

Björn Petterson

STRATIGRAPHIC ANALYSIS AND SETTLEMENT STRATIGRAPHY IN EARLY MEDIEVAL SIGTUNA

Methods and preliminary results

In early June 1990, the excavation campaign Sigtuna Excavations 1988–90, in the town block of Trädgårdsmästaren, was completed. This was one of the most extensive medieval archaeological investigations carried out in Sweden. The excavation, situated centrally in the early medieval town, covered an area of some 1100 m² of cultural deposits, containing the building remains of a dense settlement. In Sigtuna, we stressed the importance of full on-site interpretation of the features as excavated. It has been demonstrated that the site cross-sections together with dendrochronological datings, independently dated finds, and an awareness of the settlement-structure, can raise the results of the stratigraphic analysis, from a relative to an absolute dating of the phases. Settlement development on the site can be divided into ten phases covering the whole area from the late 10th to the early 13th centuries, from short town yards without any special division of function to long plots containing dwelling-houses at the far end and workshops near the main street.

Introduction

This paper will mainly concern the methodological problems that arose during the archaeological excavation and post-excavation stratigraphic analysis of the site "Trädgårdsmästaren 9 and 10" in Sigtuna in 1988–90. The aim is to show how these problems were addressed during the two years of archaeological fieldwork and the subsequent two years processing of the excavated stratigraphy, here termed the "stratigraphic analysis". Certain parts of the recorded find-material have been analysed in a database together with knowledge in town yard structure, in order to identify the different zones (I–IV) which partly form the basis for absolute dating (phases 1–10). The results are mainly collected from plots IV and V, in other words the eastern part of the excavated area, analysed by the present author (fig. 1). In the stratigraphic analysis the documented material from the excavation is treated in such a way that site-encompassing chronological phases can be reconstructed. Each phase will answer to the smallest chronological unit covering the whole excavated area containing remains of both buildings and finds of limited timespans. These phases will later become the foundation for all subsequent interpretations concerning settlement structure, trade and handicrafts.

Definitions

Absolute dating. By using the results of dendrochronological analysis and artefacts of known age from within the different phases, the relative datings will become absolute.

Functional analysis. In his article "Det arkæologiske hus", Frands Herschend (1974) presents a model for building analysis. He uses the model on material from the Eketorp project, in which he is involved, and on material from the Helgö publications. Herschend proposes, after comparing the two sets of material that an artefact should be understood not only as an object but also as a trace of a function in a particular surrounding (Herschend 1974:14ff). Finds of different types, in different quantities and in different contexts, hold different meaning for each interpretation. For example a spindle whorl found in an archaeological house does not tell us as much about that house's function as does a set of loom-weights found in the same place. The whorl is a tool which is often carried around when used, as opposed to the loom which is a fixture, a part of the furniture. Consequently these two find categories do not possess the same potential when it comes to determining the function of a building, this being an important aspect of stratigraphic analysis.

Formation of cultural layers. A *layer* is here understood to be an apparently unified deposit which can be interpreted as of the same timespan throughout. A large number of researchers have discussed how cultural layers should be classified. Järpe, Redin and Wahlöö (Järpe et al. 1979:35ff) put emphasis on the processes involved in layer formation and make a fundamental distinction between *accumulated* and *deposited* layers. For Andrén (1986:262) cultural layers are of two basic kinds: *manifest* (remains of buildings and building activities) and *latent* (intermediate layers made up of e.g. household and handicraft refuse). For Nordeide (1988:47ff) cultural

layers are grouped into successive units, *settlement layers*, which in turn are made up of *construction layers*, *activity layers* and *destruction layers*. Beronius-Jörpeland (1992:129f) makes the following distinction: *refuse layers*, *levelling layers*, *construction layers*, *destruction layers*, *fire layers* and *flood layers*. Golembnik (1991:129f) has through careful on-site analysis of cultural layers shown that questions about layer formation can be answered in the field during excavation; deposited and accumulated layers can be interdistinguished by studying the degree of decay at different levels within the layers. An accumulated layer will differ through a greater degree of decay since it has been exposed to the air for a longer time than a deposited layer.

Harris Matrix. A system developed by Edward C. Harris to chronologically sort and link archaeological features, e.g. layers, constructions, and their constituent parts.

Phase. The smallest chronologically definable unit within the excavated area (cf. Definition of phase, below).

Planning. Two types of plan drawings can be used to record an excavation: *single-layer plans* and *composite plans*. When using the *single-layer plan* each layer is recorded on a form together with any associated construction (e.g. a post-hole). This form, containing information about layer content and dimensions, and a drawing of, say, the post-hole, is regarded as a unit. Several such units, which are connected through the use of a *Harris matrix*, form a phase. Constructions are primarily recorded on a *composite plan*, the outer limits of which follow the boundary of the excavated area. Determination of which features should be attributed to which plan is made at the time of excavation on the grounds of contemporaneity. No two chronologically separated units should be recorded on the same plan (Harris 1979:61ff). This is more or less the type of planning that was employed on the "Trädgårdsmästaren" site.

Relative dating. Relative dating can be used on a phase-divided material. It describes the chronological order of the phases, designated e.g. phases 1–10 where number 1 is the oldest. Relative dating contains no information about the age or timespan of a phase, cf. *Absolute dating*.

Sections. Two main types of section drawings are defined (Harris 1979:55): The *realistic* section drawing contains no interpretations of layer interfaces, only descriptive hatching to show the types of layers. This can be described as an attempt to be objective and resembles as close as possible the photographic image. The *stylized* section drawing shows interfacial lines, layer numbers, and hatching, together with accompanying written descriptions of the layers. This method consequently contains an element of interpretation which is the first step towards stratigraphic analysis. "[T]he analysis of stratification in sections is not a question of examining the soil composition of the strata, but of studying the interfaces"

(Harris 1979:58). "Interpretation is an integrated part of recording. If the interpretation is to be precise, it has to be conscious. By demanding conscious interpretation, meaningful documentation is made possible" (Järpe et al. 1979:32ff).

Spit-digging. This involves excavating an archaeological deposit in artificial levels of a fixed depth. The method is often used on sites that lack visible stratigraphy, e.g. Stone Age settlements.

Stratigraphy. The aim of stratigraphic documentation and stratigraphic analysis of an archaeological record is to locate and link units such as layers and constructions. During excavation these units may range from single layers to remains of a whole building. The goal of the post-excavation analysis is to assess whether these units are relevant and then to unite them into phases (cf. *Phase*).

Comparisons with other methods and materials

Recent decades have witnessed a number of major reports on urban excavations in Norway wherein the methods of stratigraphic recording and analysis are presented: Bryggen in Bergen, 1955–68 (Herteig 1985), the Mindet site in Gamlebyen, Oslo, 1970–72 (Høeg et al. 1977), Søndre felt, Gamlebyen, Oslo, 1973–76 (Schia 1987), the Folkebibliotek site in Trondheim, 1973–85 (Jondell & Nordeide 1988). Siri Myrvoll reviews two main principles of site documentation and analysis: the *diary system* and the *comment system*.

The *diary system* is the older of the two. As the name implies, it has a diary at its core. In this method the excavation director records daily notes about events and changes on the site, about e.g. weather, staff, and description of, and relationships between, archaeological features. This is supplemented with forms for more detailed descriptions of individual layers, plans and photos. The supplements must be objective; interpretations have no place in this stage of the record. The system was originally developed at excavations of prehistoric sites where the layers are thin and features and structures few and fragmentary. The diary system in its purest form was used on the excavations in Trondheim, where it was supplemented with elaborate layer record sheets to accommodate handling such rich deposits.

A short outline of the 1973–85 excavation at the Folkebibliotek site in Trondheim will be presented to illustrate the diary system. It should be pointed out that that site shares many similarities with the Trädgårdsmästaren site in terms of plot layout, yard structure, function and timespan. The Trondheim excavation continued through nine seasons with the participation of a total of 460 archaeologists from 14 countries. The site was divided into 21 sub-areas without any standing sections between. Each sub-area was excavated separately. The method was strictly stratigraphic, each stratum or

construction forming a separate unit within the record. (For further discussions on recording and objectivity, cf. Christophersen et al. 1988:34, *Overdokumentation*.)

The *comment system*, the alternative system employed on Norwegian urban archaeological excavations, uses plan and section drawings as the basis for the stratigraphic record. Comments concerning layers and structures are documented in writing on a separate form for each planning level and square (i.e. unit of excavation). These comments should include information about how buildings and other features are constructed and on the composition of the layers. The interpretation on site of the different stratigraphic situations is important. The analysis is made easier if one can follow the reasoning behind the decisions about how to excavate and record.

The comment system was originally developed for the Bryggen excavations, in Bergen. This was the first modern large scale urban excavation in Norway and it became apparent that the traditional methods of recording for prehistoric sites were unwieldy when handling thick medieval deposits. The method has since been used at Gamlebyen in Oslo and Skien 1978–79, in Bergen from 1980, and at the Kaupang in Borgund (Myrvoll 1982:34ff)

In a comparison between the two, one could say that the *diary system* is an attempt to reach objectivity in the site record, the main parts of which are the written descriptions and stratigraphic relations of features. Interpretations are reserved for when writing the report. In the *comment system* the idea is to interpret while on site, on plans and on section drawings. During stratigraphic analysis, the drawings are used to connect the different features across the excavated area. This was the recording system adopted for the Trädgårdsmästaren site. It works well in early medieval Sigtuna with its densely built-up plots and where the buildings' construction layers coincide with the chronological boundaries separating phases.

The Trädgårdsmästaren site excavation Background

In early June 1990, the excavation campaign Sigtuna Excavations 1988–90 was completed. It was one of the largest urban archaeological excavations in Sweden so far. The excavation was caused by plans to commercially develop the 1100 m² plot. The original intention was to bypass an archaeological excavation by using the *Bjerking method*, which has been designed to enable buildings to be erected over existing urban occupation layers. The site is covered with a floor of concrete which rests on steel piles which in turn are anchored to the bedrock. Considering the large area that the concrete was to cover at this site, however, it became obvious that wood, leather and other organic materials in the cultural layers underneath would probably dry up and decompose completely with time. In November 1987, a meeting and one-

day seminar was held to summarize research on Sigtuna. The development of the Trädgårdsmästaren site was discussed and it became clear that here was a unique possibility to for the first time carry out a large archaeological investigation of the occupation layers in the centre of early medieval Sigtuna. New material shedding light on the town's earliest plan and its development would be made available for research. A resolution was sent to the owner and developer of the plot, Sigtuna local authority. It demanded that the whole area for development should be archaeologically excavated. This view received the support of local politicians. (Tesch 1990:8f)

The project was organized by Sigtuna Museum with Sten Tesch as project leader. The excavation was directed by Mats Roslund and the present author, who both also carried out the post-excavation stratigraphic analyses. A staff of 43 archaeologists worked on the site for two years. The site covered 1100 m². Some 1500 m³ of cultural layers were excavated and recorded. The remains of dense settlement and a large number of finds ranging from simple household articles like black earthenware pottery to exotic Byzantine ivory combs were unearthed. The main goal of the project was to employ a "stratigraphic" excavating technique to obtain a finer chronology for the previously broadly used term "Sigtuna era", the 11th and 12th centuries. Therefore, the first undertaking after the excavation was finished was to complete the stratigraphic analysis, i.e. to group the record and thus the finds into datable phases. Thereafter the project could continue to address questions about town-plan, types of buildings, trade, cultural contacts, crafts and different categories of finds. Previously, the remains of buildings and the finds were seen as the only sources of archaeological information. It has however been shown that the intermediate layers of manure, craft debris, fires, etc., can yield considerable data, linking up the building remains which together with the finds create units, the settlement layers. The material history of the town lies stacked like the pages of an enormous book. This is the basis for the "stratigraphic" method of excavation. Earlier excavations in Sigtuna indicated the existence of extensive remains of buildings and finds from the time of the formation of the Swedish State. The opportunity to uncover complete town yards in early medieval Sigtuna, made it obvious that the method of excavation should be such that would allow, already during fieldwork, a determination of which buildings were contemporary to one another and to record the finds accordingly.

Urban archaeology in Scandinavia has expanded rapidly over the past 20 years. Methods of recording and stratigraphic analyses of cultural layers have developed apace, though these methods vary among the excavating institutions. The whole process of excavating, recording, stratigraphic analysis, and the final answering of specific questions, can be seen as a chain in which all the links have to be equally strong to get the best result possi-

ble. In other words, each part in the process must be carried out with determination and with methodological awareness.

Fieldwork, excavation and documentation

Excavation at the Trädgårdsmästaren site commenced with the removal of post-medieval disturbances. Already at this stage, elongated plateaux where buildings had stood in long rows at right angles to the main street, could be observed. The plots or town yards on the plateaux were separated from each other by shallow ditches with fragmentary remains of wooden trackways. These observations were helpful when deciding where to place cross-sections. A 2×2 m square grid was laid out on the site. It was also divided into 5×10 m sub-areas separated from each other by section baulks. A section was placed along the middle of each plot to enable buildings to be related to one another. Transverse sections were laid out to record connections between the plots. A team of 4–5 archaeologists worked on, and had full responsibility for, each sub-area. The aim was to remove one “building layer” at a time.

A building layer can be seen to consist of four principal sub-layers:

1. The bottom layer forms the construction level, i.e. sill stones, clay floor and possibly wooden remains of the building itself.
2. Above this lies the accumulated layer with rubbish and artefacts emanating from the building's period of use.
3. This is usually overlain by a destruction layer, containing the sometimes burned, torn down remains of the buildings.
4. Finally, the uppermost stratum contains levelled-out deposits from the surrounding area, mixed with parts of the destruction layer and forming the foundation of the next building layer.

The on-site interpretation of constructions calls for professionally trained archaeologists. Familiarity with archaeological remains such as layers, constructions, artefacts and soil is of the greatest value. Active participation is a prerequisite for proper interpretation. The basis of the record is made up by the drawings.

At the Trädgårdsmästaren site, the drawings were supplemented with written descriptions and sketches of the features providing details about construction, relations to other features and interpretation. The accumulated and deposited layers were described per excavation level and per 2×2 m square, in a supplementary diary. The layer descriptions included layer sequence and extent and relationship to the section drawings. Cataloguing of the finds was carried out parallel to the excavation, partly because of the time pressure, but also to provide the excavating staff with a greater knowledge of the range of find categories being uncovered. When the excavation was com-

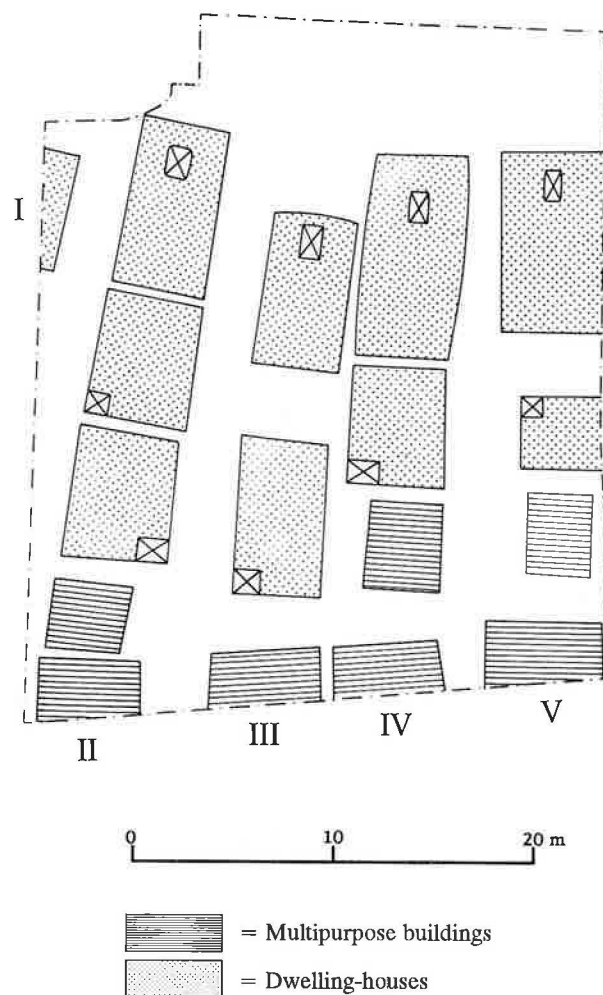


Fig. 1. The early medieval town yards on the Trädgårdsmästaren site, plots I–V. Interpretation of the buildings at the end of main-phase II, showing the principle functions of the houses. Multipurpose buildings lie close to the main street, dwelling-houses further back on the plot. After Pettersson 1992.

pleted, after almost two years of digging, some 400 constructions had been recorded on 600 drawings, plus written descriptions and photos. The finds were catalogued under 30,000 number designations, each more often than not including several finds. In addition to this, there were six tons of animal bones, and a large number of soil- and dendro-samples for macrofossil analysis and dating.

Stratigraphic analysis of the site *Background*

Prior to stratigraphic analysis, the documentation record was divided between the two site directors, each with responsibility for one half of the site. The dividing line chosen coincided with a medieval plot boundary making allocation practical and methodologically satisfactory. This paper therefore refers only to the methods and results of the eastern half of the site, plots IV and V (fig. 1).

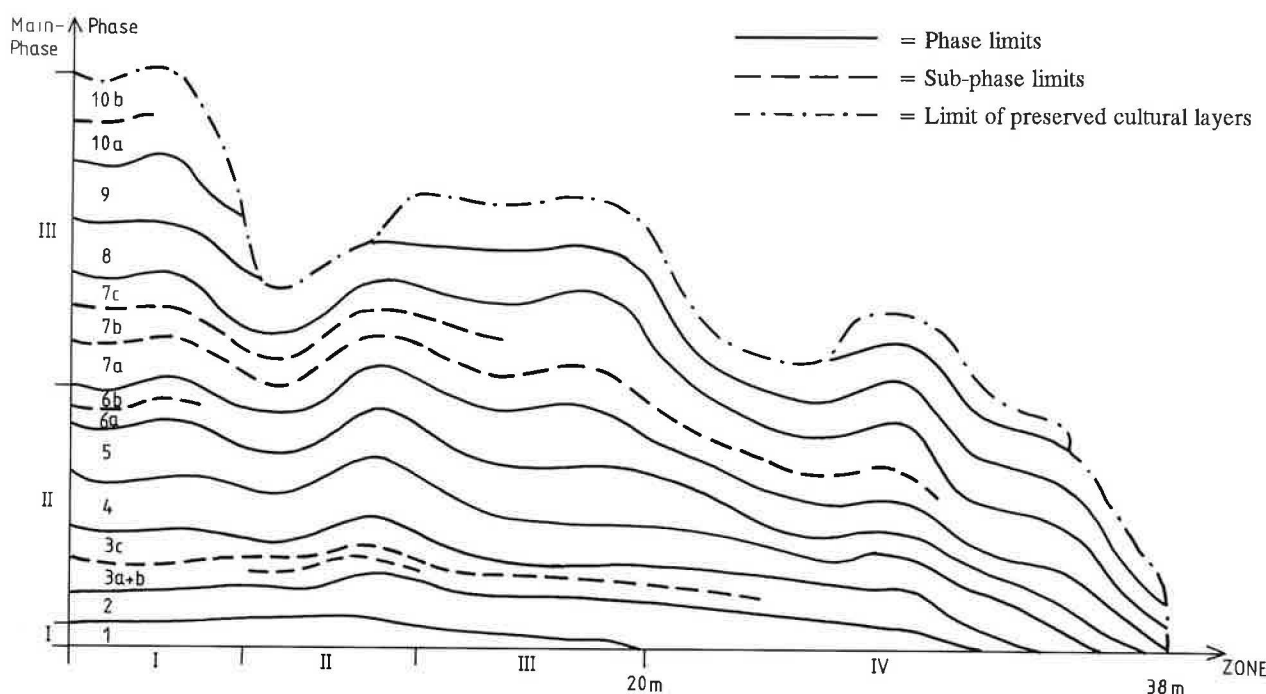


Fig. 2. Depth and extent of the different phases at the Trädgårdsmästaren site. The diagram further shows that the sub-phases appear only locally, cf. e.g. 7c. After Petterson 1993.

Definition of phase

An archaeological record of a settlement site has to be analysed in several stages to achieve a clear picture of find contexts and settlement structure, in a process whereby the site records are organized so that the different parts can be integrated with each other and can be viewed as one unit. This will ideally provide an interpretation which is not too far removed from the actual historic development. The aim is to create phases from the records and finds. The term phase can be explained as the smallest chronologically definable unit covering the whole site. Choice of what is to be assigned to the same phase, is a question of evaluating building remains and construction levels and linking them chronologically. The phases should be seen as clearly delimited spaces, one following another through time (cf. Andrén 1985:7), wherein the remains of buildings and artefacts are contained. The timespan of any one phase is constant everywhere on the site. It should be emphasized that overlapping between phases must be avoided, otherwise parts of the find material would be present in several phases which in turn makes find processing complicated. The results of the stratigraphic analysis are best presented on different levels. During analysis of the Trädgårdsmästaren site record, three levels of phases have developed.

On the broadest level lie the *main-phases*, each containing one or several phases, covering the whole site, with similar layout and town-yard usage. It is possible to

make comparisons across the whole site and with all finds. The criterion for a new main-phase is a change in the settlement structure and great changes in the find material, which may be caused by changes of an administrative, economical, social, or political nature.

The next level comprise the *phases*, each containing one building layer over the whole site. From one phase to the next, all the buildings within the site have been renewed. Each find belongs to only one phase. It is also possible to make phase comparisons across the whole site and with other phases. The change from one phase to the next may be caused by large fires or gradually changing space allocation or production.

At the finest level lie the *sub-phases*, corresponding to local changes, e.g. within a town yard. Some houses survive through several sub-phases which means that also their associated finds will be repeated. At this level, comparative find studies can only be made within areas where finds are not repeated (fig. 2). Yard changes may be caused by small fires, houses beyond repair, or changes in production.

Analysis of the site record

The first step in phasing, involves marking the construction levels and fire layers on the section drawings. After this, all plans are linked to the sections, i.e. all constructions that are crossed by a section are marked with a line on the appropriate drawing (fig. 3). Using these marked section drawings as keys, individual buildings can be lo-

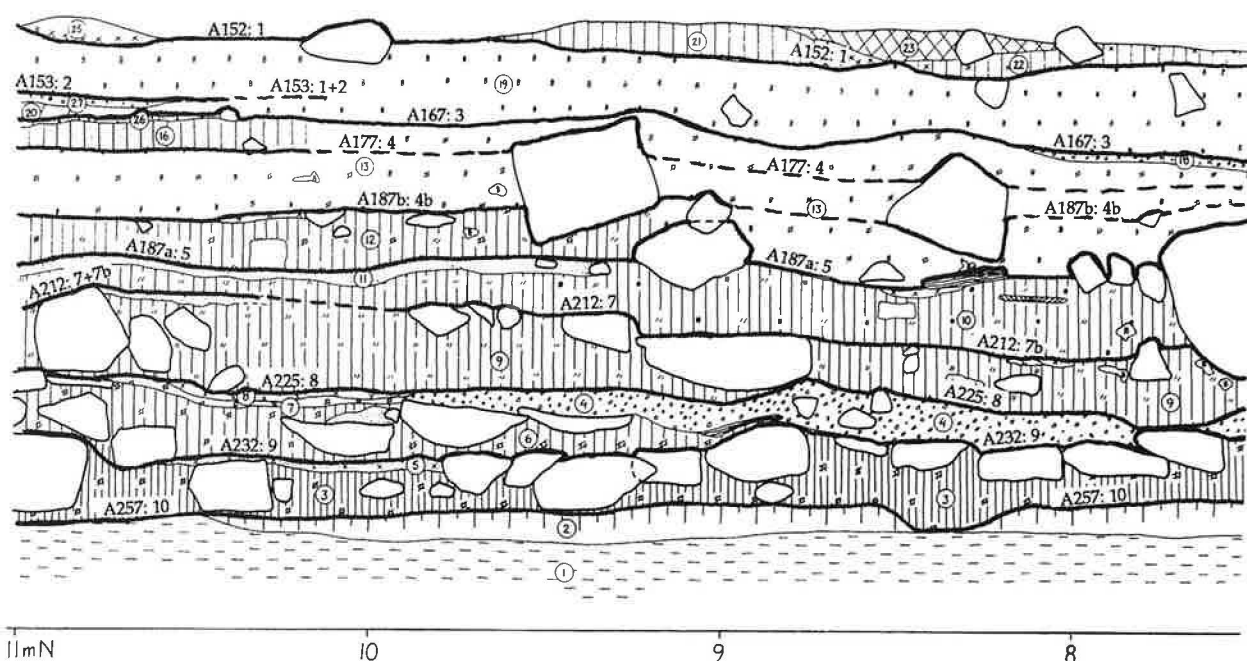


Fig. 3. Section through part of plot IV showing how plan drawings are connected to the section via construction number and plan number, e.g. A212: 7 (construction A212, plan 7). The heavy lines delimits constructions which are contemporary with one another. After Petterson 1993.

cated and delimited. Parallel to this, a form is filled out wherein it is noted which 2×2 m squares and layers belong to which building. Thereafter, all contemporary buildings within a town yard are linked up. Interpretation of alleys, the areas between buildings, must be continuously adjusted while these larger units are being assembled. Finally the chronological relationships between town yards must be established, so that features in the alleys are attributed to the correct phases.

The analysis progresses therefore, step by step, starting at post-hole and layer level, and working upwards to houses, plots and finally phases. The section drawings are important tools in this process. When finally all construction features have been redrawn on plans, each showing buildings which are contemporary to one another, the finds too will have been given a relative dating.

After two years of work with the stratigraphic analysis of the Trädgårdsmästaren site, all the drawings have been processed and a fuller picture of the settlement has emerged. In addition, all the finds have been given a "home address" in time and space, in or outside a building within a dated phase. The forms on which each excavated level in each phase for each 2×2 m square has its own reference number, is the key to the absolute chronology. With this as a tool, special studies can be undertaken such as answering questions about when the town was established, the structure of its town plan, town yards, how different parts of the plots were used, construction types, crafts, trade and exchange. As a result of our stratigraphic analysis, the more than 400 constructions recorded on site have been transformed into some 180 buildings and 20 wooden pavements.

The town yard History

As a background to the results described below, a short review of previous research on early medieval settlement in Sigtuna will be presented.

Concerning house-constructions, the results from early archaeological excavations in Sigtuna can be summarized thus: An early period with wattle-and-daub houses was at a later stage complemented by the introduction of cross-timber or post-and-plank (rare) constructions. Most of the recorded houses were small and badly preserved (Douglas 1978:61). In 1925 a well-preserved wattle-and-daub house with wooden sill was uncovered on the "Trekanten" site, neighbouring to "Trädgårdsmästaren" (Arbman 1926). In and around the house, which had a centrally placed hearth, a number of bronze clippings were found. This led to the conclusion that it was a bronze-caster's workshop. Because of the lack of other recognizable house types in the town, this came to represent the typical Sigtuna house. Some suggestions were made concerning the structure and function of the town yards. According to one theory the merchants' quarter was situated along the south side of the main street. From here, narrow alley-ways led down to the small shops and jetties. On the north side of the street lay the craftsmen's quarter with workshops and store-houses with their entrances from the yards. All dwelling-houses were situated at the back of the yards on the north side of the main street (Floderus 1941). A later suggestion follows along the same lines except for the fact that the merchants' dwelling-houses are placed south of the street (Arbman 1942).

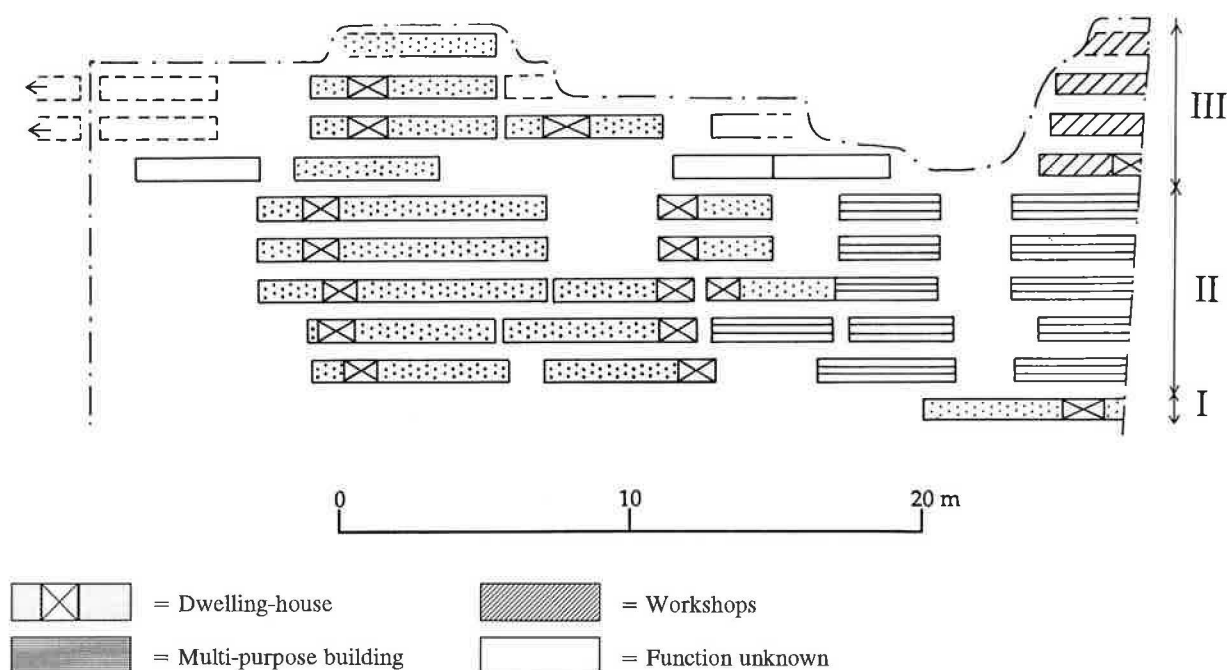


Fig. 4. A generalized section through ten phases of the settlement on one plot. Changes in the structure of the yard, and in the construction and function of the houses, have motivated a grouping into three main-phases: main-phase I – late 10th century, main-phase II – early 11th century to c. 1100, main-phase III – early 12th century to early 13th century. After Petterson 1992, p. 157.

Structure and main-phases

The post-excavation work at the Trädgårdsmästaren site has led to revisions in the views of the development of the settlement structure. This affects future interpretations of the archaeological material in Sigtuna. The results show that we are here dealing with a section of the early medieval town containing four parallel town yards north of and at right angles to the main street (*Stora gatan*). There are some 180 buildings of varying size, construction and function in ten phases. Plot boundaries were made up of ditches, when the town was founded c. AD 980. These boundaries remained unchanged and can be followed in the deposits down to the early 13th century. This development through the three main-phases is described in detail in fig. 4.

During the 980s, in the beginning of *main-phase I*, the plot boundaries are formed of long ditches at intervals of about eight metres, set at right angles to the main street. This period contains only one phase with one or two houses in a row near the street on every plot, which makes them relatively short, c. 20 m. The houses are wattle-and-daub buildings without any sill. Neither finds nor layout indicate any specialized functions. All buildings were dwelling-houses with some indications of craft working, suggesting limited production for use within the town yard.

Main-phase II has five phases and is roughly dated to the 11th century. The buildings are placed as in the previous main-phase but there are now four or five houses per plot making the plots at least 30 m. During the early parts

of the period the houses are still built with wattle-and-daub, but now a difference in function can be seen. The houses closest to the street have no distinct fireplace. Here crafts such as bronze-casting, blacksmithing and textile handicrafts such as weaving have been carried out. These houses might also have served as stores, in other words, they were multi-purpose buildings.

The dwelling-houses are situated at the far end of the plot. There are two different types. The ones closest to the middle of the plot have a hearth or an oven placed in one corner. The house furthest away from the street is a somewhat larger hall-like building with a centrally placed hearth. The large number of potsherds found in the “corner-hearth” houses suggests household functions such as cooking. It is possible that the main use of the “halls” was for meetings and social gatherings (fig. 5).

There is a similar house-type in medieval Bergen known as “schøtstuen”. This building was also placed at the far end of the plot and was used as a meeting-place at mealtimes. Food was brought there from the cooking house (Helle 1982:276, 742, 762). Olaf Kyrre’s Saga tells that “King Harald and other kings before him used to drink from a horn and to pass the horn from the high seat round the fire to drink a toast with those they wished to drink with” (Snorre Sturluson 1981:587). The high seat was obviously in a house with a centrally placed hearth.

Remains of looms survive in both types of dwelling-houses. During the later part of the same main-phase, i.e. the end of the 11th century, the town yards retain the

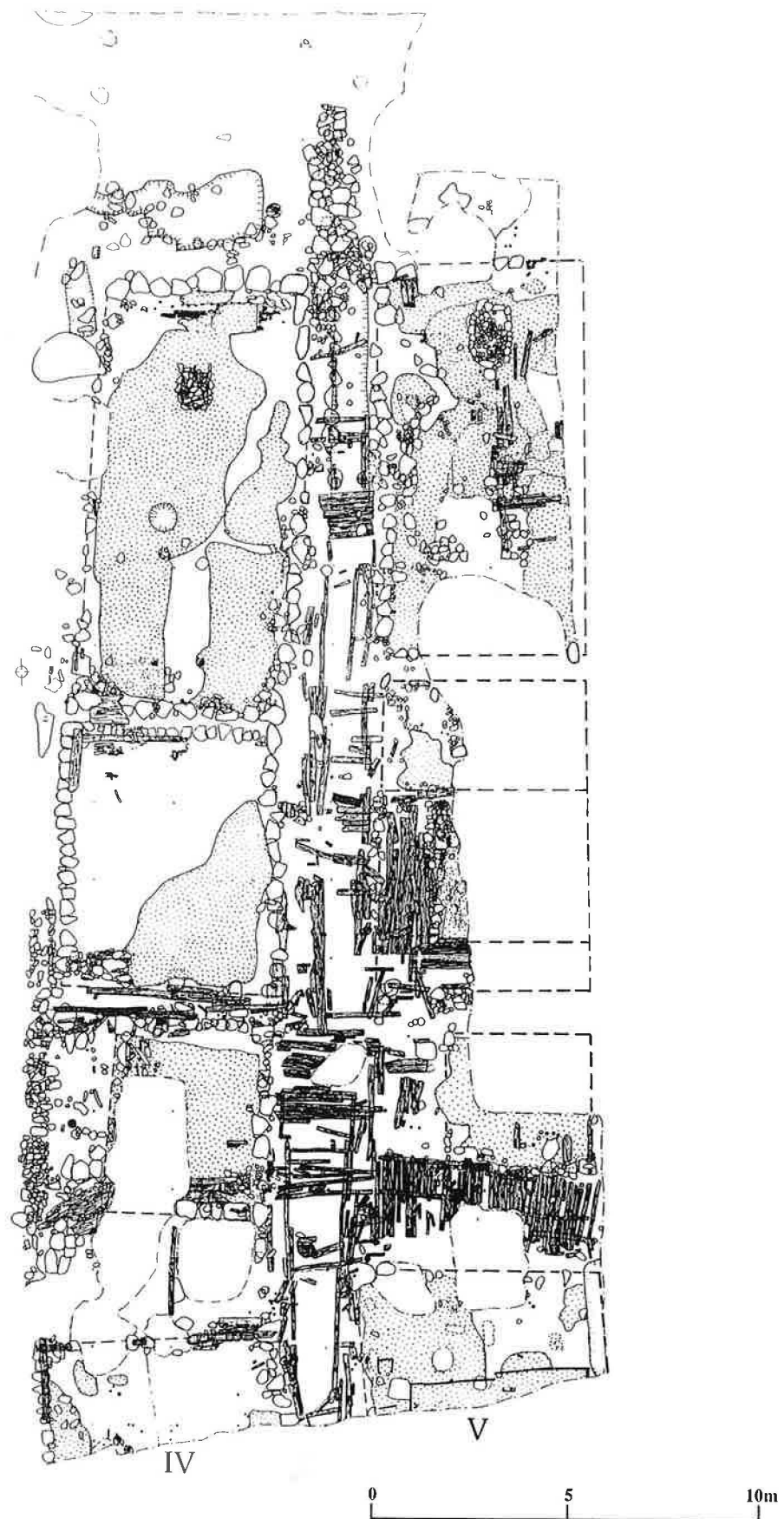


Fig.5. Settlement remains on plots IV and V, showing the buildings and their surroundings on the north side of Stora Gatan at the end of the 11th century (main-phase II): After Petterson 1992, p. 159.

same structure but all the houses are more solidly built with closely fitted sill-stones forming the foundations for cross-timbered and post-and-plank constructions. The location of crafts towards the street is even more pronounced and there is even an increase in intensity, marked by a greater amount of slag and "furnace-stones". The bone and antler crafts begin to leave traces in the cultural layers near the street, while the textile craft is no longer present in this specialized area near the main street. A similar yard plan, with multi-purpose buildings and workshops placed near the street, while dwelling-houses are placed at the far end of the plot, has been uncovered in the early medieval layers at the "Folkebibliotek" site in Trondheim (Christophersen 1990:113ff).

In *main-phase III*, from the early 13th century to the beginning of the 14th century, the town yards become even longer and the structure of the built-up area has changed once again. The remains of buildings are more difficult to interpret now than in the earlier phases, being comprised merely of scattered sill-stones, heavily decayed wood and patches of clay floors. Some wattle-and-daub constructions are also in evidence. The hearths are no longer placed in the same position when houses are repaired or rebuilt. The number of buildings has increased and that next to the street becomes replaced by two small workshops, side-by-side. In these, bronze-casting, blacksmithing and some comb-making is carried out, leaving thick layers of debris. Towards the end of

the main-phase, the plots are more than 38 m long, extending beyond the excavated area. In the workshops next to the street, comb-making is the dominating craft, leaving large amounts of elk-antler chippings.

Zone division

The evidence shows that each functional area or zone has its particular artefacts and find combinations, i.e. some activities can be identified by the traces they leave (cf. Herschend 1974:14ff). One example is specialized handicrafts: comb-making, bronze-casting and blacksmithing which can be traced through the large amounts of antler chippings and slag. Other finds in this environment are crucibles, moulds and "furnace-stones" made of clay. These latter finds are actually tools and are more scarce than antler and slag. Tools of the more durable kind such as hammers, tongs and anvils are very rare.

The textile crafts were for obvious reasons carried out in houses further back on the plots, away from blacksmithing and casting activities. They have not left traces in the form of debris, but can be detected through their tools, such as loom-weights.

The early medieval town yards can be divided into four zones (fig. 6). In *zone I*, close to the main street, metal-, bone- and antler-crafts occur especially in *main-phase III*. *Zone II* has multi-purpose buildings for crafts and storage. The dwelling-houses in *zone III* are mainly

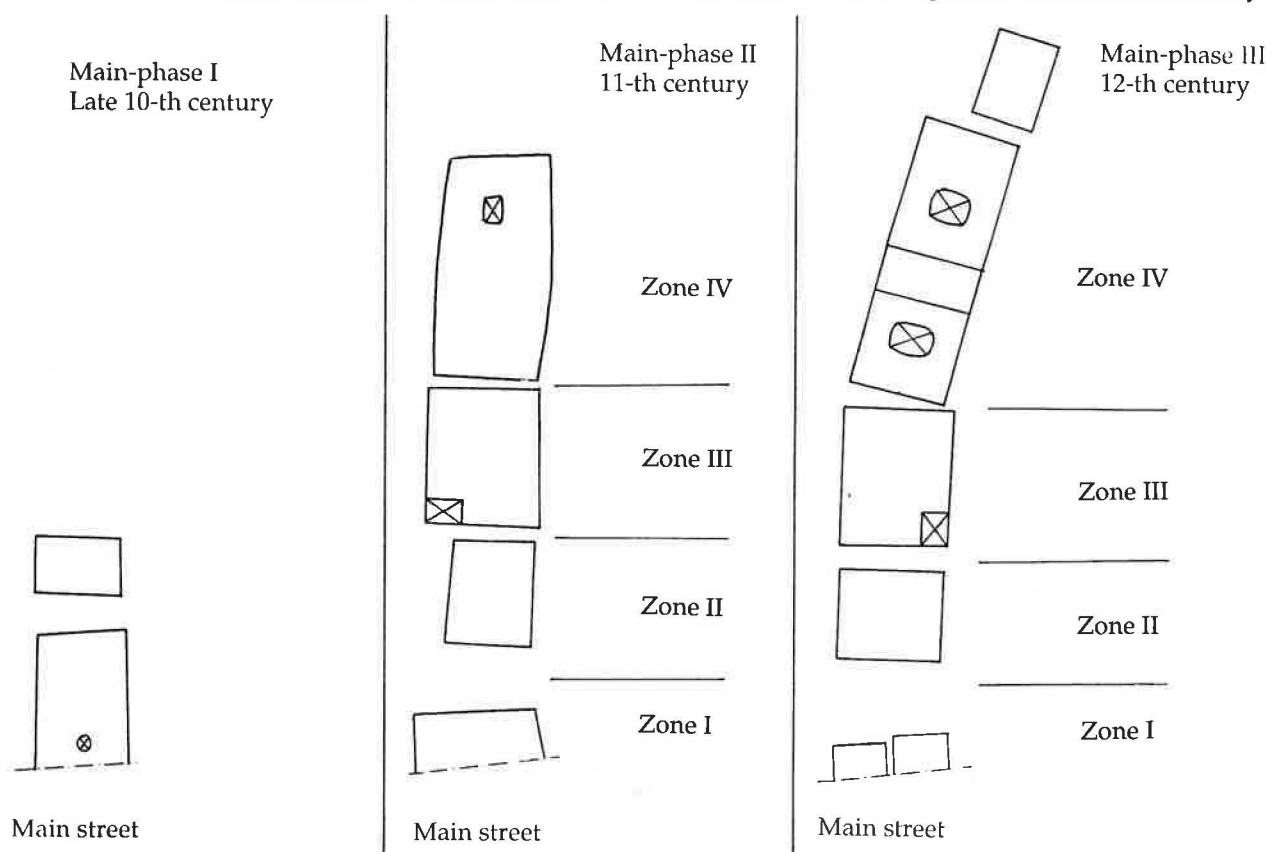


Fig. 6. A generalized picture of the town yard with the position of the four zones throughout the three main-phases. Note that the plots become longer in the later phases. After Petterson 1993.

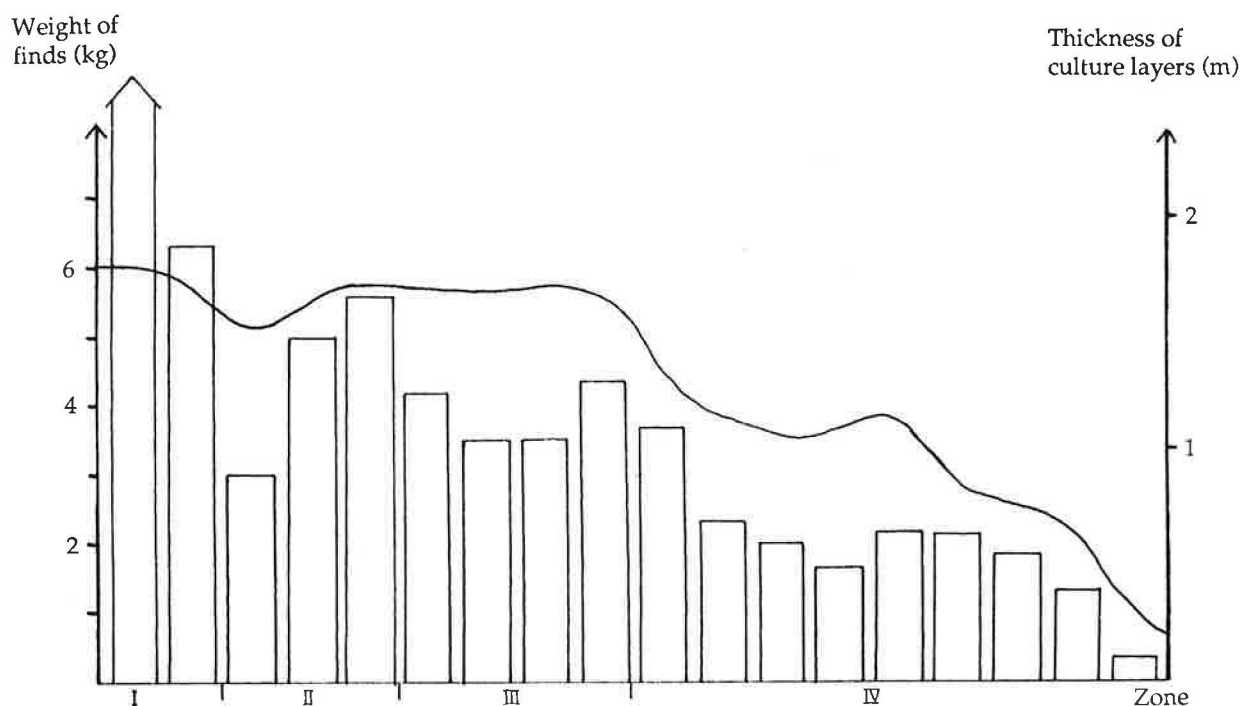


Fig. 7. The weight of the finds (kg) and the thickness of the culture layers (metres) as measured along the centre-line of a plot. The resulting diagram shows that find-weight (bars) is proportional to the layer-thickness (graph), except in zone I. Each bar represents the finds from one 2×2 m square. The finds in zone I consist largely of craft debris from the workshops along the main street, showing that debris was deposited close to where it was produced. Drawing Björn Pettersson.

for household work, revealing large amounts of sherds from simple household pottery. In zone IV, houses with social functions dominate.

Absolute dating

One remaining task in the stratigraphic analysis is to establish absolute dating for each phase. The means available for this on the Trädgårdsmästaren site are some ten dendrochronological samples from phases 1–3 and phase 9, plot II, together with a piece of lead with a coin-die impression from the mint of King Knut Eriksson. The dendrochronological samples have been dated by Thomas Bartholin to the period AD 981–1013 and the coin-die impression is dated to the 1180s (Jonsson 1985:190ff; Lagerqvist 1990:95ff). The coin-die impression has probably been thrown away quite soon after being made as it is a waste product, so a dating of phase 9 to the late 12th century seems reasonable. These circumstances provide a total timespan of 250–300 years for phases 1–10, i.e. 25–30 years per phase, though it is of course improbable that the phases in fact were of equal length.

One possibility of reaching an absolute dating of every phase is to let several source-materials work in combination. To use this method certain conditions must be fulfilled; how this has been done is shown within parentheses.

- The material must be phased with no overlap in time, i.e. dated relatively (completed stratigraphic analysis with ten phases).

- Some dates and the total timespan must be known (dendrochronological samples in phases 1–3 and the coin-die impression in phase 9).
- Establish activities and type of cultural layer accumulation on the site (division of the plots into zones and determining their functions).
- Possibility to measure the thickness of every phase in each zone (sections along the middle of each plot, where the layers are well-defined).

From this starting point it can be discussed how and why the accumulation of deposits varies in different zones and phases (fig. 2). The thickness of the cultural layers depends on several factors:

1. Occurrence of disturbances
2. Added or removed deposits
3. Degree of decay
4. Type of activity on each location
5. Timespan of each phase

Factor 1 can be excluded as the disturbances can be seen in the sections and can thus be avoided when measuring the thickness of the phases. Factor 2 does not affect the measurements since the general picture is the same in all the plots: thick deposits close to the street, thinner ones further back. Furthermore the well-preserved building-remains demonstrate that no large-scale contemporary removal of deposits has taken place. The graphs of find-weight and deposit-thickness are proportional to each other along the centre-line of the plots, except in zone I. The majority of finds in this zone consists of debris (elk-antler chippings and slag) from the workshops along the main street. Another example of this cor-

Table 1. Table showing cultural-layer accumulation per phase in plot IV as a function of years per phase together with three suggested absolute datings of phases 1–10. In the text, a total timespan of 250 years is put forward as the most probable alternative. After Petterson 1993.

Cultural layer growth (cm)/Phase					Years/Phase (rounded)			Absolute dating (years)		
<i>Zone I</i>	<i>Zone II</i>	<i>Zone III</i>	<i>Zone I-III/3=</i>	<i>200/179</i>	<i>250/179</i> ×	<i>300/179</i> ×	<i>Phase I-10=</i>	<i>Phase I-10=</i>	<i>Phase I-10=</i>	
<i>Phase</i>			<i>M</i>	× <i>M</i>	× <i>M</i>	× <i>M</i>	<i>200 years</i>	<i>250 years</i>	<i>300 years</i>	
1	6	9	4	6	7	9	11	980-987	980-989	980-991
2	10	15	11	12	13	17	20	987-1000	989-1006	991-1011
3	20	18	19	19	21	26	32	1000-1021	1006-1032	1011-1043
4	18	20	16	18	20	25	30	1021-1041	1032-1057	1043-1073
5	22	15	16	18	20	25	29	1041-1061	1057-1082	1073-1102
6	14	16	19	16	18	23	27	1061-1079	1082-1105	1102-1129
7	38	34	39	37	41	51	62	1079-1120	1105-1156	1129-1191
8	20	13	18	17	19	24	28	1120-1139	1156-1180	1191-1219
9	22	16	17	18	20	25	31	1139-1159	1180-1205	1219-1250
10	28			(18)	20	25	31	1159-1179	1205-1230	1250-1281
Σ				179	199	250	301			

respondence between find-types and functional area are the loom-weights and pottery in the “domestic” zone. The evidence indicates that debris, of every kind, has accumulated in the zone where it was produced (fig. 7), i.e. there was no significant redistribution or removal of deposits. Factor 3 is judged to not influence the results, as preservation conditions are similar in all zones and phases. Two factors remain, which affect the thickness of the deposits: type of activity (4) and the timespan of each phase (5).

The thickness of the deposits in each zone and phase

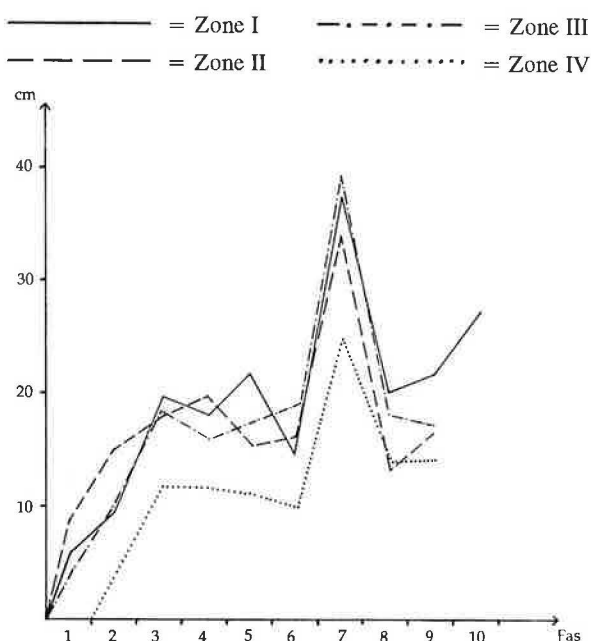


Fig. 8. Diagram of the cultural-layer accumulation in the four zones. Note the peak at phase 7. After Petterson 1993.

was measured. A total of 400 measurements were processed. The resulting graphs (fig. 8) show that the cultural-layer accumulation largely exhibits covariance between all four zones of activity through time. One might be led to believe that there had been an increase in activity up to phase 7, and thereafter a decrease. However, since we know that the zones have different functions and that the time-span of each phase is fixed over the whole of the site, the graphs should be interpreted in another way. We also know that a functional change with consequences for the accumulation of deposits is the appearance of workshops in zone I, during phases 7–10. From this follows that curve covariance illustrates a timespan variation and that lack of covariance indicates a change in function. It should be emphasized that only major changes can be studied from the diagram. Compared to the other zones, there is an accelerated deposition of cultural layers in zone I during phases 7–10. This is explained by the appearance of specialized crafts in these phases which produce large amounts of debris.

Following this line of reasoning, a table was constructed wherein a mean value of deposition per phase was calculated. These values were converted into three different suggestions for absolute dating of phases 1–10 (table 1)(zone IV was excluded from the calculations since it is situated outside the area covered by phase 1, cf. fig. 2). The table consists of three parts: to the left, the accumulation of deposits per zone and phase are shown together with a mean value for each phase. In the three middle columns the thickness of the deposits have been converted to years with three different suggestions of total timespan. To the right, the three different alternatives for absolute dating of each phase is shown. There are no deposits in phase 10 in zones II and III. The suggested

timespan is the same as in phase 9. Considering the dendrochronological datings and the date of the coin-die impression, a total timespan of 250 years seems most appropriate. These calculations have been made on material from plots IV–V and are intended to present a method that can be used in continued work with the site. The results must be viewed as preliminary until the whole record has been dealt with. The argumentation and calculations are based on carefully recorded sections and plans, which also are the basis for the stratigraphic analysis upon which, in turn, all further interpretations of the finds rest.

Conclusion

To be in a position to study the finds from an archaeological excavation in a meaningful way, the analysis of site stratigraphy must be properly conducted. This is the foundation upon which all further interpretations will stand. Consequently, the choice of both excavation and post-excavation methods are vitally important. In Sigtuna the importance of interpreting all features while on site was stressed. This need not imply that these interpretations will remain unchanged after the excavation is finished. The aim is to maximize conditions for post-excavation work where on-site interpretations will be weighed against other factors arising during the course of that work. The strategically placed cross-sections along the centre of the plots were used to link the constructions to one another. It has also been demonstrated that these sections together with dendrochronological datings, independently dated finds, and an awareness of the settlement-structure elevate the level of the results of the stratigraphic analysis from a relative to an absolute dating of the phases. Site development can be divided into ten phases from the late 10th to the early 13th centuries covering the whole site, involving a progression from short town yards with no special division of functions to long plots containing dwelling-houses at the far end of the plot and workshops near the main street. During the 12th century, specialized workshops with blacksmithing and comb-making were established, which led to the accumulation of thick layers of slag and antler-chippings. At this time, all household functions were moved to the far end of the plots. The study of the settlement structure is still under way, but the stratigraphic analysis is now completed and suggested dating has been presented here. This unique material with its complete town yards offers the possibility of determining date, function, and location, of different house types ranging from the late Viking Age to the High Middle Ages – a time of great social changes in central Sweden.

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