 in the Bugard tenement. A bone needle (no.23864) was found in the fire layer in the passage. The location-data for two weights (nos 25658 & 26025) and a spindle-whorl (no.26494) are so imprecise that it is not possible to relate them to any building. Two of the objects are also insecurely related to the fire-chronology, but possibly belong to this fire-layer.

In fire-layer II a weight (no.57419) and a steatite spindle-whorl of type E (no.56294) were found near buildings 1 and 3 respectively, but they cannot be directly related to the use of these buildings which must pre-date them as they were already destroyed in Fire III.

Period 8 (1476-1702)

Altogether three implements connected with textiles were found in the fire-layer of 1702, none of them coming directly from buildings.

As well as the two weights mentioned above which may belong to period 8, a weight of type A (no. 25292) was found unrelated to any construction.

Summary

The examination of textile equipment found in the actual fire-layers has demonstrated that the finds were lying to a great extent inside buildings. This, and the fact that there were often several objects lying together, warrant the conclusion that they do actually reflect a working environment in most cases. The analysis has further shown that the fire-layers were so disturbed that finds from the fire may also be lying a little below or above the actual fire-layer. This is more easily demonstrated when it involved stone objects which were heat-damaged (cf Askvik, Appendix), but any conclusions from such find-contexts concerning the contemporary situation are less certain than those based on objects found directly in the fire-layers.

In all there are 264 objects identified as textile implements, which can be connected with the actual use of buildings. In other words there is evidence for a definite textile environment in certain areas of Bryggen over a relatively long span of time. In the oldest period, before 1170/71, there are indications of textile working in at least three perhaps four of the buildings, ie in 14% of the total number of buildings recorded as affected by the fire. The evidence is not entirely clear, but two or perhaps three of the buildings should be regarded as most likely burnt in the fire.

In the following three periods from 1170 to 1332 the traces of textile production are even clearer. From each period there are respectively eight, five and nine buildings with textile equipment in the fire-layers. The location of these buildings is relatively stable throughout the three periods, being concentrated to the site of the later Gullskoen tenement.

In period 3, 1170-1198, 25% of the buildings damaged in Fire VI contained textile equipment in the fire-layer. Seven of the buildings were concentrated in the north-eastern part of the site in rows 3, 4 and 5. The eighth building was at the other end of the site in Bugard. Groups of weights were found which indicate that upright looms had been standing in at least three of the buildings. If single finds of weights are included, the number of buildings is five. Four of them also contained spindle-whorls indicating that spinning was also carried on. Moreover, one building contained needles, a shears-case and a hone as well as various spindle-whorls.

Five (13%) of the fire-damaged buildings from Fire Level V, ie 1248, comprised textile equipment. These were also concentrated in the north-eastern area, in rows 2, 4 and 5. Two buildings contained groups of weights, suggesting that they had upright looms and even the three buildings with only a single or a few weights may suggest the same. Spindle-whorls were found in only two of the buildings. Three of those with evidence for weaving had a distinctly greater variation of equipment, including needles and combs of a type possibly used in textile production.

Nine (24%) of the fire-damaged buildings from Fire Level IV, ie 1332, contained remains of textile equipment. The majority of these were found on the site of the later Gullskoen tenement in rows 3, 4 and 5, and only one building respectively in the Bugard, Engelgard and perhaps also the Søstergard tenements. The collections of weights and the location and combination of finds make it likely that there had been upright looms in at least four – perhaps five – of the buildings and that spinning and sewing had also been carried on in several of these buildings.

From period 6 onwards, 1332-1702, it is no longer possible to demonstrate textile working in the fire-damaged buildings. Only one of the finds – a pair of scissors – can be directly associated with a building during these periods. This change in affairs cannot just be explained by the different preservation conditions in the later layers. Moreover, those areas containing most of the buildings with textile equipment were generally excavated from the levels right down to the earliest layers.

Apparently the location of the textile production in the Bryggen area in the High Middle Ages remained relatively static, being especially confined to the north-eastern part of the site, in the area later occupied by the Gullskoen tenement (rows 4, 5 and periodically 2 and 3). During the period 1170-1332 there have been at least between two and four – perhaps as many as six – buildings with fixed equipment such as a loom, and at the same time spinning and sewing activities went on both in these and other buildings. Judging from the finds in the fire-layers the drastic reduction in textile activity began during the fourteenth century, at some time after the fire in 1332.

2.4 *Other buildings with textile equipment*

The finds from the actual fire-layers make up only 14% of the total collection of finds associated with textile working. The conclusions drawn exclusively from this material can hardly be expected to give the full picture of textile production at Bryggen. However, the finds from the layers of make-up between the fire-layers within the buildings are far more uncertain as indicators of the use of these buildings. Consequently there is little point in giving a detailed inventory of all the buildings where textile equipment was found. One condition for being able to diagnose a function is that the object was found on or just under the floor-level. Finds lying any deeper in the foundations are of little use in this context. An object found near the building must of course also be contemporary with the building if it is possible to demonstrate connection by means of the fire chronology at Bryggen.

We shall now consider the connection between textile equipment and the use of buildings in accordance with the principles stated above. In order to obtain the best picture of the development outside the actual fire-layers the material will be examined period by period, but it will not be feasible to consider every building with finds of textile equipment. Single finds are considered to be too uncertain indicators of the use of buildings to be included. The larger the number of finds of textile equipment in a building, the more likely does it reflect activities carried on there.

Period 1 (under fire-layer VIII)

From this period there are no finds of textile equipment.

Period 2 before 1170/71

From period 2 there are finds of more than a single object in four buildings. Two stood on the site later occupied by the Gullskoen tenement, in the same area as the burnt buildings containing textile equipment from this period. The other two buildings lay further south.

TABLE VII.2. BUILDINGS FROM PERIOD 2 (BEFORE 1170) WITH MORE THAN A SINGLE FIND OF TEXTILE EQUIPMENT (cf fig VII.1)

Building no.	In building	Near building
38	1 bone needle (D) 1 weight	1 wooden comb 1 small hone 3 spindle-whorls
43	1 spindle-whorl 1 small hone	1 pin (E)
130	1 wooden comb 2 weights	
196	1 small hone 1 needle, (A2) 1 weight	1 possible knifebeater

Assuming that these objects reflect activities in the buildings, then probably seven and possibly eight buildings gave room for textile working in this period, ie 24-28% of the total number of excavated buildings.

Period 3 (1170-1198)

In period 3 (1170-1198) finds of more than a single object were recorded in only one building. If items of textile equipment in the near vicinity are also included, in all three buildings come into consideration. Adding the eight buildings with objects recorded in the actual fire-layer, textile working may have been carried on in at least between nine and eleven buildings during this period, ie 21-26% of the total number of excavated buildings.

TABLE VII.3 BUILDINGS IN PERIOD 3 (1170-1198) WITH MORE THAN A SINGLE FIND OF TEXTILE EQIPMENT (cf fig VII.3).

Building no.	In building	Near building
33	1 weight	1 possible flax-beater
35	1 possible shuttle 1 wooden comb 1 ring from shears 1 wooden needle (D) 1 weight 2 stone spindle-whorls	
138	1 wooden spindle-whorl 2 wooden needles (A&F)	3 weights bone needle (A)

Period 4 (1198-1248)

In addition to the five buildings with textile equipment in the fire-layer there are three buildings with more than a single object connected with textile working under the fire-layer. This means that textile working may have been carried on in at least eight buildings in this period. They represent 15% of the total number of excavated buildings from the period.

TABLE VII.4 BUILDINGS IN PERIOD 4 (1198-1248) WITH MORE THAN A SINGLE FIND OF TEXTILE EQUIPMENT (cf fig VII.4)

Building no.	In building	Near building
466	1 weight 1 needle	
117	1 shears 1 pin 2 weights	1 weight
211	2 weights	1 weight

Period 5 (1248-1332)

While there were nine buildings in this period with finds of textile equipment in fire-layer IV, there are in all fourteen buildings with more than a single find associated with textile working from below the fire-layer. When buildings with finds in the vicinity are also included, the total comes to seventeen, which represents 18-22% of the total of 79 buildings recorded in this period.

Some of the buildings had been pulled down before the fire in 1332 and new buildings had replaced the old ones. It is interesting to note the presence of textile implements in such buildings overlapping each other. This situation has been observed in buildings nos 17, 22, 55, 186 and 218 erected after the fire in 1248 in rows 3, 4 and 5, and in buildings 463, 12, 188 and 14 which subsequently replaced them and were themselves destroyed in the 1332 fire. This means that in period 5 (1248-1332) there were between twenty-two and twenty-five buildings with remains of textile equipment, but they were not all contemporaneous.

Most of the buildings were located in rows 3, 4 and 5 in the area later occupied by the Gullskoen tenement. These three rows contain a total of 26 buildings covering the two building phases in this period, and 15 (58%) of these contained textile equipment. The list of equipment is varied in most cases but particularly so for buildings 218 and 460.

TABLE VII.5 BUILDINGS IN PERIOD 5 (1248-1332) WITH MORE THAN A SINGLE FIND OF TEXTILE EQUIPMENT (cf fig VII.6)

Building no.	In building	Near building
13	1 weight	1 stone spindle-whorl
17	1 stone spindle-whorl	1 weight
22	2 weights	
54	5 spindle-whorls 2 weights	
55	1 spindle whorl	1 small hone 2 weights
113	2 spindle-whorls 2 weights	1 wooden comb
186	2 weights	
188	3 weights 2 stone spindle-whorls	
189	1 stone spindle-whorl 1 pin (B) 1 weight	
191	weight spindle-whorl	
201	1 pair of scissors 1 spindle-whorl 2 weights	
206	13 spindle-whorls, stone 15 unfinished spindle-whorls 1 beater of whale bone	
214	1 wooden needle (F) 1 weight	
218	1 wooden needle (F) 1 wooden comb 1 spindle-whorl 1 pair of scissors 4 weights	
260	2 weights	1 weight
335	1 drop-spindle 2 spindle-whorls	
460	4 weights 1 wooden pin (F) 1 bone needle (A) 1 bone pin (B) 1 steatite spindle-whorl 1 possible flax beater 1 long-toothed comb	

Building 206 stands out due to the large number of unfinished and defect spindle-whorls. This may indicate that they were being produced in this building – probably of soap stone taken from St Lawrence's Church (Building 50) nearby. Two spindle-whorls which were found close to the church may also stem from church stones but they can hardly be used as evidence for textile production here.

Period 6 (1332-1413)

Although it has not been possible to demonstrate the presence of textile equipment in the fire-layers of buildings from period 6, there are in all eight other buildings with more than a single find of textile equipment from this period. When finds close by are included, there are nine buildings in all containing such equipment. They represent 9-10% of all excavated buildings from this period.

Period 7 (1413-1476)

In the buildings from this period there is only one with more than a single find of textile equipment, building 287 in the Bugard tenement, which contained 7 metal sewing needles.

TABLE VII.6 BUILDINGS FROM PERIOD 6 (1332-1413) WITH MORE THAN A SINGLE FIND OF TEXTILE EQIPMENT (cf fig VII.7)

Building no.	In building	Near building
5	2 weights	1 weight
7	1 spindle-whorl 1 weight	1 small hone 2 weights
49	1 spindle-whorl 1 weight	
131	3 weights 1 spindle-whorl	
132	2 weights	
185	1 weight	1 stone spindle-whorl
324	5 spindle-whorls 1 wooden needle (F)	
329	11 weights	
331	2 weights	

Period 8 (1476-1702)

In the buildings from this period there is none with more than a single find of textile equipment.

2.5 *Discussion and general conclusions*

By considering those buildings containing more than a single find of textile equipment, we have extended the basis for an examination of the question concerning the presence of a textile production environment at Bryggen.

When the finds from the fire-layers are included, there are in all 64 buildings with textile equipment, or in other words 18% of the buildings recorded on the site. However, they may hardly all of them be regarded as indicative of a textile production environment. In many cases the evidence is too slight, particularly when it consists of equipment or objects with other possible uses, eg. as fishing equipment. In some cases, for example in building 66 and building 14, certain features indicate activities other than textile production. A review of the whole finds assembly in each building would presumably help to present a more differentiated picture of the building's function, but as the data has not so far been entirely processed such a total review is not yet possible. Anne Ågotnes is currently studying the household equipment from the excavation and her results will make a particularly interesting contribution to the solution of the question of the functions of buildings (Ågotnes, in prep).

The majority of the burnt buildings containing textile equipment in the fire-layers would nevertheless seem to point quite clearly to at least one aspect of the use of these buildings, even though it is difficult to comment with certainty on the extent of the textile activity. It is worth noting that the more uncertain occurences (several different kinds of textile equipment in a building) have in general the same sort of distribution pattern as the more secure occurrences. If the less secure examples are included as evidence for textile producing activities, the area of textile production is greatly extended. Before we start drawing conclusions from this evidence, we must, however, consider the question of the representativity of the material.

As mentioned in the Introduction, the site was not excavated from present ground surface down to natural everywhere (cf fig 0.5 p 18). Only in the area later occupied by the Gullskoen tenement is it possible to follow the development from the earliest to the most recent levels. In the Bugard tenement, periods 6 and 7 are not represented in the rear part of the site, because the upper layers were removed by machine. The same is true to a greater extent in the Engelgard and Søstergard tenements, where

TABLE VII.7 BUILDINGS WITH TEXTILE EQUIPMENT IN THE FIRE-LAYERS AND OTHER BUILDINGS CONTAINING MORE THAN A SINGLE FIND OF TEXTILE EQUIPMENT, DIVIDED ACCORDING TO PERIOD AND LOCATION IN THE DIFFERENT TENEMENTS.

Period	Phase	Tenement-sites Gullskoen 6 building-rows	Søsterg 2 building-rows	Engelg 2 building-rows	Bug 2 building-rows	Contemporary	Total
7					2	2	2
6	6.2	5			1	6	9
	6.1	1			2	3	
5	5.2	13	1	1	1	16	26
	5.1	5		3	2	10	
4	4.2	7				7	8
	4.1	1				1	
3	3.2	8			1	9	11
	3.1	2				2	
2	2.2	5	1	2		8	8
Total		47	2	6	9		64

even more of the upper layers were removed in the rear part.

Table VII.7 shows the total number of buildings with more than single finds of textile equings with more than single finds of textile equipment divided according to their location on development. The area later occupied by the Gullskoen tenement included, as we have seen, six separate rows of buildings, belonging to several tenements in the High Middle Ages and cannot therefore be compared directly with the other tenements. It was in this area that three-quarters of the buildings with textile equipment were situated. By comparison Søstergard has only 3%, Engelgard 9% and Bugard 14%.

This concentration in the northern part of the site is not necessarily due to the way the site was excavated, as there is also a concentration in the three earliest periods, 2-4, where it is possible to make a direct comparison across the whole site. For periods 5, 6 and 7, however, we must allow for the possibility that there may have been several more buildings containing textile equipment in the southern part of the site than is shown in table VII.7.

As a fully representative development can only be seen in the Gullskoen area, we shall consider the situation here in greater detail. It must, however, be emphasised that the numbers listed in table VII.7 represent a maximum interpretation, as the evidence in some cases is too slight to draw reliable conclusions about textile activities. On the other hand it is difficult to find sufficiently acceptable criteria for a more definite interpretation. The finds in the fire-layers of buildings provide perhaps the best indication of minimum figures, but as we have previously mentioned, not even all those in the category can be considered equally reliable.

The buildings with textile equipment show a remarkable concentration in the three rows 3, 4 and 5 in the Gullskoen area. Of the 47 buildings in this area with such finds, 41 or 87% belong to these three rows. Period by period the ratio of such buildings to the total number of buildings in the three rows mentioned was as follows:

Period 2 before 1170	5 out of 18 buildings	= 28%
Period 3 1170-1198	8 out of 23	= 35%
Period 4 1198-1248	7 out of 24	= 29%
Period 5 1248-1332	13 out of 18	= 72%
Period 6 1332-1413	5 out of 20	= 25%
Period 7 1413-1476	0 out of 14	= 0%

No doubt the proportion of buildings with textile equipment in this area is very high. From period 2 to period 6, ie. from before 1170 to 1413, between a quarter and a third of contemporary buildings are involved, with a marked peak, both absolute and relative, in period 5, 1248-1332. From what is otherwise known about this activity at Bryggen – primarily commerce – it becomes even clearer that the figures must represent a maximum interpretation.

A corresponding calculation just for the buildings in the same area with textile equipment in the fire-layers gives the following results:

Period 2 before 1170	3 out of 18 buildings	= 17%
Period 3 1170-1198	7 out of 23	= 30%
Period 4 1198-1248	5 out of 24	= 21%
Period 5 1248-1332	6 out of 18	= 33%
Period 6 1332-1413	0 out of 20	= 0%
Period 7 1413-1476	1 out of 14	= 7%

The proportion of buildings with textile equipment is now somewhat lower, but there is still a relatively large number of buildings containing such finds. From period 3 to 5, between a fifth and a third of contemporary buildings are involved. The peak in period 5, however, becomes less marked, while in period 6 no buildings are represented.

It is not possible to make equivalent calculations for other areas of the site, as not all periods are represented there. Nevertheless, the situation in the earliest period would suggest that the difference between the Gullskoen area and the rest of the site is a genuine one. How great this difference was after period 4 is, however, impossible to ascertain.

The chonological distribution for the whole material (cf Chapter X, pp 139-144) for the various periods seems to fall into the same pattern as we have been able to indicate for Gullskoen.

CHAPTER VIII
DOMESTIC OCCUPATION OR ORGANISED CRAFT?

1 Aspects of the problem

The next question to be considered concerns the type of textile production carried out at Bryggen in the Middle Ages. Does the archaeological material show traces of the professionalisation of textile production indicated by documentary sources? Is it possible to determine on the basis of the objects themselves whether they were used by professional craftsmen or for textile work on a domestic level?

Similar questions have often been raised about other archaeological material, and it has only occasionally been possible to give a proper answer. As far as technical skill is concerned, the boundary between a craft and a domestic occupation is not a fixed one. The items of equipment did not need to be very different, even though the professional craftsman more often had a wider range of tools and equipment for dealing with the various processes. The difference between a domestic occupation and a craft lay in the social and economic organisation of the work rather than in technical equipment, and also in the volume of production. Regular and systematic trading of products under the conditions of a market economy made it possible to employ and pay full-time workers in the larger crafts and industries.

But these factors are seldom directly reflected in the archaeological material. Traces of a professional craft or industry will at the most consist of the remains of workshops. The occurrence of certain types of equipment not normally used in a domestic setting, such as the horizontal treadle-loom, may also be considered as indirect evidence for a specialised craft. Uniformity in the method of production, in the form of mass-produced products, is another potential sign of professionalisation. The distribution pattern of mass-produced products along trade routes and at route-intersections may lend further weight to the hypothesis that these are the products of an organised craft or industry.

On the strength of these criteria we shall take up the question of craft versus domestic occupation at Bryggen.

2 Differentiation in tools and equipment for textile production

We have seen that weavers appear in the Urban Code of Bergen in the 1270s (p 14). Since there is no mention of them in other medieval sources it has usually been assumed that they were an insignificant group in medieval Bergen, due to the great influx of textile products from abroad. The earliest weaver mentioned by name in Bergen is a Jon Vever who figures in a list of citizens in 1574. Not until the seventeenth century is there available information about the number of weavers in Norway. At that time there were rarely more than six or seven in each town. Bergen, however, had a particularly large group of such craftsmen. In 1645 there were no less than 27 weavers registered in the town (Hougen 1948, 30). Still, there are no reasonable grounds for projecting this situation back into the Middle Ages. Such a large group would certainly have been designated a special quarter under the Urban Code. Finds of parts of horizontal looms may indicate that there have been professional weavers in the Bryggen area. But we have seen that the possible remains of horizontal looms at Bryggen are not only extremely few, but also uncertain; the majority of finds of weaving equipment belonged to the upright loom or the band loom. The archaeological evidence does thus not suggest any great degree of specialisation in weaving, and weavers cannot be considered an important group of craftsmen in medieval Bergen.

The spinning equipment found at Bryggen covers a wide range of weights and would suggest that the various items were made specifically so that thread and yarn of different calibre could be produced. The lightest spindle-whorls were used to spin the lightest, finest thread; the medium range, ca 20-30g, was usually used for spinning wool, and the heaviest were probably used for thick yarn or for plying threads. Compared with the spindle-whorls found in graves from the period AD 600-1050, as well as those found in medieval rural settlements in Western Norway, those from Bryggen are far more differentiated. This variation can nevertheless be reconciled with a purely domestic use and there is no real reason for suggesting that spinning was so specialised that it gave rise to an organised occupation and that it should be described as a trade.

The pins and needles made in wood, bone and antler were, as we have seen, very varied in shape and size, presumably reflecting a wide range of uses. It has not been possible to tie this group of finds to any specific occupation. Moreover, they were most likely made by the comb-maker. Wood, bone and antler needles have in all probability been used for making fabric in single-needle knitting, for fishing-nets, for sewing coarser fabrics and perhaps as pin beaters in upright looms. None of these occupations are connected with professional craftsmen.

The metal needles, shears and scissors, on the other hand, may be associated with professional tailoring, but they were also necessary items in an ordinary domestic situation. The groups of metal pins and needles found in the vicinity of the area designated to the tailors by the Urban Code of 1276, may be regarded as significant in the present context. As mentioned in the Introduction, this area stretched from Buaalmenning to the door of St Peter's, contiguous with the southern part of the area are grid-squares 11 and 12 of the excavated site (cf fig 0.5, p 18). It is interesting to note that a large proportion of the metal pins and needles (80%) was found in these grid-squares. Other equipment which can be associated with tailoring was also found here – six pairs of shears or scissors and five of the possible needle-cases. However, most finds of shears and scissors were made in the rear areas of the northern part of the site including buildings 484, 35, 135, 117, 193, 201, 113, 12, 218. The finds of needles and pins cannot therefore be regarded as certain traces of a tailoring district, but they may nevertheless be taken as an indication of it.

Considered as a whole, then, only a small and limited part of the finds of textile equipment at Bryggen may be said to indicate the existence of a professional craft or industry. It is most reasonable to conclude that the material mainly represents activities of a domestic nature.

As discussed in the preceding chapter only a small proportion of the finds – those from the fire-damaged buildings and to some extent from under the fire-layers within the buildings – do directly reflect activities at Bryggen. For the remainder of the finds other interpretations are possible: 1) the objects may be rubbish brought from other parts of the town, 2) they may be objects of trade lost during loading or unloading, and 3) they may be items lost at Bryggen by people who did not actually live there.

3 Workshops or dwellings?

3.1 Specialised premises for textile working, known from documentary sources

Is it possible to ascertain whether the buildings associated with textile working in Chapter VII have been workshops or living-quarters? According to written sources there could traditionally be special premises for textile work in Western Norway in the Middle Ages. The term *dyngja* was used for a special building on the farm designated for the women's work such as sewing, weaving etc. The building usually had a sunken floor and low walls, and benches or raised areas are also mentioned (Magerøy KLNM III, 396). Another term is *vevstofa*, weaving-house. On the farm belonging to the *lendmann (baron)* at Kvåle in Sogn there were at least two weaving-houses at the beginning of the fourteenth century (DN IV No.14). But there is little reason to believe that the work involved the production of anything more than the farm's own requirements, and it is reasonable to classify it as a domestic occupation. Specialised buildings as these emphasize the unclear boundary between an organised craft and domestic occupation. Domestic handwork could be carried on both in special premises and by special workers, usually the women on the farm under the direction of the lady of the house. We know less about how this was arranged in towns.

There are no clear archaeological criteria for what constitutes a workshop as opposed to a room used for handwork on a domestic scale. We have seen that the various crafts were designated specific areas on either side of Øvrestretet in the Urban Code of 1276. There is evidence that this was in fact put into practice and also that some craftsmen moved into Vågsbotn in the Late Middle Ages (Helle 1982, 752). This would seem to make it less likely that these buildings connected with textile work at Bryggen were used for a craft or industry on an organised scale.

3.2 Special premises for textile working at Bryggen?

Some buildings may nevertheless have existed at Bryggen for textile work in the same way as they existed in rural districts. It is reasonable to interpret some of the buildings with textile equipment as special premises for textile work.

Weaving is involved in the majority of the buildings where textile equipment has been found (chap VII), altogether 58 (90%) of the buildings. In 16 buildings (25%) weaving equipment occurs without any finds from any of the other groups of objects. In three cases weights were found in such concentrated groups that they should be interpreted as evidence for looms standing there; in the other cases the evidence is more uncertain. Spinning equipment is the next most frequent group, being present in 41 buildings in all (64%) – but in only three cases was this only group of objects present.

In 70% of the buildings more than one group of equipment was present. Most usual was a combination of weaving and spinning, which occurred in 32 buildings (50%). There are other examples of two groups occurring together, but no clear pattern is discernible. In 24 buildings there was evidence for more than two processes. A combination of three different processes occurred in 18 buildings with spinning, weaving and sewing as the most usual combination. In three buildings 4 processes were represented with two different constellations being recorded, and finally there were three buildings where five groups of equipment were noted.

The chronological distribution of such combinations is as follows: From period 2 (before 1170) six of the eight buildings with textile equipment contained evidence for more than one process. The most usual combination was spinning and weaving, but there were also buildings with a more varied inventory, particularly complex in buildings 38, 484 and 196.

From period 3 (1170-1198) eight of the total of the eleven buildings contained equipment for more than one activity and this was most varied in buildings 35 and 135, as well as in 138, 25 and 137.

The same pattern was more or less repeated in period 4 (1198-1248), where six of the eight buildings with textile equipment reflect more than one process in textile production. There were two buildings with a more complex inventory in this period: buildings 211 and 117 (ct pp 127)

In period 5 (1248-1332) several processes are demonstrated by the finds in or near at the most eighteen of the twenty-six buildings with textile equipment. Once more the combination of weaving and spinning was the commonest, but as in the preceding periods there were other combinations as well. Six of the buildings reflect an even more varied activity, in particular buildings 218, 333, (cf pp 128), as well as nos 188, 189, 55, 113, 12, 193, 201, 460 and 38.

In period 6 (1332-1413) there are far fewer buildings with textile equipment from different production processes. Only three of the nine buildings actually contained combinations. If finds in the vicinity of a building are also included, then five buildings are involved. In three cases this was a combination of weight and spindle-whorl and in one case of spindle-whorls and wooden needle. Only building 7 had a more complex combination, if we include finds in the vicinity.

3.2.1 Items of equipment found in combination

Let us consider in greater detail which items of equipment and types of objects occur in the cases where a combination of activities is indicated.

Of the 25 needles found together with other items of equipment, the wooden and bone/antler needles were evenly distributed. Of the wooden needles type F with 7 examples is more strongly represented than the others. In nearly every case such needles were found in buildings with a very varied collection of equipment which clearly demonstrates the existence of a textile producing activity (buildings 135, 137, 214, 218, 460, 33 and 218). It is not possible to discern any clear trend in the grouping of these needles and other equipment. They usually occur together with weights or with spindle-whorls – often both. F type needles also occur with needles of other types (A, B and D), shears, small hones, and equipment which may have been used in the preparation of the raw material (flax-beater, flax rippling-comb). An analysis of the constellation of finds brings us no nearer to solving the problem of the use of these needles. All the other types of needles are also represented but to a lesser extent than type F.

The spindle-whorls found in various combinations represent a wide range of types, weights and raw material, but no single type or weight is overrepresented compared with the whole group of spindle-whorls.

Of the wooden combs with an uncertain function, discussed as possible flax rippling-combs (p 29), six of the eight found in buildings occur in a clear textile producing context: buildings 21, 35, 38, 113, 130 and 218. They were found together with weights in every building, spindle-whorls in five buildings, hones in one building, needles in three buildings (D, E and F), a possible shuttle in one building, and in two buildings with shears and a shears-ring.

We have decided not to include the long-toothed combs among textile equipment, but it is nevertheless interesting to note that they were all found in association with buildings which clearly demonstrate textile production, such as buildings 149, 135 and 460. They occur in combinations with weights and bone needles in all buildings, with spindle-whorls and wooden needles in two buildings, and with shears, a shuttle (?) and a possible flax-beater in one building.

The wooden needles of type F and the so-called flax rippling-combs occur in contexts related to the production of textiles. They are closely associated with spinning and weaving, but we still lack clear evidence for their function as specialised items in the production of textiles.

The preceding analysis of combinations of various types of textile equipment, then, does not provide definite answers to the questions which were posed at the beginning. But there were, apparently, buildings with rooms for different kinds of textile working, perhaps even special buildings along the lines of those known in rural districts.

3.2.2 Location and types of buildings

As shown in the previous chapter, most of the above-mentioned buildings lay in the area of the site which was later occupied by the Gullskoen tenement, and they were concentrated to four of the rows in this area (cf table VII. 7). This becomes even clearer when the 44 buildings with combinations of equipment are considered. No less than 37 of these buildings were located in the Gullskoen area. Only a couple of them were located in each of the tenements of Søstergard, Engelgard and Bugard further south.

It would be interesting to know whether the textile activities were connected with certain types of buildings, but unfortunately this is not possible, as the architectural-historical analysis of the Bryggen finds is not yet completed. Further research will perhaps confirm whether textile production was associated with certain types of buildings. There is, however, one connection which ought to be looked into already at the present stage of research.

3.2.2.1 Textile equipment and buildings with fireplaces

It has been suggested that at Bryggen there was a connection between buildings with a hearth or fireplace and finds indicating a kitchen-function or textile-working (Herteig 1969, 120). Altogether 27 buildings with a fireplace or its remains have been located, and no less than eight of these have indications of textile working:

Period 3:	Building 236:	26 weights
Period 4:	Building 149:	25 weights, 1 needle
	Building 60:	2 weights
Period 5:	Building 12:	2 pairs of shears, 1 spindle-whorl and 1 weight
	Building 10:	Several items of equipment in and close to the building
	Building 14:	2 weights
	Building 201:	Shears, 1 spindle-whorl and 2 weights
Period 6:	Building 7:	1 spindle-whorl and 1 weight

In other words about a third of all the buildings with fireplaces registered so far may be associated with textile work. On the other hand only 13% of buildings connected with textile equipment have evidence for a fireplace. The hypothesis that there is a close connection between buildings with a hearth or fireplace and textile production should therefore be modified, more so as several of these hearths or fireplaces have been placed in association with lime-burning (Herteig 1969, 121), including that in building 14.

4 Women's work

From the objects themselves it is rarely possible to conclude whether they have been used by women or men. In one case, however, the female name Sigrid is incised in runes on the shaft of a bone needle (no.39283), indicating perhaps the owner or user. Unfortunately such cases are the exception and not the rule.

In the period AD 600-1050 textile equipment occurs in unambiguous archaeological contexts more often than in the Medieval period. Grave goods may show quite clearly whether the burial was male or female. As it was general practice to equip the deceased with tools, etc, we have a good basis for conclusions about the division of labour. The commonest category of finds buried with women are those connected with textile production. Often the whole process is represented from flax hackle via drop-spindle and loom-weight to sewing-needle. Textile equipment may also occur with male burials, but usually in the form of shears only (Petersen 1951, 317). It appears that textile working was a common activity among more prosperous women in the Viking period. But the equipment as such does not explicitly tell whether the woman actually practised the work or only organised it.

In the Middle Ages the sexual identification of textile equipment can be more problematic. With the specialisation of crafts and trades in the towns part of the textile work became more strongly differentiated. Shearmen, tailors and weavers, for example, are mentioned with their own designation of trade. And these crafts were probably practised by men. The *bastarar* (sing *bastari,* m), ie those who worked with bast or roots, with which baskets, matting, ropes, etc were made, were probably also men. Accordingly some types of needles and shears may be connected with such specialised handwork and are not necessarily evidence of women's work. This is one of the reasons why the present study has paid so much attention to the context of the finds and the combinations of various types of objects. In this way it may be possible to ascertain which process the equipment was used for.

The results of this investigation point fairly unambiguously to domestic activities as opposed to organised crafts. Such activities were most probably practised by women in the same way as they were in the Viking period and as is also indicated in the written medieval sources. Spinning in particular was regarded as a purely female occupation in the Middle Ages and in the written sources the old norse term «snælda, f» (=spindle-whorl) is found as a symbol for woman. But even here we cannot be entirely certain. Spindle-whorls, bone needles and thimbles found during excavations at Dragør in Denmark have in fact been interpreted as indicating a sailmaker's trade and not women's work (Liebgott 1976, 7). From more recent times it is known that shoemakers spun cobbler's thread with the use of a drop-spindle and spindle-whorl (cf Mandelgren 1871-72, 156).

In the Bryggen-finds spindle-whorls are the commonest objects after loom-weights and occur in association with buildings, often in combination with other pieces of textile producing equipment. From the combination of finds, it is therefore reasonable to assume that these other objects were also used by women, and furthermore that women in most cases worked in the buildings in which the object occur (cf chap VII).

In one case runic inscriptions contain indirect evidence of the connection between women and textile work. On one side of a wooden lable is the inscription *«Solveig(?) a` þrædr þessa»* (Solveig(?) owns these threads) and on the reverse we can read that they weigh *«hof: fimta mark»* (4 1/2 marks or c 1kg) (Liestøl 1964, 7) Whether the women working with textiles were married women without any specific occupational status or servants cannot be ascertained on the basis of the archaeological material. Documentary sources indicate that female servants were a large group in Bergen's working population in the High Middle Ages. A royal amendment for Bergen from 1293/94 contains the following clause:

«Similarly we have totally forbidden drinking-companies or guilds for coastal pilots, goldsmiths, blacksmiths, England-farers, journeymen, porters, ale-brewers, women servants and all other drinking-companies . . . » (Norske middelalderdokumenter, 200-1).

This is the earliest known reference to guilds in Bergen, and female servants are included. When the Bredsgard tenement at Bryggen was divided in 1337, a separate quarter or *lopt (loft,* top storey) for female-servants, so-called *heimakonur,* belonged to the common-rooms of the property (DN II, No. 223). There is no direct information about the duties of these women. They probably did house-work such as preparing the food and cleaning the rooms but they possibly also took care of a large part of the textile work indicated by archaeological material. But married women living in Bryggen presumably also played their part in textile production.

CHAPTER IX
WHERE WAS THE EQUIPMENT PRODUCED?

Were the various items of textile equipment produced locally in Bergen or the neighbouring districts, or were they to any extent imported from abroad?

An answer may perhaps lie in the choice of raw material and in a comparison between the types of objects from Bryggen and material from other medieval excavations. However, as only a limited amount of the textile equipment from other medieval towns in Scandinavia and Northern Europe has been published, such a comparison will hardly provide more than a suggestion of an answer. Unfinished objects and other evidence for actual production provide the surest means for proving where the various items were made. The use of raw materials found locally or in the close vicinity would also suggest local production.

In part I we have touched on these questions within the individual categories of finds. It will be sufficient here to give a short summary with this particular aspect in mind.

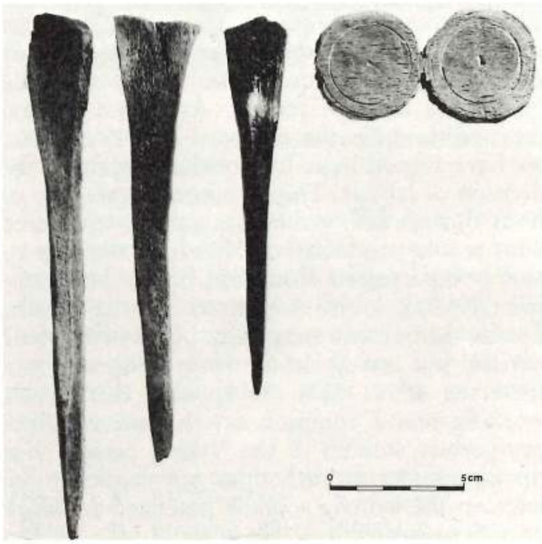


Fig IX.1 Unfinished needles and spindle-whorls of bone

1 Unfinished objects

The occurrence of 47 unfinished spindle-whorls – 43 in stone, 3 in wood and 1 in bone or antler – shows that textile equipment was in fact produced in the excavated area of Bryggen from the end of the twelfth century to the second half of the fourteenth (cf fig II.10). Contrary to the finished spindle-whorls, the unfinished examples show a preference for the simple types, such as the flat spindle-whorls made of steatite. The size of the unfinished ones are, however, comparable to the finished products. A number of needles made in bone, antler and wood without an eye should also probably be regarded as unfinished objects, and certainly so where the eye has been begun (fig IX.1). Two of the wooden combs discussed as rippling-combs in part I were unfinished examples. They were made of the same material as the finished ones, namely oak (cf fig I.6).

Most of the unfinished spindle-whorls in steatite were found together with other more defect examples in building 206 on the site later occupied by Gullskoen, indicating that they were produced in this building. The building stood just in front of Lavranskirken (St Lawrence's).

2 Raw material

The raw materials used to produce the various tools and items of textile equipment are as follows: stone 57%, wood 29%, bone/antler 8%, metal 5%, pottery or clay 1%. Tables IX.1, 2 and 3 show the distribution for the various groups. The majority of the materials involved could probably be found locally (see Askvik, Appendix, p 149).

The stone objects (table IX. 1) consist overwhelmingly of steatite (soapstone). The remaining 12% are of greenstone/diabase, slate, schist, amphibolitite, gneiss and sandstone, all of which are found in Western Norway. Even though it is not possible to state the exact location, it is nevertheless reasonable to assume that these objects have been made from Norwegian and not from imported raw materials. Foreign spindle-whorls and loom-weights are more often made from other raw material, particularly clay (p 53).

TABLE IX.1 RAW MATERIALS, STONE OBJECTS (N=1103)

Mineral	Total	%
Steatite	966	88
Slate/schist	61	5,5
Greenstone/diabase	50	4,5
Gneiss	5	0,5
Sandstone	2	–
Amphibolite	1	–
Chalk	1	–
Unident	17	1,5
Total	1103	100

Of the wooden objects where the material has been identified, 74% are made from various softwoods (table IX.2). All the coniferous varieties represented – pine, yew and juniper – are found in Western Norway and there is no reason why the objects should not have been made locally. Pine and yew dominate, with juniper in third place. Of these pine has the greatest variety of uses. Almost all the categories include objects made of pine. Yew which is a tough, supple and very durable material has a less varied area of use, being used mainly for needles. Even in more recent times we know that yew has been used for quite special purposes, such as weaving shuttles, various instruments and works of art. Juniper was also used relatively often for needles. This is also a strong and durable wood, but it is usually of limited dimensions and has been used for the smaller objects.

The hardwoods are generally less durable than the softwoods, which is presumably the main reason why they have been used to a lesser extent for textile equipment. With the exception of box-wood, all the deciduous varieties represented in the material are found in Western Norway: birch, oak, beech, willow, aspen, Norway maple, bird-cherry, rowan and hazel. For the wooden raw material, then, it there is no need to postulate sources abroad.

Specific use was apparently made of the special properties of the various kinds of wood. Birchwood which is fairly strong, supple and easy to work was mostly used for drop-spindles and spindle-whorls. Ash and Norway maple are good woods to carve and are also favoured for objects turned on the lathe. It is therefore hardly a coincidence that many of the found drop-spindles are made of Norway maple.

The bone and antler objects make up a smaller group (table IX.3). Again, from the point of view of raw material, it is not impossible that they are of Norwegian manufacture. Antler from red deer and reindeer are the largest sources of raw material, with whale bone as the second largest. Quite a lot of the textile equipment is made from domestic animals such as cattle and pigs. Most of the objects made from animal long-bones, where it has not been possible to give a more specific identification than large mammal, presumably come from domestic animals.

Even for the objects made of metal it is not impossible that they were produced in Norway. There is nothing which technically needs prevent the local production of any of these

TABLE IX.2 RAW MATERIALS, WOODEN OBJECTS (N=549)

	Wood	Total	%
Soft-wood	Pine (Pinus silvestris)	158	29
	Yew (Taxus baccata L)	130	24
	Juniper (Juniperus communis L)	77	14
	Unident softwood	2	0,5
Hard-wood	Oak (Quercus)	46	8
	Birch (Betula)	30	5
	Norway maple (Acer)/Bird-cherry (Prunus avium)	13	2
	Willow (Salix)/Aspen (Populus tremual)	7	1
	Beech (Fagus Silvatica)/Ash (Fraxinus)	4	1
	Hazel (Corylus Avellana)	2	0,5
	Box-wood (Buxus)	2	0,5
	Rowan (Sorbus aucuparia)	1	–
	Unident hardwood	25	4,5
Unident wood		52	10
Total		549	100

TABEL IX.3 RAW MATERIAL, OBJECTS OF BONE (N=158)

Raw-materials	Total	%
Bone (incl. metapods, metatarsals or metacarpals, femurs, fibula and unspec long-bones)	59	37
Whalebone	47	30
Antler (incl reindeer, red deer and elk)	42	27
Unident	10	6
Total	158	100

materials – iron, copper, bronze, brass and lead. Documentary sources refer, for example, to both heavy and fine wrought ironwork in Bergen (Helle 1982, 432-34).

With regard to the spindle-whorls of both fired and unfired clay which make up the smallest of the raw material categories, it is in fact less likely that they are of Norwegian production. At present we know of no local pottery production from this period. Still, it is not impossible that the unfired clay spindle-whorls, which require a simple production technique, were made locally, but we have no means of being able to prove this.

3 Typology

In the analysis of the objects (Part I) the question of foreign parallels has often been raised. The results of the comparative studies can to some extent throw light on the question of imports as opposed to local products.

Most of the items have parallels in the comparative material, including possible flax-beaters, distaffs, drop-spindles, bobbins, sword-beaters, rigid heddles (heddle-frames), needles and pins made from bone or metal, shears and scissors.

The areas over which these objects are found are, however, so extensive and the period of use so long that it is difficult to point to any particular area of origin. In the High Middle Ages the forms have become so universal that it is reasonable to suggest that they were made in several places – presumably not far from where they were to be used.

Some of the types of equipment do not seem to have any parallels in the contemporary foreign comparative material, including the wooden combs, a number of wooden needle types, rigid heddles, knife beaters and reed hooks. To what extent this is due to poorer preservation conditions for wooden objects elsewhere, the lack of published examples of parallels or the fact they simply were unknown, is difficult to say. At present it would seem that these types of finds from Bryggen are of local origin.

Some items of equipment have forms which do not have the same representation at home and abroad, such as certain loom-weights and spindle-whorls. From both the raw material and the form it is reasonable to assume that these have in general been produced in Norway.

4 Conclusions

There are few reliable criteria for determining where the textile equipment found at Bryggen was produced. Only in the case of unfinished objects is it possible to draw definite conclusions. The use of raw materials only found locally might have been a secure criterion, but none of the raw materials used for these objects is so limited in its occurrence. However, the actual raw material is also found locally and these local sources may have been used. The only exceptions are spindle-whorls of clay and chalk and possible needle-cases of box-wood which most likely have been imported. Typology is probably the most unreliable criterion for determining the source of these objects, as the types are to a large extent functionally determined.

In conclusion the question of where the textile equipment was produced cannot be determined. It is nevertheless highly likely that most of these objects were made locally, either in Bergen or in the vicinity of the town. In Bergen several groups of craftsmen could have produced these items, such as the comb-maker working in bone and antler, the turner working in wood and the smith working in metal. Furthermore, the types of objects were common over such wide areas and so simple to produce that it may be assumed that they were made locally. It is difficult to see that particular centres of production could by virtue of better quality or low prices be the centres of large-scale export over long distances.

CHAPTER X
HOW LONG DID TEXTILE PRODUCTION CONTINUE AT BRYGGEN?

1 Can the textile equipment throw light on the question of the transition from a Norwegian waterfront to a Hanseatic settlement?

Throughout the whole period Bergen was an important sea-port and trading-centre. Was the area covered by the excavations merely a part of the harbour quarter with the usual activities connected with trade, handwork and the storage of goods or was it also an area where men and women lived? If it was the latter, did the pattern of settlement change with time and if so, at what point?

The dating of the various types of textile equipment within the period c 1150-1500 may help to answer these questions.

The traditional view is that Bryggen started to change its character when the German traders ceased just to visit Bergen in the summer months and a part of them became permanently established around the middle of the thirteenth century. The process of change is thought to have accelerated particularly after the establishment of a Hanseatic *Kontor* (one of the four more important Hanseatic factories abroad) in Bergen around 1360 (Helle 1982, 733-34). The properties at Bryggen were let and the houses gradually sold to the German merchants who formed their own colony under the protection of the Hanseatic League. From the very first days of the history of the *Kontor*, the Germans organised a form of internal jurisdiction where Norwegian legal authority did not apply (*ibid* 747-48). The *Kontor* was a purely male society where everyone from houseservant to alderman was to practise celibacy. This was apparently gradually enforced during the period c 1350-1450 (*ibid* 746-47) and in this way the *Kontor* properties eventually became a closed society, exclusively male, and quite separate from the rest of the town (*ibid* 761-63).

In Chapter VIII we have demonstrated that textile equipment was probably most often used by women, which means that the finds of textile equipment may be used as evidence for women's work. How these finds are distributed chronologically will also help us to decide whether the Hanse in practice really took over the whole of Bryggen, so that it ceased entirely to be an area where women lived and worked, and if so, when it happened.

2 Dating the textile equipment from Bryggen

Table X.1 shows on the basis of the Bryggen fire-chronology how the various categories of equipment are distributed period by period. A good 90% of the finds can be placed in a chronological context (N=1746). Circa 80% belong to periods 2-5, ie. from before 1170 to 1332, and the greatest concentration – over 70% – are confined to periods 3,4 and 5, ie c 1170-1332.

The question is whether this gives a representative picture of the development of textile work. As mentioned in the Introduction and discussed further in chapter VII, the whole site is not directly comparable. In some parts only the earlier periods are represented, so it is natural to expect a systematic overrepresentation here when the total finds assembly is considered. In order to throw light on the question of changes in time, I have made use of the finds from areas which have been completely investigated (cr fig 0.5 p 18). This comprises 83% of the material (N=1605) and of this c. 90% can be placed in a chronological context (N=1449).

Diagram X.1 shows the percentage distribution for each period, both for the total collection of textile equipment and for the objects from the more representative area. To a great extent the two graphs are practically the same and show in both instances a marked peak in period 5 (1248-1332) and a minor peak in period 3 (1170-1198). The representation in period 4 is only slightly larger than in period 6. As would be expected, the graph for the total assembly of finds shows a bias towards the earlier periods.

How are the various categories of finds distributed, compared with the general trends in the total assembly? If we take the largest groups, objects representing spinning (=24% of the datable finds from the more limited representative area), weaving (44%), needles

TABLE X.1 DATING OF TEXTILE EQUIPMENT FROM BRYGGEN (N=1928, DATABLE N=1746).

Type	Period								
	2	3	4	5	6	7	8	Undated	Total
Possible flax beaters	4	3	5	3	4			3	22
Possible flax combs	2	10	7	11				3	33
Distaffs			3		1			2	6
Drop-spindles	1	4	5	15	4	1		1	31
Possible drop-spindles		6	2	15	4			2	29
Spindle-whorls	36	43	47	156	68	17	3	40	410
Winding equipment			2	6	1	2		1	12
Possible loom-upright					1				1
Possible loom-weights	63	164	159	203	92	27	12	72	792
Possible sword-beaters		2	4	3	1			2	12
Possible heddle-horses				1					1
Possible pulleys		1		1	1				3
Possible winding pins	1			1					2
Paddles		2	2	4	1				9
Possible reed-hooks	1	4	1	2					8
Heddle-frames		1		1					2
Knife-beaters		3	1	2					6
Small beaters		6	4	6	3			1	20
Weaving tablets			1					1	2
Possible band-loom shuttle				1					1
Shuttles		3	1	2	1			1	8
Wood & bone pins/ needles	45	94	61	86	27	9	2	18	342
Neeting needles				1			1		2
Metal pins/needles		2	1	2	8	9	14	23	59
Shears, scissors, rings,cases	2	1	2	10	4	2	3	4	28
Thimbles							2	2	4
Needles-cases and lids	4	5	3	6	2		1	1	22
Hones	7	5	5	15	8	3		3	46
Linen-smoothers		6	3	3		1		2	15
Total	166	365	319	556	231	71	38	182	1928

(bone, antler and wood) (19%) and sewing equipment (9%), then we find that each category presents its own pattern, but with certain features in common. All have an absolute and a relative peak in period 5. The spinning and weaving equipment shows the greatest points of similarity.

When the relative occurrence of finds from the larger groups of 1) spinning equipment, 2) weaving equipment, 3) bone, antler and wooden needles, and 4) sewing equipment in the total assembly of finds (table X.1) is compared with their occurrence in the more representative area there is again a great degree of similarity. Both groups have 80% of the objects within periods 2 to 5 and both have more than half the objects concentrated in periods 4 and 5. Weaving equipment, however, is somewhat better represented in periods 3 and 4 than the spinning equipment which is better represented in period 5. The needle group deviates slightly compared with the general trend, with an earlier maximum. No less than 87% of the needles are dated to periods 2 to 5. The numbers in period 3 (1170-1198) and period 5 (1248-1332) are equal.

Sewing equipment such as metal needles, thimbles and shears have a somewhat different pattern compared with the general trend, with the peak coming in periods 5 and 6, ie 1248-1413, which is later than in the other categories. The remaining groups are too limited to provide any clear tendencies in their chronological distribution.

It is difficult to draw any simple conclusions from this varying pattern. The similar chro-

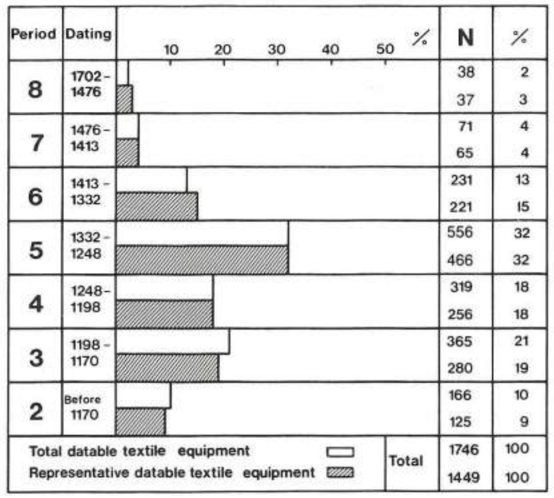


Diagram X.1 Textile equipment from Bryggen: number of finds per period

nological distribution for items connected with spinning and weaving does nevertheless suggest that these activities went together to a great extent.

This pattern is interesting as these items in particular are regarded as the most reliable evidence for women's work. Even though there are few finds, it is nevertheless striking that sewing equipment, which can equally well be associated with men's work such as tailoring, has a later distribution. As far as Bryggen is concerned, it is not unreasonable to imagine that Germans at the *Kontor* repaired their clothes themselves with the help of this sewing equipment just as they must have laundered them themselves. In fact they have quite a few boy servants to do housework (Helle 1982, 741-42), and they may have taken care of cloth repairs and laundering as well. The laundering place which was excavated was, as we have seen (fig VI.1), from the period 1476-1702.

The remaining groups of objects may to a greater extent represent special functions. Their distribution may, of course, be partly due to the different preservation conditions in the various parts of the site. We have already noted that bone, antler and wooden needles have a different distribution in that a large proportion were found in layers associated with or in the vicinity of the wharf-foundations in the front part of the site, but this can hardly have been the whole reason as the preservation conditions of organic material generally were good, even in the upper layers.

The different distribution of the various groups of finds shown in diagram X.2 clearly gives a fair picture of the actual situation. But as the length of the periods varies from 28 years to as much as 226 years, the periods are not directly comparable. It is therefore not possible on this basis alone to draw conclusions about increases or decreases in the activities associated with the different groups. This can best be done by comparing the frequency of the finds per year within each period (diagram X.3).

When the frequency of the finds per year within each period is considered, the peak is moved significantly backwards in time, with a clear maximum in period 3, 1170-1198. Unfortunately we do not know the starting point of

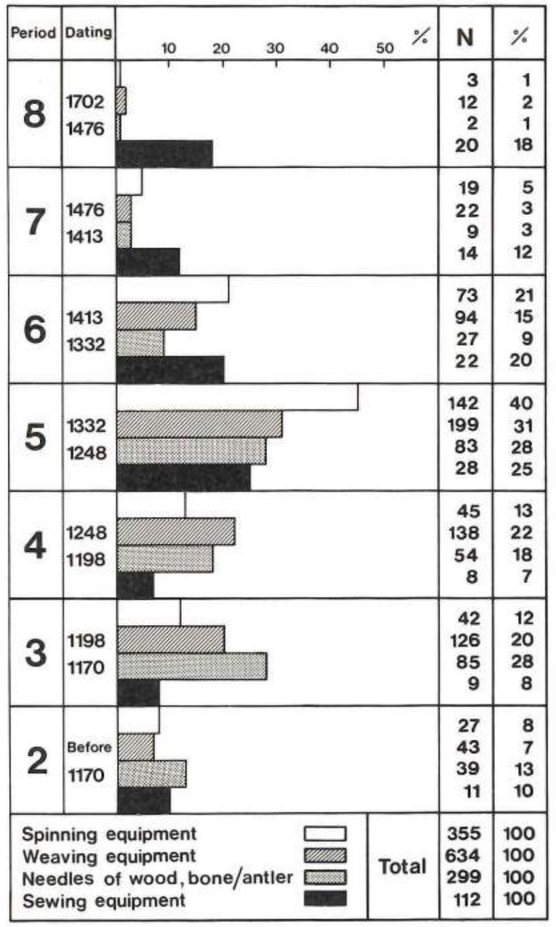


Diagram X.2 Relative distribution in time of equipment for spinning, weaving and sewing, and wood, bone and antler needles

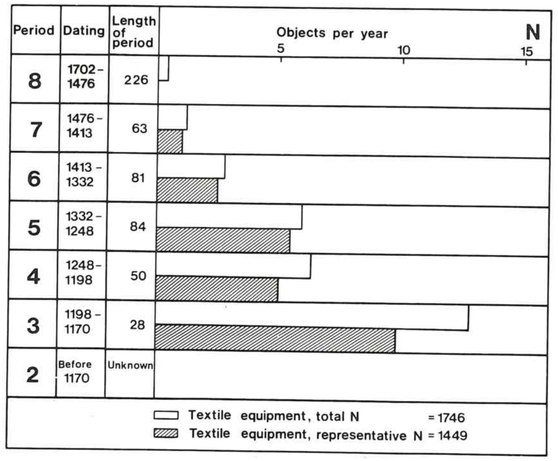


Diagram X.3 Textile equipment from Bryggen: frequency of finds per year within each period

period 2, so we do not know its length in years and are therefore unable to calculate the frequency of finds per year. In periods 4 and 5 the frequency is about the same but is only half as great as it was in period 3. In period 6 it drops even further and is very low in period 7. The diagram also shows similar tendencies in the total material as in the more limited representative area.

3 Distribution of finds in the different periods

There appears to be a certain difference in the relative distribution of finds in time and space. As demonstrated in Chapter VII, there is only a limited amount of the material which at the best may be directly associated with textile production in the actual area. Finds associated with buildings are a more secure indicator of their use *in situ*, and the most reliable finds with regard to the working situation are the objects found *in situ* in the fire-layers. For the textile objects this involves at least 264 items or 15% of the total datable material. In addition to these there are 179 objects from buildings which contained several finds of textile equipment, but not in fire-layers and therefore less securely reflecting a work situation. This gives a total of 443 objects or 25%.

The majority of items of textile equipment from Bryggen were not found in locations which automatically reflect their use. They are mainly from the thick deposits in or around the foundations of buildings (c 10%), in or around the wharf-foundations (c 1/4) and to a lesser extent (c 10%) in layers beneath roads, passages, etc. and in the gaps between buildings. A good quarter of the finds are from general deposits which cannot be definitely associated with any particular construction. As we have mentioned previously, objects could easily have been deposited as rubbish. An object does not therefore necessarily reflect an activity which took place where it was found; it may have come from some other place in the medieval town; such as neighbouring areas at the back of the site or from Øvrestretet, which are traditionally regarded more as residential areas than the merchants' quarters at Bryggen. But it is also quite possible that they are derived from buildings on the site. We lack the relevant information to be able to decide this issue.

Finds in the wharf-foundations are relatively much more strongly represented in the earlier periods than either finds associated with buildings, roads, passages etc. or those with no direct association at all. They have their greatest frequency in periods 3, 4 and 5. This may reflect the fact that the harbour area was used as a dumping place for rubbish more in the earlier periods than later, but it is more likely a result of the extensive deposition of material and building of foundations which took place after the fires in 1170 and 1198 as part of the wharf extensions. If this is the case, then it is even more important to be cautious when attempting to tie an object to an activity in the area where it was found. Compared with the later periods, the harbour area in the earliest periods was relatively larger than the area occupied by buildings. When considering both the place of use and the period of use for an object, the material presented in Chapter VII must be regarded as the most relevant.

We shall now consider the changes in the distribution of finds from the areas occupied by buildings compared with the total material and the more limited representative material.

Diagram X.4 shows the relative distribution in time for 1) objects found *in situ* in burnt buildings, 2) these together with finds of textile equipment found in other buildings, and 3) the total amount of textile equipment from the more limited representative area. It turns out that the occurrence of objects found *in situ* is relatively greater in the earliest period than the distribution of the total material and that it also

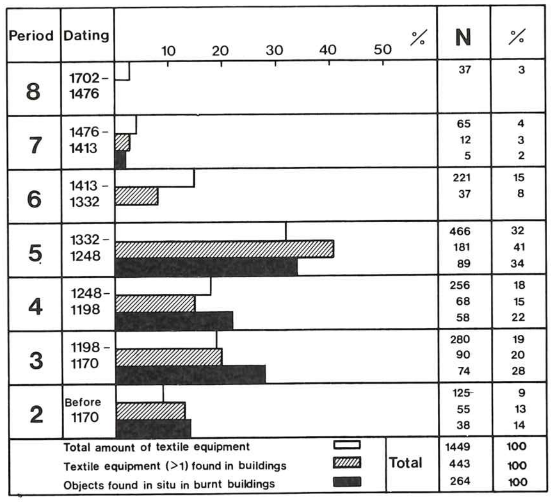


Diagram X.4 Textile equipment found in buildings: relative distribution in time

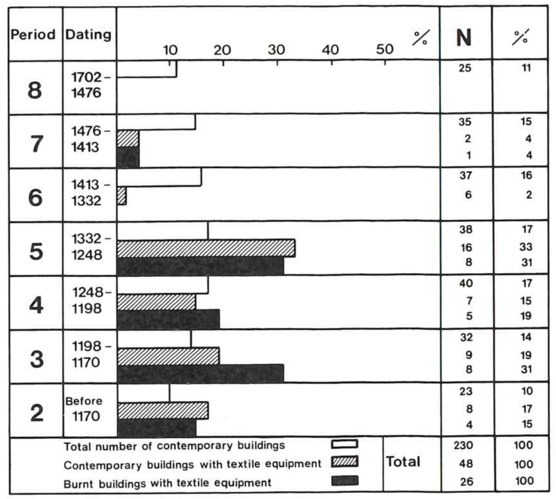


Diagram X.5 Buildings containing textile equipment, compared with the total number of excavated buildings at Bryggen for each period

decreases earlier. When taken together with finds of possible textile equipment in other buildings, the picture changes somewhat. The increase in the earlier periods is less and is more comparable with the distribution of the total material, while the peak in period 5 continues for a longer time but is still decidedly under the distribution of the total number.

It is important to remember that there are several possibilities for misinterpretation. The total material is very limited and small concentrations of finds which involve only one particular type of object may have a significant effect on the total when each individual item counts separately.

It is therefore also necessary to consider the distribution of 1) burnt buildings containing objects *in situ* and 2) these together with other buildings containing textile equipment, and compare them with the total number of buildings. As already mentioned (p 139), the earlier periods will be systematically over-represented, but this also applies to the total number of buildings, so that the comparison should give a relevant and reliable impression of the total situation throughout time.

It is interesting to note that buildings containing textile equipment present quite a different pattern in time when compared with the total number of buildings excavated at Bryggen. The latter show a relatively stable situation from period 3 to period 7, whereas buildings containing textile equipment reach a peak in period 3 and an even greater peak in period 5.

If we compare this with the changing pattern in the Gullskoen area, which is the only area representative for all periods (diagram X.6), we see that in the earlier periods the total number of buildings here is relatively greater than on the site as a whole, mainly because the build-

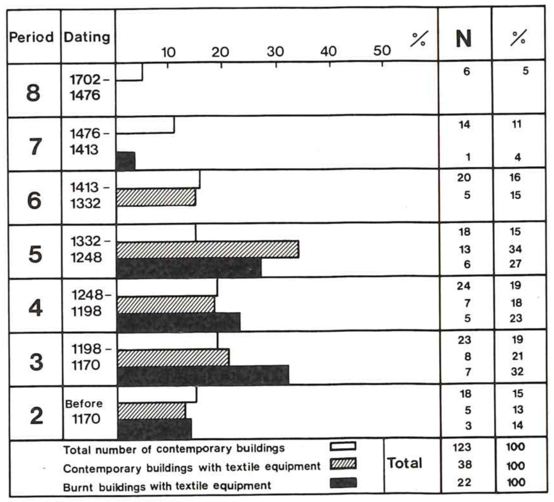


Diagram X.6 Comparison between the Gullskoen area and the rest of the site regard to all buildings containing textile equipment ings were replaced more often (cf table VII.7). It is even more interesting to note that there are relatively more buildings containing textile equipment than on the site as a whole (cf diagram X.6). The peak in period 5 is even more pronounced. Buildings with textile equipment once again follow a different pattern here than buildings in general. This development pattern must be regarded as significant.

The concentration of textile equipment in the buildings of a particular row and the repetition of this pattern in period after period (chap VII), tend to confirm the significance of this pattern. The *contemporary* buildings containing textile equipment are probably the best indicator of the extent of the activity. But activities associated with textile production have hardly been equally great in all the buildings. We shall therefore turn our attention finally to the frequency of finds associated with textile production in burnt buildings with the finds *in situ* and in other buildings with more than single finds.

If the frequency per year of textile equipment from the firelayers is considered, the greatest number occur in period 5, whereas when all finds are counted it comes in period 3. Compared with the figures for the whole site (diagram X.7), the number is relatively lower in period 3 and relatively higher in period 5, but the trend is otherwise remarkably similar.

The changes in the pattern can be summarised as follows:

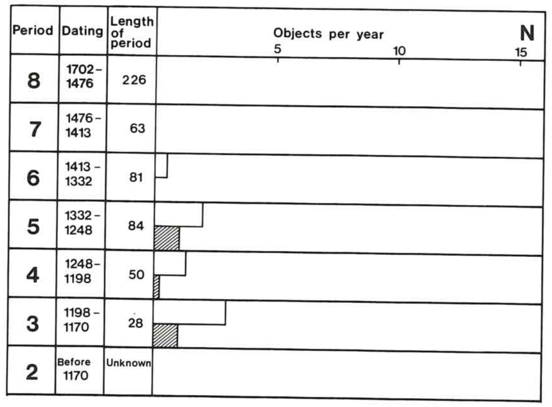


Diagram X.7 Frequency per year within each period of textile equipment found in situ in fire-layers in buildings and in other buildings with more than single finds

The occurrence of textile equipment as a whole reaches a peak in periods 3 to 5 (1170-1332) and it occurs to a lesser extent in both periods 6 and 7 (1332-1476), decreasing generally and usually occurring as scattered finds. However, the finds cannot all be used as indicative of a textile producing activity at the location where they were found.

The relationship between buildings and finds suggests that there were areas at Bryggen concerned with textile production from period 2 until period 5, ie from before 1170 to somewhat after 1332. If only the most secure criteria are used, those finds from the burnt layers in buildings destroyed by fire, it turns out that from before 1170 and until 1332 there was an increasing number of buildings among the tenements at Bryggen where work involving textile production was carried on. A peak was reached in period 5.

When unburnt buildings with more than single finds are included, the same general pattern of development is found, but the point of maximum activity occurs somewhat earlier.

When this is compared with the total occurrence of textile equipment, it is seen that finds associated with specific activities reach a maximum somewhat earlier, with peaks in period 3 (1170-1198) and period 5 (1248-1332).

The actual location varied somewhat in the various periods, but there seems to have been a greater concentration of textile producing activity at all times in the area which was later occupied by the Gullskoen tenement. Compared with the situation in periods 2-4, this concentration of finds in the Gullskoen area does not seem to be a change occurrence. From period 6 there are no finds associated with textile production *in situ* in the burnt buildings. Activities associated with textile production appear therefore to decrease within the period 1332-1413.

4 Archaeological and written sources

Only to a very limited extent does written material provide an insight into the daily activities in microplan in medieval Bergen, such as textile activities and housework. Only occasionally is there any concrete information about how these activities were carried on in the different houses. Neither do the written sources contain any concise information about when and how a Hanseatic all-male society developed in Bergen. To what extent may our analysis of archaeological material supplement and fill in the picture which can be drawn from written evidence?

The spoken or written word can never be entirely replaced by the archaeological material alone. Words transmit meaningful contexts in a totally different way. Wherever possible, therefore, both types of material should be used together in order to place the physical remains in a wider historical setting. In the last part of this chapter it will be considered whether and, if so, how the two categories of source material may supplement each other. In this way we shall attempt to come to a conclusion about the problems which were presented at the very beginning.

The establishment of the Hanseatic *Kontor* in Bergen cannot be tied to any single year. It was rather a gradual process over a long time, but by the middle of the fourteenth century it had come as far as formalised common organisation for the Hanseatic merchants and their German staff in the town. There are strong indications that the Bergen *Kontor* achieved a more permanent form of organisation during the 1350s and certainly by 1365 (Helle 1982, 733-34). There is positive evidence that most of the Bryggen buildings came to be owned by Germans during the hundred years after 1350 but that the ground was normally leased from the Norwegian owners. Around 1520 the accounts for Bergenhus castle show that the Germans totally dominated in all the Bryggen properties and in all probability this development had essentially come about during the period 1350-1450 (*ibid* 722-28).

Helle's researches in the Bryggen properties have shown that in the first half of the fourteenth century Norwegians lived in most of the tenements and were moreover clearly in the majority. Even though the documentary evidence is far scantier in the second half of the century, Helle maintains that it is symptomatic that Norwegians are only occasionally mentioned in connection with the Bryggen properties. As late as 1411 there were probably Norwegians still living in one of the properties, Dreggen, but this is the last reasonably clear indication that Norwegians lived at Bryggen. Helle suggests that after the middle of the fourteenth century, the number of Norwegians living at Bryggen was greatly reduced and that relatively early in the fifteenth century Norwegian settlement more or less ceased (*ibid* 722).

Of the actual properties lying within the excavated area, Gullskoen was partly in German ownership in 1372 and at the same time Germans owned houses in the Sveinsgard and Bugard tenements. The Engelgard tenement was in German hands in 1408 and Søstergard by 1440 (*ibid* 722-26). It is interesting to note that the latest information on Norwegians living at Bryggen between 1370 and 1411 concerns the outermost properties: Northwards from Atlegard/Oddsgard and southwards from Skapten (*ibid* 722). Atlegard/Oddsgard possibly stood in the area on the southern edge of the large Gullskoen property as it was in 1955 (*ibid* 704-6). And it was exactly here that especially many traces of textile working were found.

Considering now the frequency of buildings with textile equipment over the course of time, we find that there is essentially a correspondence beween the reduction of these at some point between 1332 and 1413 and the establishment of the Hanseatic *Kontor* and the gradual German takeover of the properties here. We find no clear indications of textile working and consequently no evidence for women working here as late as 1413. The archaeological material thus suggests a decline in textile work done by women at Bryggen and its ultimate end, coinciding with the transition to a German male settlement during the latter part of the fourteenth century. The archaeological picture, then, corresponds essentially with the information available in the documentary sources.

The establishment of the *Kontor* was the result of a lengthy trade contact between German merchants wintering in Bergen and Norwegians. As early as the 1250s merchants from Lübeck and other German towns started to spend long periods in Bergen and an association between these wintering merchants and the properties within the excavated area is known. German merchants wintered, for example, in 1259 in both Sveinsgard and Engelgard (Helle 1982, 380). But in the first half of the fourteenth century, these merchants were still probably a very small number just lodging or renting storage space in the properties which were occupied dominantly by Norwegians (*ibid* 472-75).

There is nothing to suggest that the early wintering Germans forced textile working and consequently women away form the area. It was in fact from the middle of the thirteenth century that this activity had its greatest expansion. This corresponds closely with the impression gained from written material: that the population and activity in Bergen and particularly

Bryggen reached a peak exactly in this period (Helle 1982, 487-92).

In Chapter VIII were mentioned the women servants' quarters in the upper storey of Bredsgard in connection with the division of this property in 1337. The document attesting the division probably provides an insight into the way the wintering merchants could be integrated with the Norwegian population including women in Bryggen tenements. Among the 44 buildings or rooms recorded, two German quarters are mentioned (Helle 1982, 216-18).

The term used for these quarters *(stofa)* is that usually applied to the most important room in a building, the living room, but can also in fact be applied to a complete building containing several rooms. The occurrence of buildings with textile equipment in the excavations can indicate that such rooms can have existed in these properties as well.

The textile working environment which was revealed during the excavations at Bryggen may indicate that work performed by women played a larger part in this merchant dominated quarter of the town and lasted somewhat longer than it has previously been possible to prove.

APPENDIX

PETROGRAPHY OF MEDIEVAL WARP-WEIGHTS FOUND AT BRYGGEN, BERGEN

by HELGE ASKVIK

Warp-weights found during excavations at Bryggen have been subjected to petrographic analysis. In all, 792 weights have been classified macroscopically, the great majority (c 98%) consisting of soapstone. The remaining 2% were green massive or schistose rocks, schist, gneisses or similar rock types.

A number of weights possess physical properties which deviate from the usual properties of the rocks; the minerals may be harder, more friable or of a different colour than normal, probably because they have been subjected to high temperatures.

A selection of sixteen weights, consisting of various rock types, has been investigated petrographically. Thin sections have been made for examination in polarised light, and some examples with mineralogically deviating properties have also been examined by x-ray diffractometer and electron microprobe. The following varieties occur among the material examined in greater detail: soapstone, chlorite-actinoliteschist, phlogopite-tremolitefels, meta-peridotite and fine-grained augengneiss.

Soapstone

Weights 21572, 36719, 44946, 59994, 75493 and 51886 are all made from soapstone, consisting essentially of talc and magnesite (carbonate) in various proportions. Their appearance and properties vary according to the modal composition (proportion of minerals), a high talc content rendering the stone soft (talk has hardness 1 on the Mohs hardness scale), while grains of magnesite (hardness 3.5-5.0) makes the stone feel harder. In colour they range mostly from light grey to grey-green, depending on the colour of the talc and the proportion of the dark minerals.

Weight 44946 is very schistose, the remainder are massive. The mineral content of the weights was established by thin section studies using a petrographic microscope and the modal composition estimated (table 1).

Talc occurs in foliated masses where the individual grains are mostly under 0.5mm. Magnesite occurs in irregular grains with diameters from less than 1mm to almost 5mm. Ore minerals, mostly occurring as irregular grains, is usually under 0.2mm. Chlorite, in separate flakes and aggregates is mostly under 1mm.

Chlorite-actinolite-schist

Weights 33309 and 43207 are green in colour and consist of almost equal quantities of chlorite and amphibole. Macroscopically, they are both clearly schistose, and the inividual minerals can be detected by the naked eye. Under the microscope, amphibole displays inclined extinction, colourless to light green pleochroism (colour variation) and is probably an actinolite with a high proportion of magnesium. Chlorite is light green. Small quantities of ore minerals and carbonate occur. Accordingly the rock is a chlorite-actinolite schist.

TABLE 1. SOAPSTONE, ESTIMATED MODAL COMPOSITION (VOLUME PER CENT)

Talc	Magnesite	Chlorite	Amphibole	Serpentine	Ore	minerals
21572	63	30	5	1		1
36719	90		6	2		2
44946	60	30	5	2	1	2
59994	67	30	1			2
75493	70	15	10			5
51886	60	36	1	1		2

Phlogopite-tremolite fels

Weight 82149/01 is green in colour, medium to fine grained, relatively massive and consists of dark green amphibole and golden brown mica. Under the microscope it has an unevenly – grained texture with elongated, euhedral (well developed) tremolite crystals and large aggregates of mica in a finegrained matrix of the same minerals. The mica shows a colourless to pale brown pleochroism and must be a phlogopite.

Metaperidotite

Weight 21932 consists of a slightly-schistose, medium-grained to fine-grained, greyish green rock containing scattered c 5mm large flakes of golden brown mica. Under the microscope it proves to contain c 15% actinolite with a pale yellow to brownish pleochroism, c 30% biotite with a high content of magnesium, and 15% bastite (altered pyroxene), in a matrix of c 40% fine-grained massive talc.

Fine-grained, schistose augengneiss

Weight 25205 consists of a grey, schistose gneiss with small felspar augen. Under the microscope it has a porphyroclastic texture with porphyroclasts of microline and saussuritisized plagioclase in a fine-grained foliated matrix of quartz, microcline, plagioclase, biotite, muscovite and epidote.

Weights affected by heat

Several weights show deviations in their physical properties, and these changes are probably due to the effects of intense heat.

This is the case for weights 43009, 53149, 53171 A and E, 63816, 72684 and 88395. From sections through weights 43009, 53171 A and 72684 it can be seen that the inner parts of the weights consist of soapstone, composed essentially of talc, while the external surface of the warp-weights is hard and cannot be scratched with the fingernail. It probably has a hardness of c 3.5-4.0. Some uncommon, brownish, fibrous mineral aggregates occur evenly distributed throughout the stones.

The pale grey weight 63816, which from its even, rounded form also seems to be made from soapstone, shows the same hard external skin, but this weight is equally hard throughout. On its surface there are some round sandy grains which seem to be welded fast. Some of these resemble glass and an examination under the polarisation microscope shows that they are partly isotropic and therefore presumably consist partially of glass. This must have been created during an intense heating of the sand grains.

Weights 53149, 54171 E and 88395, which are darker and richer in amphibole, also bear evidence of having been strongly affected by heat and have a hard surface.

Under the microscope, changes can be detected. Weight 43009 has an outer «skin» c 0.-5mm thick, where foliated (or fibrous?) crystalline aggregates with light brown-dark brown pleochroism and low (first order) interference colours have been formed. The aggregates are also found distributed throughout the whole stone which otherwise consists of soapstone, and from the way they occur as an almost continuous layer in the skin, it is likely that they are due to the decomposition of talc.

Weight 63816 (hard throughout) is dominated by fine-grained, foliated masses, resembling talc in texture, but with a varying, commonly faint brownish pleochroism and first order interference colours, which is in strong contrast to the ordinary maximum third order colours of talc. A few grains exhibit a peculiar light yellowish brown – dark blue pleochroism and first order interference colours. The brown pleochroic, foliated aggregated described from weight 43009 occur throughout the whole stone.

Prismatic, colourless or light greenish brown crystals resembling tremolite occur, but the interference colours are lower than for tremolite, and the extinction angles may vary within the grain to values exceeding the common values for amphiboles. The optical properties of the grains of weight 63816 differ from the properties of the common minerals of soapstone, and it has not been possible to relate the properties to any known mineral. X-ray diffraction patterns both of the brown aggregates and the dominating fine-grained masses of 63816 have similarities to those both for talc and enstatetite. The conclusion based on the optical and x-ray diffraction data is that the components of weight 63816 have been formed by thermal alteration of common soapstone minerals.

Studies of the thermal decomposition of talc have all yielded clino-enstatite and cristobalite as the end products, but an intermediate phase prior to clino-enstatite has been noted and described variously as metatalc and protoenstatite (Deer *et al* 1962, 124-25).

Sources and origins of the rocks in the weights

Apart from weight 25205, the fine-grained, schistose augengneiss which is a relatively common rock in W Norway, all the weights which have been examined consist of rocks which are formed by metamorphism of peridotites. Peridotites consist mainly of olivine and pyroxene in various proportions and occur most often in lense-shaped bodies which vary in size. During metamorphism peridotite can be transformed into serpentinite or soapstone or transitional rocks depending on the circumstances and degree of metamorphism. The mineral composition of the peridotite will also be a decisive factor. There can therefore be large variations within any one source of soapstone. Dark green chlorite-actinolite-schists occur in many places in the margin of the bodies.

There are many sources of soapstone in W Norway and especially in the area around Bergen (Kolderup C F 1915, Kolderup N-H 1928, Kolderup C F & N-H 1940). The rocks in the different outcrops often vary greatly, so that there may be greater differences among the samples from the same body than among samples from different sites. The various bodies have not been studied in detail and it is therefore not possible to determine where the individual weights might have come from.

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THE BRYGGEN PAPERS is a series of publications giving a scholarly presentation of the archaeological finds from the excavations at Bryggen – The German Wharf – in Bergen, which took place between 1955 and 1968.

Bryggen was the economic centre of the old Norwegian capital. Later – in Hanseatic times – Bergen became one of the largest and most important seaports and commercial centres in Northern Europe. The excavations at Bryggen have revealed extensive material which provides valuable information about the development of the city as well as European cultural history in general.

In the present volume are presented the results of a study of the objects associated with textile production found during the excavations. The author attempts to throw light on the essential questions concerning the development of the textile industry in Bergen during the period 1150–1500. The significance of this activity at Bryggen is demonstrated by the extensive range and variety of such equipment, and one of the main aims of the author has been to trace the nature of the textile production at Bryggen by, for example, analysing the various combinations of finds associated with particular buildings in the different phases of the excavation. The finds also indicate that work performed by women played a larger part in this merchant-dominated quarter of the town and lasted somewhat longer than it has previously been possible to prove.

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ISBN 82-00-02537-3

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