HIDDEN CARPENTRY

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HIDDEN CARPENTRY

INVESTIGATIONS OF MEDIEVAL CHURCH ROOFS IN VÄSTERGÖTLAND AND NORTHERN SMÅLAND

ROBIN GULLBRANDSSON

UNIVERSITY OF GOTHENBURG

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Cover:
View of the nave attic in Forshem church, towards the chancel.

All photographs and drawings are by the author if not otherwise mentioned.

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Abstract

Hidden carpentry. Investigations of Medieval Church Roofs in Västergötland and Northern Småland.

This licentiate thesis examines through three articles the corpus of preserved medieval timber roofs in churches of Västergötland and Northern Småland, based on surveys in the dioceses of Linköping, Skara and Gothenburg 2010–2021. These were the first systematic surveys of medieval roof structures in the regions.

The primary aim of this thesis is a typology and chronology concerning the medieval church roofs of the two regions. Focus is put on the High Medieval material of Västergötland, where cross-disciplinary case studies have been made. Systems and techniques applied by the medieval carpenters could be identified, interpreted and structured. These in-depth field studies have together with studies of reference roofs from other regions and countries given a deeper insight into the roof structure and its part in medieval church building. Motives behind technical choices are discussed as well as the extent of possible domestic features. A narrative for Västergötland is sketched, from a pluralistic carpentry in the first half of the 12th century – although part of a European tradition of trussed tiebeam roofs – towards a more normative one. The latter just slowly opened up for new impulses from the continent, due to a decline in church building commissions in Västergötland after the mid-13th century. The uniform character that developed in Västergötland is not at hand in the material of Northern Småland.

This thesis also points at the values that can be identified in historic roof structures through cross-disciplinary fieldwork and how such investigations are necessary in order to maintain and restore an important European heritage in timber.

Keywords: Medieval timber roof structures, Medieval carpentry, Medieval church buildings, Typology, Survey methods

Figure 1. The nave attic in Gökhem church, Västergötland. Etching by the author 2022.

Preface

As buildings conservator in regional museums I have had many stimulating tasks, thus I long hesitated to start a postgraduate education. But the stone put in motion by my first survey of medieval roof structures in 2010 led to a situation where the swelling empirical material begged for a more profound treatment. In 2018 I and my "roof mate", carpenter Mattias Hallgren, took the newly appointed professor in craft research at the University of Gothenburg, Harald Bentz Høgseth, and Linda Lindblad of the Craft Laboratory, to some favourite church attics in Västergötland. Supported by my employer, Västergötland's Museum, this ended with me making an application for the licentiate degree at the Department of Conservation.

Research is seldom one-mans-work. Be it ventures into dusty, dark attics with colleagues and crafts practitioners, continous exchange of thoughts on site, in writing and drawing, at conferences and so forth. I ought to thank several, not least the staff in the parishes that gave access to the churches. A special acknowledgement goes to the carpenters and craft researchers involved in the Södra Råda Project and the diocese surveys. Foremost Mattias Hallgren for our close cooperation in the attics and many discussions on "how and why", his enthusiasm has revived my energy at many times. This also apply to fellow PhD student Karl-Magnus Melin, who has shared information and thoughts from the horizon of Scania, always trying to think outside "the 21st century box". Hans Linderson and Anton Hansson at the Dendrochronological Laboratory of Lund University are to be thanked for meticulous work and good co-operation. Many colleagues in other countries should be mentioned. I will just name some that have dedicated their time in commenting on my thoughts, shared observations and not the least taken me to interesting sites. Frédéric Épaud for showing me roofs in Normandy. Burghard Lohrum for taking me to roofs in Baden-Württemberg and the Rhine Valley. Tilo Schöfbeck for sharing observations and showing me round in Mecklenburg-Vorpommern. All other colleagues in "Arbeitskreis für Dachwerke" should be thanked for inspiring excursions and talks, I cannot mention all.

A certain acknowledgement goes to the now late architect Lennart Grandelius, Eksjö, who fortified my interest during the first survey and with enthusiasm followed the progress of research.

My other fellow PhD students are to be thanked for fruitful discussions during courses and seminars.

Main supervisor for this thesis was Harald Bentz Høgseth, who started as a carpenter, then became a buildings archaeologist, later head of craft education at the Norwegian Craft Institute before he became professor in conservation at the University of Gothenburg and now professor in art and craft at the Norwegian University of Science and Technology. With profound knowledge in both practice and theory, he helped me put the theoretical framework of my research into words. My assistant supervisors, first Kristina Linscott and later professor Gunnar Almevik have helped me forward through reading, recommending literature, posing vital questions and comments. Kristina was also the one who raised my interest for the attics in the first place. The director of Västergötland's Museum, Luitgard Löw, has been a steady supporter throughout the task of combining the everyday life of a buildings conservator with writing a thesis. I also thank my old friend Claes Uhnér for a careful proofreading of the final text.

Study journeys were made possible by a grant from the Royal Swedish Academy of Letters, History and Antiquities (Montelius minnesfond) and the support of my employer. The surveys, case studies and analyses were financed by public funding (*kyrkoantikvarisk ersättning*) from the Church of Sweden, which also supported a literature study via the Craft Laboratory. Participation in conferences has been facilitated by a grant from The Donation Board of the University of Gothenburg (Oscar Ekmans stipendiefond). A grant from the Helge Ax:son Johnson Foundation, together with the supportive attitude of my employer, provided time to write the final article and the framework. Another grant from the Royal Swedish Academy of Letters, History and Antiquities (Oscar Montelii fond) supported the printing of this thesis.

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Terminology

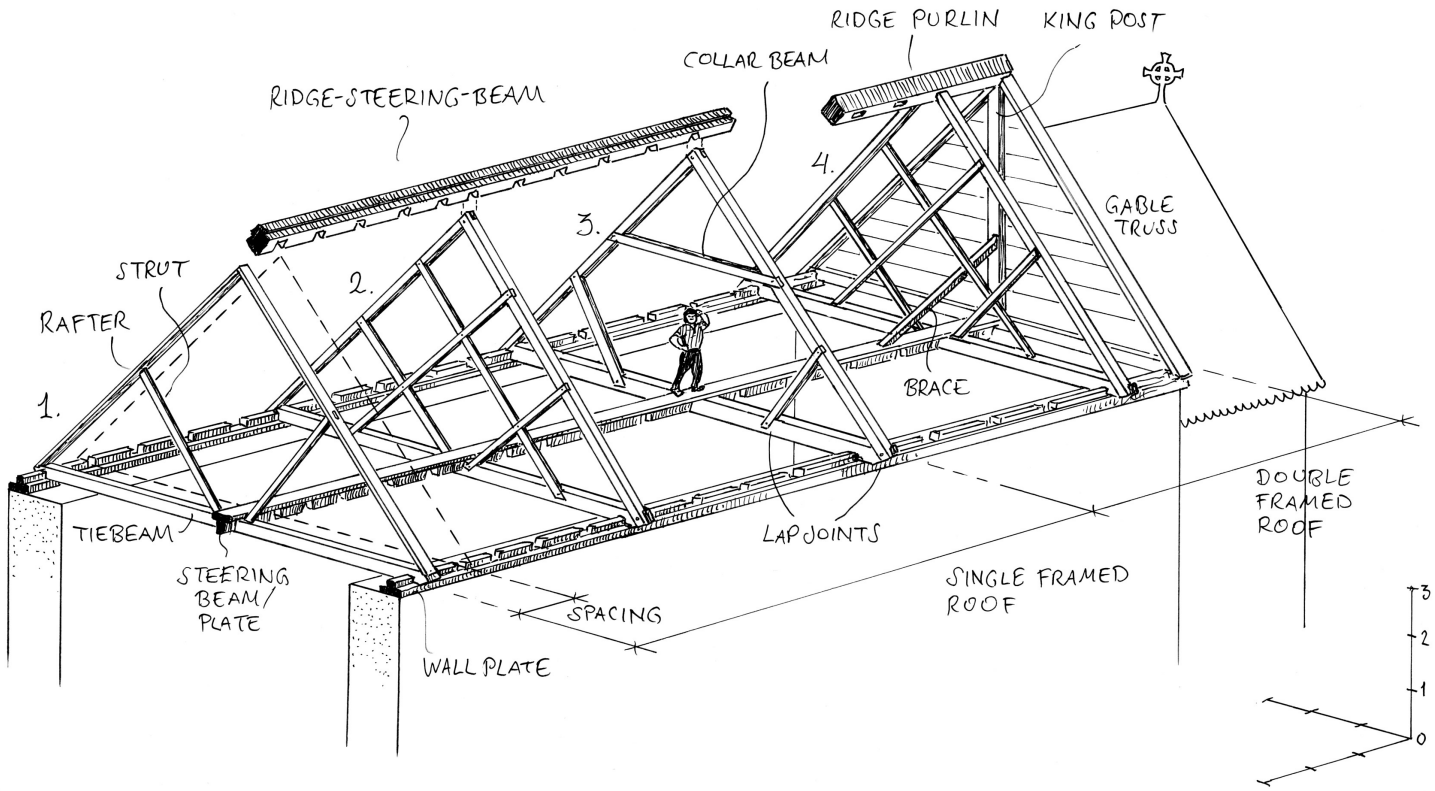


Figure 2. Terminology of tiebeam roofs, 12th and 13th century. 1. Truss with canted struts (assembled with tenon and mortise). 2. Truss with lattice of struts. 3. Truss with collarbeam and struts. 4. Roof with ridge purlin on posts and tiebeam trusses. Drawing by the author.

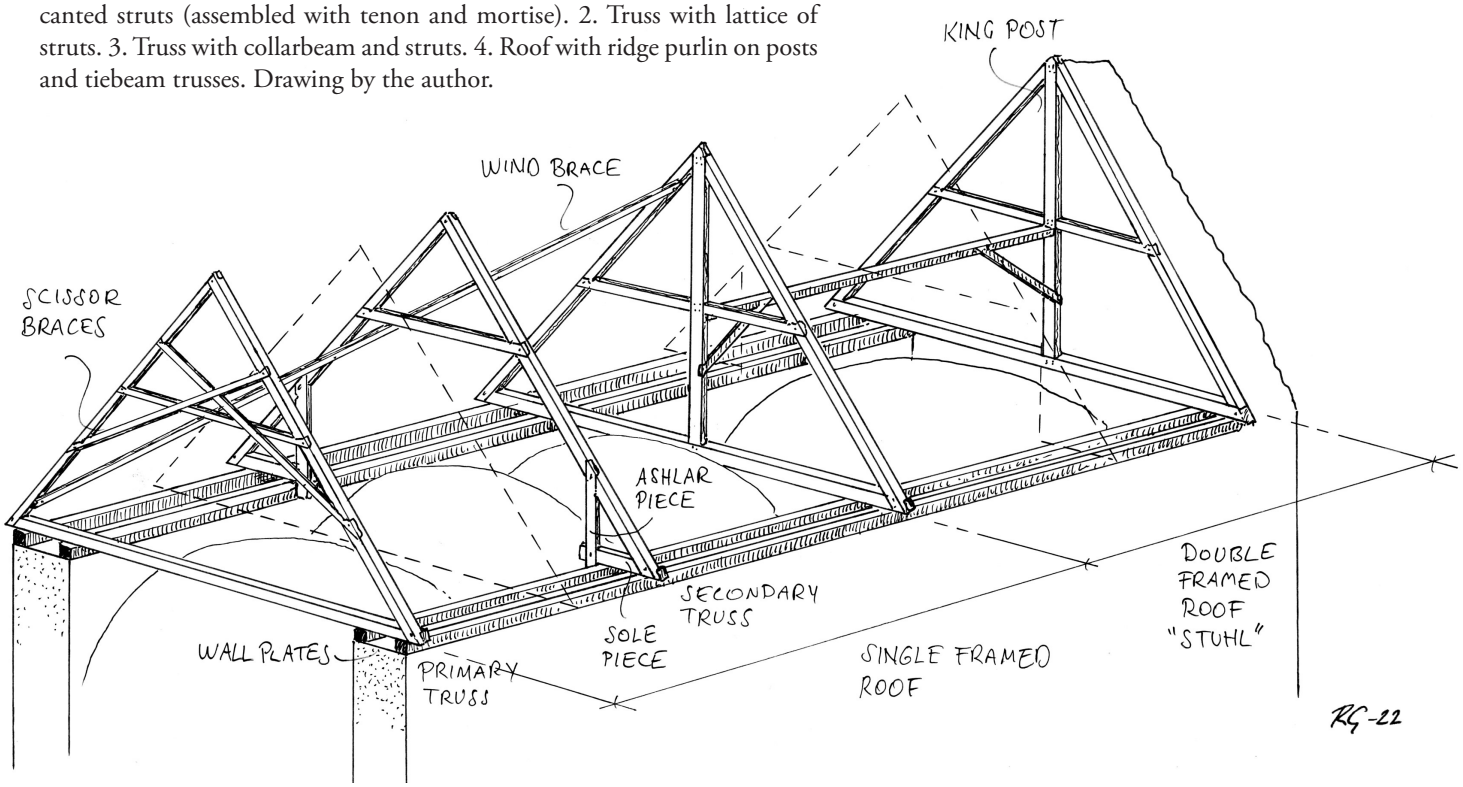


Figure 3. Roof structures adapted för vaulted interiors, late 13th century and Late Middle Ages. Drawing by the author.

Chapter 1
Introduction

Parsifal:
Ich schreite kaum,
doch wähn' ich mich schon weit.

Gurnemanz:
Du siehst, mein Sohn,
zum Raum wird hier die Zeit.
(from the 1st Act of "Parsifal" by Richard Wagner)

1.1 Background

It happens that you find things forgotten. Forgotten by yourself or by the time we live in. For me, an old student of archaeology and since nearly two decades buildings conservator, it is clear that the earth and the buildings around us are full of forgotten stories, from the trivial to those that demand rewriting of history. One could suppose that after more than a century of studies, Sweden's medieval churches would be quite void of new discoveries. It is not the case since much remains unnoticed and untold behind plaster, under floors, in attics. The medieval church attics are such a void of knowledge, hard to get at, but rewarding if you want to grasp the entity of the building. Whereas large parts of the Middle Ages in the church interiors are hidden under several layers of history, in the attics the time is almost frozen, roof timbers may even still look fresh. Sure, the medieval roof structures of Sweden is not a pristine page of research, but what has been written has only regarded a small portion of what is actually preserved.

The objective of this licentiate compilation thesis is to cast light on medieval roof structures in churches. This unique source material is remarkably underused in most previous research on churches, despite it being the oldest surviving timber structures in the country and in a wealth and condition that attract international interest. Some reasons shall be mentioned to why I wrote this thesis in conservation and not in archaeology or art history. My interaction with the empirical material of roof structures grew forth through my practice as a buildings conservator and my background in archaeology made me willing to move between disciplines. My collaborations with craft practitioners as well as the need of gathering knowledge for conscious maintenance and restoration could also be put forth as an argument to why this theme is relevant inside conservation. The discipline of conservation is a junction between different fields, united in an aim to discuss heritage, its preservation and uses (Almevik & Gustafsson 2021); very much related to the aims of a regional museum, which is my normal point of departure. The theme of medieval timber structures has a history within the field of conservation, which will be further presented in chapter 2. The University of Gothenburg has with the Department of Conservation, the Dacapo School of Crafts in Mariestad and the Craft Laboratory played a role in inciting a new interest for the corpus of preserved medieval church roofs in Sweden.

As buildings conservator in a regional museum, I do not have the nowadays more common background from the conservation programmes. In the early 2000s I took my master's degree in archaeology together with courses in history, art history and conservation. An interest for buildings archaeology manifested itself in my master's thesis that addressed early church building in my home province Västergötland. My fascination for small medieval parish churches awoke already during the traditional ceremonies at the end of each school semester. As a small boy I sat there inside those thick medieval walls, under the benevolent eyes of angels and saints, left there through ages or reinstated in the 20th century by restoration architects and congregation in an act of reverence for the pious skills of long gone ancestors.

After university I got employed in a project run by the diocese of Skara, surveying the historical values of its parish churches for upcoming maintenance plans. Most churches had not been the object of a structured antiquarian survey since the 1920s and then only concerning the inventory (Gullbrandsson

Figure 4. Mularp church by the Åsle valley, Västergötland.

Figure 5. Investigation of the nave attic in Högstena church, Västergötland.

2006). Many attics had never been scrutinized by any archaeologist or conservator. Architect Kristina Linscott, then associate professor at the Department of Conservation opened my eyes for the existence of a medieval wooden heritage up there, the roof trusses. But there was normally no time to penetrate into that dark world, especially since the access could be tricky. These intense, in total two and a half years, including a summarizing report plus a master's thesis in conservation on 20th century church restorations (Gullbrandsson 2008a, 2008b) led me from a future in archaeological commissions to the field of buildings conservation and heritage care in regional museums. I worked ten years at the County Museum of Jönköping with surveys, assessments and restoration control, which was a great school of learning. Since 2016 I have had my desk and with time quite crammed office at Västergötland's Museum in Skara, which meant a return home. To large extent my work in these years has been with church buildings and I could from time to time dwell into tasks of buildings archaeology, most notably the field of exploring church attics. A vivid interest in languages facilitated the establishment of several international professional contacts, especially in German-speaking Europe.

A buildings conservator working in a regional museum has a broad field of action and must apart from knowing a wide array of built constructions from different times and their social and cultural contexts know a little about a lot concerning craft techniques, traditional maintenance and materials. Since a buildings conservator can not be trained in all crafts, it is important to have an open mind for the knowledge to be gained from bearers of traditional craft knowledge, learn to see but also dare to question. The craft imminent in 800 years old trusses is not necessarily related to the traditions brought by today from elder crafts men. The team of carpenters in the "Södra Råda Project", reconstructing a burnt 14th century timber church, has clearly showed the importance of trying to go beyond what has been taught (Almevik & Melin 2015). My interest in the crafts of historic constructions grew forth through projects where I met with practitioners from the Södra Råda Project, some

of them are part of "Traditionsbärarna", a network of practitioners in traditional crafts. Pipe organs as historical constructions became another aspect of my interest, a field rarely known to the buildings conservators set to judge, which for my sake led to three months in a German workshop specialized in the restoration of historic organs. This gave me tools to assess the historical values beyond the facade. In order to recognize and safeguard values, one must have a degree of understanding of crafts and materials in the constructions.

A proper assessment of values in relation to need of measures is the foundation of a conscious heritage care in line with international charters as ICOMOS' "Charter on the built vernacular heritage" (Mexico 1999), but in practice this is not always the case due to lack of time, resources and sometimes knowledge. This has been especially true for historic roof structures. Often I have found interventions that would never been accepted in any other part of a protected building.

Although my thesis concerns the Middle Ages, these roof structures exist here and now, containing stories that could engage and inspire the users of today. The timber roofs have been both cared for and neglected through the centuries. To give these – for the buildings essential – constructions the means to continue offering shelter and maintaining their values is an important task for conservators and parishes. Surveys of medieval roofs in Swedish dioceses, combined with the Södra Råda Project, have provided tools to identify central values inherent in the physical material. Understanding the roofs as historical constructions with their diverse technical and aesthetic features, not only as structures carrying loads, is the foundation for good caring. I regard this thesis in itself as a tool for better assessment, management and restoration, taking in the building as a whole. The medieval roof structures as enduring products of local resources could be an inspiration for the present discussion on sustainability in society. The Church of Sweden could here act as a model in putting research into practice through promoting the use of local resources as lime and timber and traditional craft methods (compare Eriksson 2019). In the end we want to care for the built heritage for centuries to come.

1.2 Objectives

The core of this licentiate thesis is made up by three peer-reviewed articles with a buildings archaeological focus, the last one going deeper into the craftsmanship that can be interpreted from the constructions. The introduction and discussion will try to frame these articles in the context of different disciplinary approaches as well as practices of documentation and care. The thesis exemplify the value of roof structures as source material as well as the advantage of collaborative, cross-disciplinary fieldwork.

The aim of my thesis is to structure, analyse and interpret the newly surveyed corpus of medieval church timber roofs in the Swedish regions Västergötland and Northern Småland. The work highlights patterns and variations in systems and techniques encountered in the roof structures, shaping a foundation for discussing typology and tradition/s. I also want to put the material in an updated European context. Finally, though not part of the articles, the thesis aims at highlighting the importance of cross-disciplinary fieldworks as a path to a more holistic understanding and maintenance of the churches.

1.3 Research questions

1. How can the surveyed medieval timber roofs be structured with regard to typology? (articles 1 & 2)

2. Which are the key features of High Medieval church roofs in Västergötland and how do they correspond to different types of roof constructions? Where and when do they occur? Can motifs be proposed for why? (article 2 & 3).

3. How do the High Medieval roof structures in Västergötland compare to roofs from the same period in Northern, Western and Central Europe? (article 3)

1.4 Source material and delimitations

I will in the following present the delimitations of my material in space and time and provide motivations to these choices as well as the selected sources.

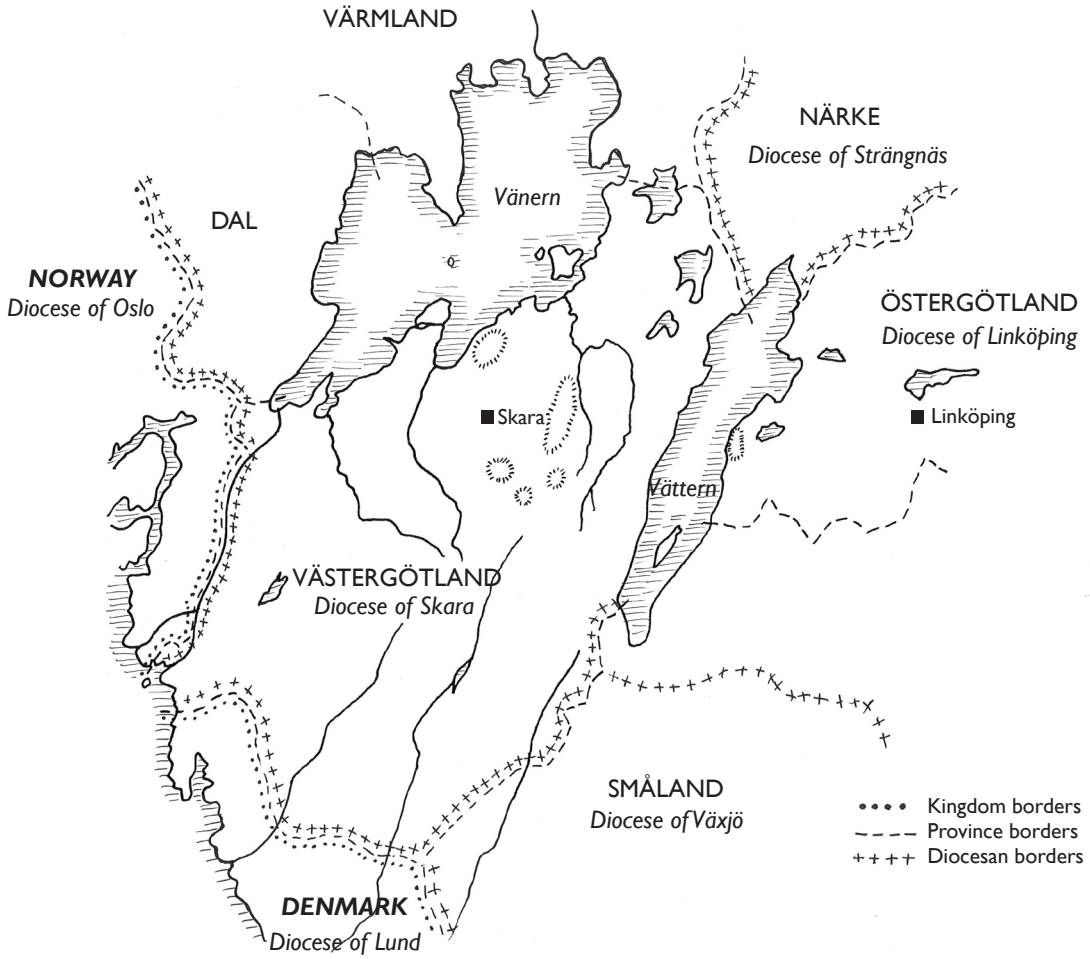


Figure 6. Map showing the provinces of Götaland during the Middle Ages. Map by the author.

1.4.1 What about the Middle Ages?

For the Nordic countries the Middle Ages span over 500 years with several great changes in crafts and society. The people erecting the first generation of stone churches in Sweden did not know they lived in the Middle Ages. The term came into use in the Renaissance to characterize the millennium between the decline of Antiquity and its *rebirth* in the Early Modern Era. The fall of Constantinople, the conquest of the *New World*, the Renaissance in art and culture and the Reformation are other hither boundaries used by historians depending on horizon. Medieval roofs have often been described as *Romanesque* or *Gothic*. Renaissance scholars gave birth to the term *Gothic* as a label for the architecture that emerged in the 12th century. The term *Romanesque* was invented in the early 19th century when the Middle Ages and its monuments got re-evaluated as part of forging national identities and the shaping of art history as a discipline (Kåring 1995; Piltz 1996; Christensson 2004; Fried 2015).

Perhaps the people of 12th century Västergötland could to some extant sense that they were part of a world in change, a conjuncture when new orders and customs emerged, shaping what would become the Medieval Swedish Kingdom, integrated in European catholic Christianity. In Sweden, Denmark and Norway the Christianization and the Lutheran Reformation are the limits of the Nordic Middle Ages, c. 1050–1520s. This is in contrast to the Eu-

ropean concept where the Middle Ages start around 500 with the dissolution of the since long Christian West Roman empire. The period c. 500–1000 is in European historiography known as the Early Middle Ages. In the Nordic countries this period is known as the Late Iron Age and is a necessary background for understanding the birth of the Swedish Christian kingdom (Harrison 2020:9). Historian Fredrik Charpentier Ljungqvist has argued that present research give few reasons not to adopt the *longer* European Middle Ages (Charpentier Ljungqvist 2022). What in Europe is known as the High Middle Ages corresponds in Nordic historiography to the Early Middle Ages, c. 1050–1300/1350. It is a period of population growth, emergence of centralized Christian kingdoms, technical and economical developments, a prosperous period that came to its end with the 14th century and several crises related to climate, agriculture, epidemics, political instability and conflicts. The Late Middle Ages mark in the Nordic countries and the rest of Europe the following period up until c. 1500. The task of building, enlarging or decorating a church was a central one up until the Reformation, an issue to keep many crews of craftspeople busy, the political and religious changes of the 16th century was a greater rupture than the Black Death.

In the introductory chapters, the third article and the discussion I use the common European definition of the High Middle Ages and not the Scandinavian. My first and second articles embrace the entire 500-year medieval period as delimited in Nordic research. The third article is limited to the High Middle Ages, c. 1100–1350, the period with the richest preserved roof material in Västergötland.

1.4.2 Västergötland and Northern Småland

The choice of combining Västergötland and Northern Småland is rooted in the progress of my surveys. Northern Småland was a pilot project to test a method for rapid survey, thus shaping a foundation for the project in Västergötland, which is the main focus of this thesis. The two regions connect through Lake Vättern. On the east side of the lake is also the province of Östergötland, whose western part is similar to central Västergötland with regard to medieval land- and *church*scape. First I thought about incorporating Östergötland, but it would have been too large a material and no comprehensive survey has yet been made there, which would have made the conclusions less valid. Some churches in western Östergötland are important reference material in my third article.

The material in Västergötland is the focus of my thesis since it was comprehensive surveyed and 48 structures are dated with dendrochronology. I have visited and documented all structures. For the references outside of the province I have preferred using roofs that I have had the possibility of visiting myself. Some are only known from literature, or better, from colleagues who kindly have shared observations, drawings and photographs.

Northern Småland constitutes the parishes of the province that remained part of the diocese of Linköping after the creation of Växjö diocese c. 1170. These parishes also remained under the jurisdiction of the province of Östergötland until 1559 (Ullén 2006:41; Lundh 2015:7f).

Västergötland as a province constitutes a clearer entity and delimitation. Another possible delimitation for the thesis could have been the medieval diocese of Skara (today encompassing the larger part of Västergötland), its first bishop claimed to have been the German Thurgot around 1010. The borders of the diocese have been prone to changes through history, both expanding and after the Reformation shrinking. Chronicler Adam of Bremen in late 11th century claimed that Skara was the bishop see of all Götaland, but already c. 1100 Linköping in Östergötland was the diocese for the eastern half according to the Florence list. Skara diocese later incorporated the northwestern part of Småland, Dalsland and loosely defined Värmland, with the latter two encircling Lake Vänern and bordering to both the Norwegian kingdom and the diocese of Oslo (Adam av Bremen 1984:220f.; Franzén 2022:13; Mellberg 2014:114). The bishop of Skara controlled or aimed to control very diversified areas. After the Reformation and Danish-Swedish wars in the 16th and 17th centuries large parts of Skara diocese went to the newly instated ones of Gothenburg and Karlstad.

Västergötland as a political entity is at least as old as the diocese. An administrative structure of *bon* is known in the early 13th century, but has been


Figures 7&8. Excursion with "Arbeitskreis für Dachwerke" to the churches of Forshem and Marum in Västergötland, May 2018. Photo (right): Mattias Hallgren.

proposed to go back longer, later in the Middle Ages replaced by *härader* (Franzén 2002). The "Old Law of Västergötland" is supposed to have been written down in the first half of the 13th century, but could go much further back (Ferm 2022:51). Central Västergötland with plains and Cambro-Silurian plateaus show a long continuity of residence with a character similar to western Östergötland. The forested northeast and south were colonized later. The province and not the changing medieval extension of the diocese has been taken as delimitation.

1.4.3 Source material

The source material is primary the buildings and their constructions *per se*. These I documented and analysed in survey projects 2010–2021 in the southern part of Linköping diocese, the diocese of Skara and the northeast part of Gothenburg diocese (before the 17th century part of Skara diocese). The following phases in Skara and Gothenburg dioceses consisted of case studies of selected churches and their roof structures, thereby giving material for questions approached in my third article. The documentation reports of the in total four diocese projects should be regarded as freestanding catalogues to this thesis (Gullbrandsson 2011, 2015, 2020 (ed.); Gullbrandsson, Hallgren & Hansson 2021). A discussion on the representativeness of the empirical material in Skara diocese is put forth in my second article.

Three church attics have due to archaeological excavations (or rather cleanings) (Gökhem, Marka and Ransberg) and subsequent restorations (Gökhem and Ransberg) rendered extra material (Gullbrandsson & Hallgren 2017; Gullbrandsson 2020, 2023). This is complemented by literature and reports on historic roofs, as well as earlier research on medieval churches, mainly in Västergötland. Topographic and historic literature has been used to put the objects in a spatial and historic context. Historic roofs also figure in church archives from the 17th century and onwards, which was used in the case studies to obtain information on roof coverings, maintenance and reconstruction works.

In Scandinavia there are few written medieval sources mentioning roof structures in churches. I have used the well known texts concerning building and maintaining a church in "The Old Law of Västergötland", written down in the beginning of the 13th century (Wiktorsson 2022) and a Norse church inauguration sermon called the "Stave church sermon", its various versions written down in the 13th century (Ágústsson 1975).

Study voyages in Sweden and abroad (Germany, Normandy and Norway) have together with a study of Nordic, German, French and English literature

(Gullbrandsson 2021a) provided a reference material for the conclusions on the structures discussed in my third article. Most rewarding were the regular excursions and meetings of the network ”Arbeitskreis für Dachwerke”, a subdivision of the ”Arbeitskreis für Hausforschung”, joining architects, engineers, buildings conservators, architecture historians and craft researchers in German-speaking Europe.

Figure 9. The ornate ridge-steering-beam on the 1120s (d) nave roof in Garde church, Gotland, once more in daylight during restoration works 1931. Photo: Alfred Edle, National Board of Antiquities.

Chapter 2
A historiography of medieval roof structures

The aim of this chapter is to show how the research on medieval roof structures has evolved since the 19th century in English-, French- and German-speaking Europe as well as in the Nordic countries, with focus on Sweden. I will highlight different perspectives and methods as well as their contexts. In positioning the former research, its traditions and changes of paradigms I will end with an attempt to position my own research inside this field.

2.1 European architects in search for evolution and models

Medieval monuments got into focus in the first half of the 19th century, not just in an antiquarian sense, but also as part of a romanticist reaction against the rationalism of Enlightenment, the seemingly eternal chain of classicist-inspired architecture. The search for national identities and clerical renewal fostered a fascination for Gothic architecture. The medieval cathedrals got treated as historical monuments in their own rights, some architects came to devote their careers to the restoration of them, trying to restore or fulfil their true or imagined original concept; as the century and the industrialization went on not seldom with the help of modern techniques and materials. In late 19th century the concept of buildings conservation grew forth, as opposed to pervasive restoration, instead safeguarding authenticity and patina, promoted by the writings and actions of John Ruskin, William Morris, Alois Riegl and Georg Dehio (Kåring 1995; Edman 1999; Bye 2010).

With the motive of finding models for restoration as well as for new official buildings in the wake of the Gothic revival, architects turned to surviving medieval monuments. The open timber roofs – that is open to the interior with few or no tiebeams – in French and English but also Norwegian churches met with particular interest for inner design. The architect brothers Raphael and Joshua Arthur Brandon published in 1849 a commented set of lithographies titled "The Open Timber Roofs of the Middle Ages. Illustrated by Perspective and Working Drawings of some of the best Varieties of Church Roofs." The aim was as the title reflects to enhance the Gothic roofs as models for the renewal of English parish churches. They made a classification of roofs, later questioned as to simplistic (Brandon 1849:11; Howard 1914).

The French restoration architect Eugène Viollet-le-Duc (1814–1879) spent much of his life to enhance the status of medieval architecture and carpentry in both restorations and theoretic writings. Medieval carpentry and not the least roof structures (*charpente*) got several pages and analytical drawings in his grand "Dictionnaire raisonné de l'architecture française du XIe au XVIe siècle" (1854–1868). Viollet-le-Duc meant that the carpentry during the Gothic period in France reached a perfection that could not be matched by later periods' works. The German architect and theorist Gottfried Semper (1803–1879) approached the theme of open timber roofs in "Der Stil" (1878–1879). He regarded the open roofs of the Norwegian stave churches as inspiration for the ones constructed in England and France, a much debated question that was to linger on up until the application of dendrochronology (Hauglid 1972).

The first profoundly researched monograph on genesis, development and constructive thinking in medieval roof structures of Europe was "Die Geschichte des Dachwerkes" (1908) by Friedrich Ostendorf (1871–1915), an architect inspired by medieval and later on also baroque building traditions. He had travelled large parts of the continent, seen hundreds of roofs, measured and drawn, also profiting from observations of colleagues in shaping his synthesis of origins and developments. Coloured by the nationalist thinking of the time Ostendorf regarded the open trussed roofs as sprung from *the Germanic wooden building* whereas the tiebeam roofs originated from the Roman Mediterranean world, fortifying the old pair of opposites, a wooden North and a masonry South. The chronology and linear development in Ostendorf did

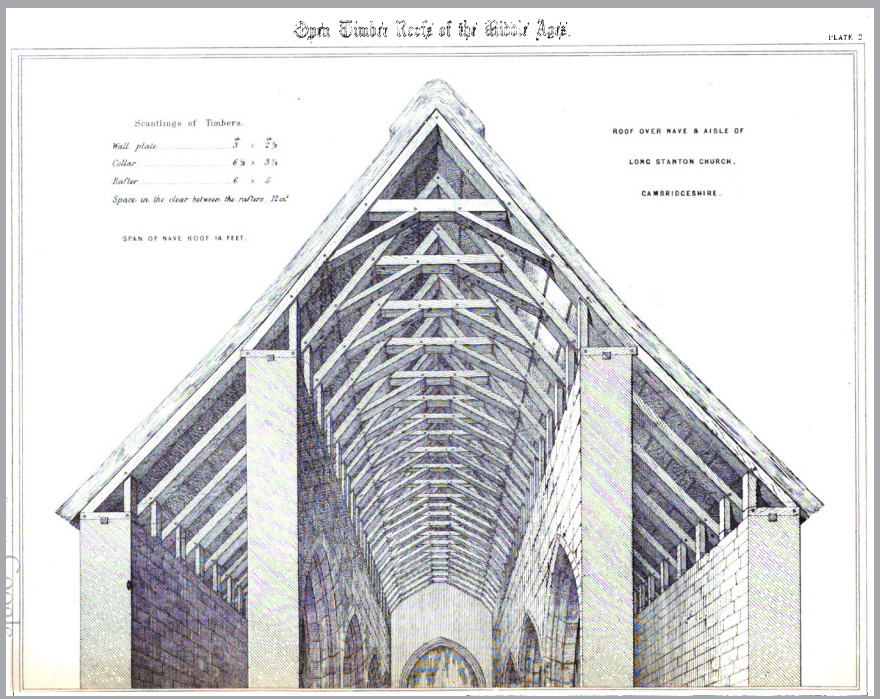


Figure 10. Plate from Brandon (1849) displaying in perspective the open and thatched timber roof of Long Stanton church, Cambridgeshire. The rendering conveys in a pedagogic but also detailed way the interior experience of the structure as well as information on the scantling. Unknown scale, diminished (Brandon 1849:Plate 2).

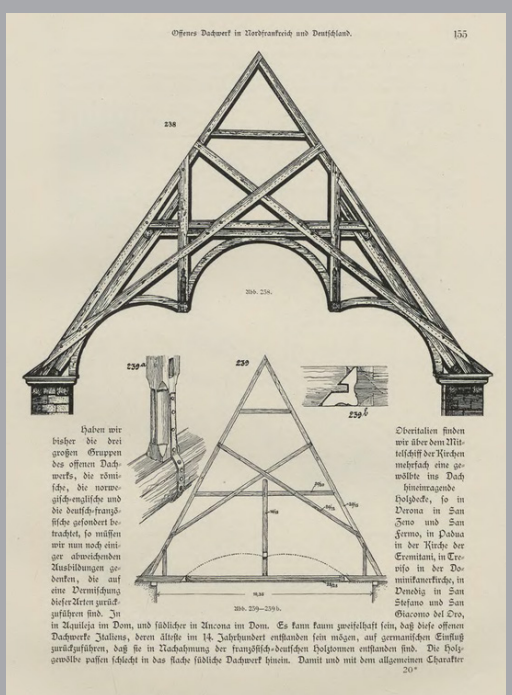


Figure 11. A representative page from Ostendorf (1908) showing two examples of vaulted trusses with details and sections (Ostendorf 1908:155).

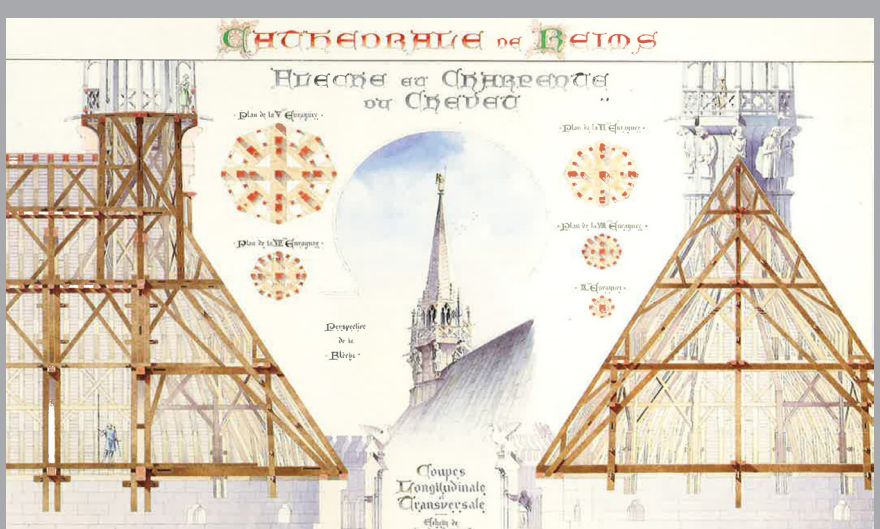
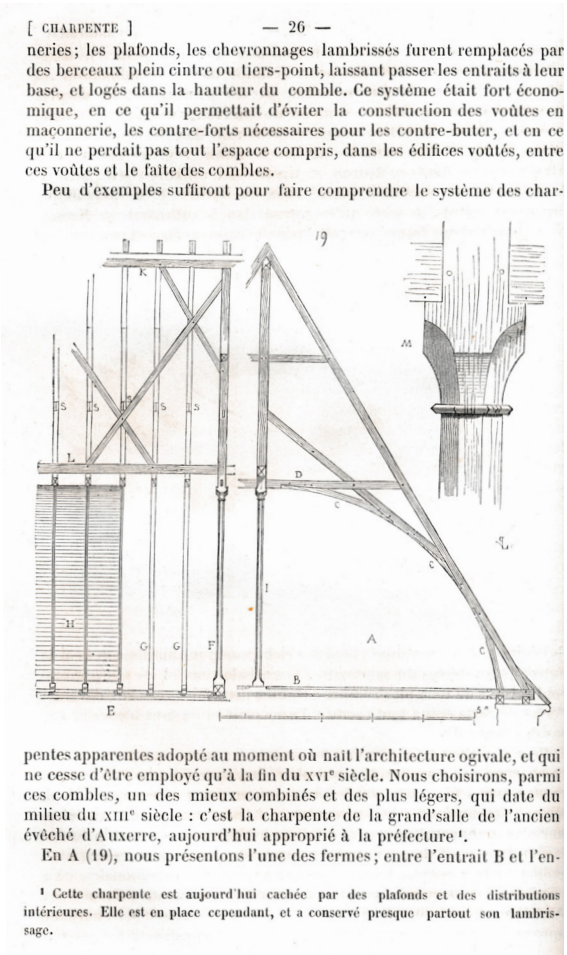


Figure 12. One of Deneux' artistic presentations of the roof structures in the cathedral of Reims, the features delicately couloured in different tones to suggest the depth. Unknown scale, diminshed (Deneux 1983).



[CHARPENTE] — 26 —

neries; les plafonds, les chevronnages lambrissés furent remplacés par des berceaux plein cintre ou tiers-point, laissant passer les entraits à leur base, et logés dans la hauteur du comble. Ce système était fort économique, en ce qu'il permettait d'éviter la construction des voûtes en maçonnerie, les contre-forts nécessaires pour les contre-buter, et en ce qu'il ne perdait pas tout l'espace compris, dans les édifices voûtés, entre ces voûtes et le faite des combles.

Peu d'exemples suffiront pour faire comprendre le système des char-

pentes apparentes adopté au moment où naît l'architecture ogivale, et qui ne cesse d'être employé qu'à la fin du XVI^e siècle. Nous choisirons, parmi ces combles, un des mieux combinés et des plus légers, qui date du milieu du XIII^e siècle : c'est la charpente de la grand'salle de l'ancien évêché d'Auxerre, aujourd'hui approprié à la préfecture [1].

En A (19), nous présentons l'une des fermes ; entre l'entrait B et l'en-

[1] Cette charpente est aujourd'hui cachée par des plafonds et des distributions intérieures. Elle est en place cependant, et a conservé presque partout son lambrissage.

Figure 13. A page from Viollet-le-Duc's "Dictionnaire raisonné". (Viollet-le-Duc 1868:26).

not survive dendrochronology and modern buildings archaeology, but due to the meticulous drawings and constructive analyses Ostendorf remained for long a standard monograph (Fischer-Kohnert 1999:13; Eißing 2009).

A parallel to Ostendorf was the French restoration architect Henri Deneux (1874–1969) at "Monuments historiques" who in 1927 published his article "L'évolution des charpentes du XI^e au XVIII^e siècle", structuring almost 500 roof structures from Northern France in a chronology, a work that was a steady point of reference for long time. Apart from meticulous drawings of several roof structures in churches he also made models in scale as pedagogic demonstrations of evolution, manifesting his vivid interest in techniques. The writings of Ostendorf and Deneux were much in line with the evolutionist linear thinking of 19th century research (Hoffsummer 2002; Mayer 2002).

2.2 The creation of Nordic art histories

The Nordic countries followed the above outlined tendencies in Europe. In the case of the Norwegian stave churches the documentation and safeguarding was early. The stave churches' appearances and dark interiors with open roof trusses attained an international interest and got crucial in the shaping of a Norwegian national heritage, not least through the artistic depictions of painter Johan Christian Dahl (1788–1857). He was a driving force in highlighting the stave churches as monuments from the independent medieval kingdom of Norway, useful to foster a Norwegian identity. With State Archaeologist Nicolay Nicolaysen (1817–1911) the study got more academic and as the archaeology of the time markedly positivist (Bye 2010). In publications of the 1850s and 60s Nicolaysen addressed the stave church roof structures as well as the open roof in the large stone church of Værnes, Trøndelag, which he compared to the open roofs in England. Nicolaysen held the roof structure in Værnes to be the only medieval one preserved upon a Norwegian stone church (later proved wrong). Thus it became the natural role model for reconstructions of timber roofs on the cathedrals of Stavanger and Trondheim in the 1860s and 70s (Hauglid 1972; Storsletten 2002).

In 1887 Sophus Müller triggered a long lasting argumentation among Danish archaeologists on whether some of the Romanesque parish churches in Denmark originally had open roofs (Müller 1887; Schulz 1940, Møller 1953; Madsen & Bonde 2016). In Scania cathedral architect Carl Georg Brunius (1792–1869) was a pioneer in the study of common medieval parish churches, whereof several were restored and enlarged by him (Grandien 1974). He meant that these churches, as "the basilicas of Rome", originally had interiors with visible tiebeam trusses (Brunius 1850:21), a question to become central in later Swedish research.

The interest in small countryside churches, less spectacular than stave churches and cathedrals, reflects a general shift in focus from the monumental to a

broader field of study around 1900, which went hand in hand with the emergence of national *art histories*, a centralized organisation of heritage care and the overall ambition of creating modern and increasingly democratic societies in the Scandinavian countries (Wetterberg 1992; Edman 1999; Åman 2008).

The growth of 19th century industrialist society affected both city- and landscapes, endangering material and intangible cultural heritage. In Sweden Romanesque parish churches were in decay or underwent heavy refurbishing or were replaced with new structures. The archaeologists of the Royal Academy of Antiquities (Kungl. Vitterhetsakademien), the National Antiquarian and newly founded regional societies for the protection of cultural heritage (for example Västergötland's Society of Antiquities in 1863) were mainly reactive, trying to document and collect before it was to late, the legislation for heritage protection was weak. First the turn of century 1900 saw the emergence of a proactive heritage care in Sweden and the formation of a new restoration doctrine under the auspices of the National Antiquarian to be, the restoration architect and art historian Sigurd Curman (1879–1966). In much this was linked to a reaction in several European countries towards the negative effects of industrialization and modernization, notably the British Arts & Crafts Movement, which sought inspiration in the medieval societies and their guilds, propagating the revival of crafts and the proper protection of historic buildings. The architects of Nordic *national romanticisms* turned to preserved historic buildings for inspiration, medieval stone churches, renaissance castles, 18th century manor houses as well as rural timber houses, combining modernity with craft and natural materials. This movement was to have an impact on the shaping of a more antiquarian approach to historic structures as documents, partly in opposition to the former *style* restorations (Wetterberg 1992; Edman 1999; Åman 2008).

Curman and fellow art historian Johnny Roosval (1879–1965) started the first Swedish university seminar in art history aiming at a national architectural history placed in international context, using stylistic

Figure 14. The fascination of the open roofs in Norwegian stave churches, here Lomen (c. 1192 d).

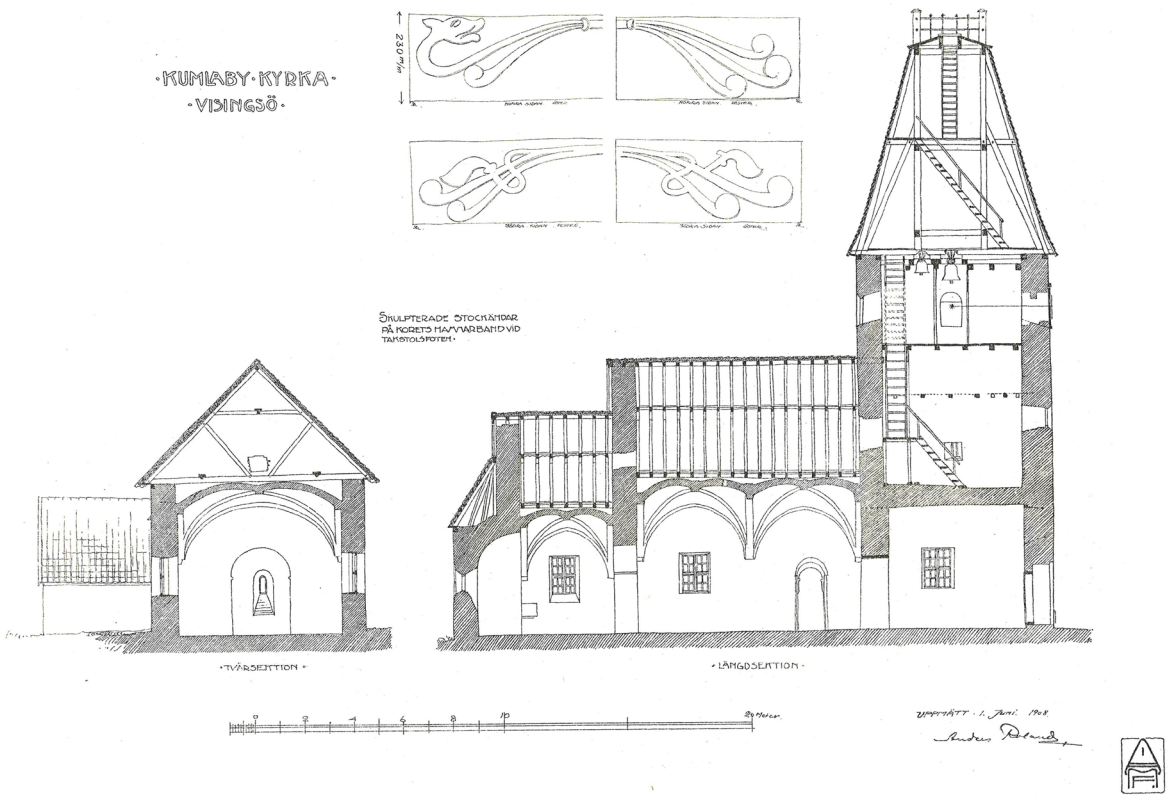


Figure 15. Architect Anders Roland's sections of Kumlaby church, Småland, from 1908 in "Svensk Arkitektur" are exemplary of the measurings later made inside the project "Churches of Sweden" (Svensk arkitektur 1908:Plate 3).

and diffusionist analysis.[1] In his courses on *restoration art* at the Royal Academy of Arts (Kungl. Konsthögskolan), Curman trained a generation of restoration architects, which would shape the present apparition of many medieval parish churches (Gullbrandsson 2008). Restoration should be an art firmly grounded in the actual building through investigations of and respect for its historical layers.

As part of their training and also through societies as The Society for Architectural Monuments (Arkitekturminnesföreningen), students in architecture, art history and ethnology travelled the country, photographing and measuring endangered heritages. In all Nordic countries ambitious survey projects were launched during the first decades of the 20th century, among them art historical inventories of the total corpus of churches and ethnological inventories of vernacular architecture, leading to a division of the study of buildings into different disciplines with differing questions and methods. The churches became an art historical domain focused on chronologies and stylistic diffusion, while the mainly rural vernacular buildings became the object of ethnological mapping of types and functions (Edman 1999; Gustafsson 2014).

It was in this dynamic period of social change and pioneering conservation that the first documentations and interpretations of medieval roof constructions in Swedish churches were made. In 1902 archaeologist Otto Janse (1867–1957), National Museum of History (Historiska museet), published some thoughts on High Medieval roof structures he had seen in Östergötland, providing proof for Brunius' suggestion that the structures were originally part of the interior. Art historian Andreas Lindblom compared in 1910 the roof of Knista church, Närke, to ones in Norwegian stave churches. Archaeologist

1 Tracing how style has originated and spread in different cultural circles and also changed in that process.

Figure 16. Photograph of the nave roof in Forshem church, Västergötland, taken by Anders Roland in 1912, National Board of Antiquities.

Emil Eckhoff (1846–1923) treated the corpus of until then encountered remnants of stave churches in Sweden and made suggestions on their probable roof structures (Eckhoff 1914–1915). The knowledge of preserved original roof structures was mainly the result of an increasing restoration activity, such as the documentations made by architect Anders Roland of the Superintendent Board (Överintendentsämbetet), concerning the trusses in Forshem church in Västergötland 1912, maybe one of the earliest photographic documentations of a medieval roof in Sweden. Two years later Curman safeguarded the original trusses in Ugglum, Västergötland, and the uniquely ornate trusses of nearby Gökhem church got known in a restoration project. The roof structure of Kumlaby church on Visingsö got drawn by Roland and published in the series "Svensk Arkitektur" (1908–1912) and subsequently the object of a for its time exemplary restoration through architect Göran Pauli, respecting the authenticity and statics of the trusses.

The roof structures came to be an integrated part of the documentations inside the inventory "Churches of Sweden" that started in 1912, but to a very shifting degree of detail due to varying interest, access and light. Former county antiquarian Gunnar Lindqvist has told his memories of as young student having been assisting *stick boy* to Curman and Armin Tuulse in measuring high up in the dark attics of churches in Uppland (Johannesson 2014:23). The project "Churches of Sweden" soon became headed by the Royal Swedish Academy of Antiquities and the reorganised National Board of Antiquities (Riksantikvarieämbetet). It had an outspoken art historical approach and helped defining Swedish art history as a new discipline. The examination of churches was at the core of the field and played an important role in shaping its methods. The interface between the practice of fieldwork and the production of knowledge has been thoroughly discussed by Karin Gustafsson concerning the related field of Swedish ethnology, she underlines the importance of practice in shaping the discipline (Gustafsson 2014). The early church researchers were trained in art history under Curman and Roosval, some of them were also restoration architects. With time a staff of specialized art historians got employed by the National Board of Antiquities (Johannesson 2014). The churches of Uppland and Gotland came early in focus, whereas in Västergötland only one *härad* got completely covered. Of Sweden's 2.564 parish churches c. 600 have until today been treated.

In 1937 Curman tried to gather some thoughts from documentations he as a young man had participated in, concerning the 12th century roof structures in Kumlaby and Garde church on Gotland. He regarded these constructions as a meeting between surviving Iron Age Scandinavian carpentry traditions and the novelty of European masonry building. He also claimed that Sweden seemed to have an unusually rich corpus of medieval church roofs in comparison to other countries, and that it still awaits a systematic treatment (Curman 1937). The awareness of medieval roofs lead due to a strengthened protection of the cultural heritage to their safeguarding in theory. But the slow rate of surveys in "Churches of Sweden" left

Figures 17–19. Former National Antiquarian Sigurd Curman following coworkers of "Churches of Sweden" to Håtuna church in Uppland 1959. The roof structure had a wooden barrel vault before the Late Medieval brick vaults. Photographs by Sören Hallgren, National Board of Antiquities.

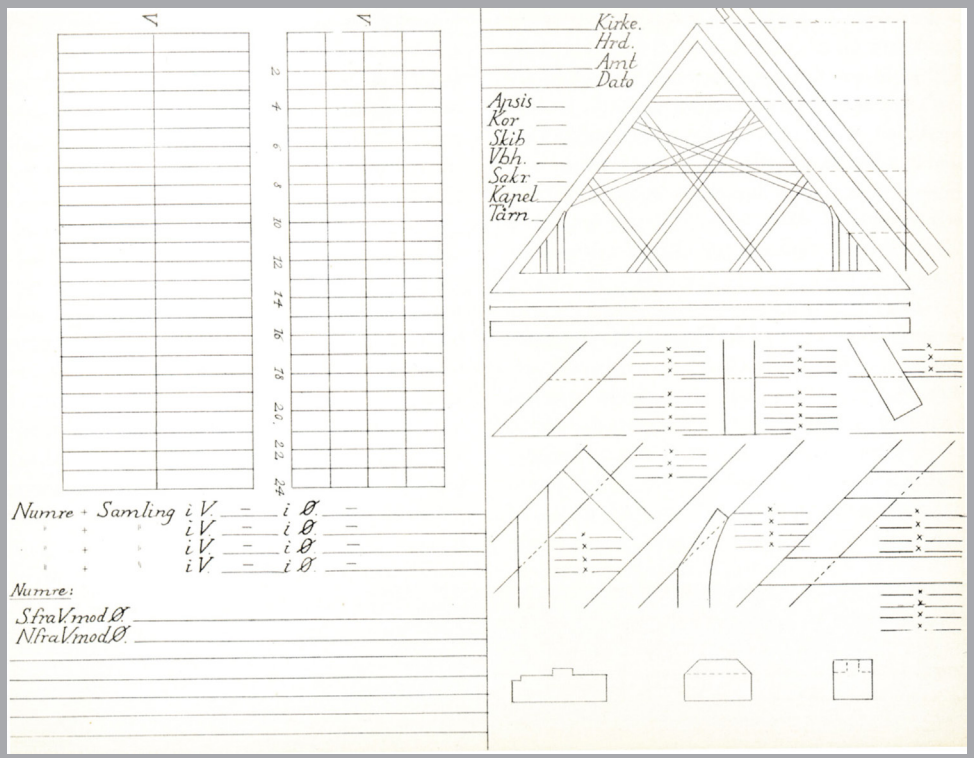


Figure 20. Elna Møller's pre-printed protocol card for quick registration of roof structures. It is designed for the registration of important measures, carpenters' marks and joinery, enabling a later production of a sufficient accurate section drawing (Madsen 2007:14).

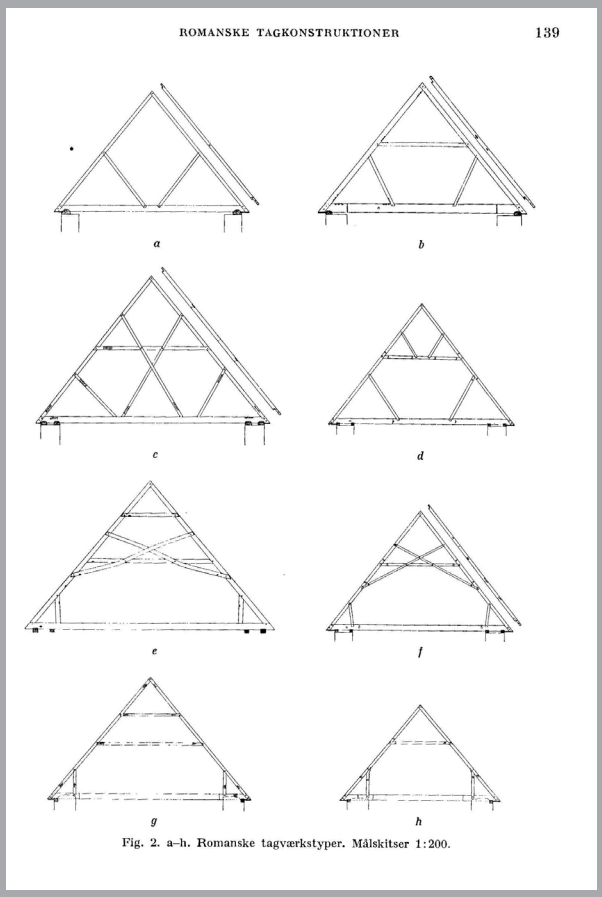


Figure 21. Elna Møller's typology of *Romanesque* trusses, characterized by the presence of a tiebeam in each truss (Møller 1953:139).

the majority of medieval church attics unexplored and many original roofs have up until today been the object of interventions not paying regard to the historical values. Even known structures have been treated rather randomly.

2.3 The legacy of Nordic architects-conservators

Towards the mid-20th century legislation and institutions for the safeguarding and documentation of church buildings as national heritage were at hand in the Nordic countries. But the timber roofs of the medieval stone churches were rarely studied. Two architects, though, put an effort into approaching and trying to read these structures, the swede Erik Lundberg (1895–1969) and the dane Elna Møller (1913–1994), whose studies were made possible by the large scale church surveys, many of their questions and thoughts directly sprung from the conservation practice of which they were an active part. Their methods and approaches differ, Lundberg was a product of the pioneering Swedish art history while Møller paved the way for modern buildings archaeology.

The restoration architect and art historian Erik Lundberg was a disciple of Curman and Roosval. Among his extensive writings, ”Byggnadskonsten i Sverige under medeltiden” (1940), ”Arkitekturens formspråk. III.” (1949) and ”Trä gav form” (1971) show a vivid interest into medieval Swedish timber constructions as well as a by then rather unmatched knowledge of European counterparts. He discussed the origins and development of certain roof structures and their constructive thought. With an aesthetical and diffusionist art historic perspective, he questioned the Scandinavian character in Swedish High Medieval roofs structures and claimed the importance of influences from former Carolingian Europe. A fellow student in art history, Gerda Boëthius (1890–1961), could be seen as a precursor to Lundberg's writings. In “Studier i den nordiska timmerbyggnadskonsten” (1927) and “Hallar, tempel och stavkyrkor. Studier till kännedomen om äldre nordisk monumentalarkitektur” (1931) she pioneered in using multiple sources: preserved buildings, archaeological excavations and historical documents. She stressed the importance of wood as a construction material that actively shaped building traditions, but under influence of European styles, a thought that Lundberg followed. Her view, though, of the Swedish stave church as a missing link between a *nordic hall* influenced by Carolingian architecture and the preserved Norwegian stave churches received critique.

Elna Møller, belonging to the next generation, had a different methodological approach. She could be regarded as one of the key persons in shaping Danish church archaeology (Olsen 1983). Her background as trained carpenter gave a new perspective, she was the first to pay respect to tool marks. Møller shaped methods for documenting roof structures with protocols called *truss cards*, since further developed (Madsen 2007). As editor in “Churches of Denmark” (since 1933 at the National Museum) she found that medieval church roof structures were more common in Danish churches than former assumed. In her only major article on roof structures she developed a typology for *Romanesque* and *Gothic* truss types, the former with tiebeam, a categorization long referred to in Danish research (Møller 1953).

In Norway the stave churches and their structures were a focus of research throughout the 20th century, much from an art historical perspective as in the writings of State Antiquarian Roar Hauglid (1910–2001), but also with the eyes of the architect as was the case with Håkon Christie (1922–2010). His meticulous drawings and perspectives are often reproduced. Architects as Christie and his teacher Gerhard Fischer (1890–1977) as well as Arne Berg (1917–2012), have highly influenced the methods of documenting historic buildings in Norway, emphasizing the act of measuring and drawing to document and present interpretations (Sjömar et al. 2000).

2.4 The archaeological perspective

Architects as Møller and Fischer, working close to the built heritage, meant much for the development of a buildings archaeological approach, promoted in the Danish and Norwegian research. Thus methods and theories from archaeology got introduced in documentation and analysis. This also gained ground in Sweden and challenged the art historical approach so

firmly rooted in "Churches of Sweden". In the 1950s the discipline medieval archaeology – later historical archaeology – got established at the University of Lund (Eriksdotter 2005; Bentz 2011). A buildings archaeological, stratigraphic approach influenced not only the works done in southern Sweden but with time also "Churches of Sweden", notable in Ragnhild Boström's work with the churches of Öland and the project "Medeltida träkyrkor" (Ullén 1983; Lagerlöf 1985). From the 1980s Swedish church archaeology came to shift focus from art historical questions of typology and stylistic influences to questions concerning the social context of church building, its actors, resources, organization and layers of meaning (Nilsson 2009:17–23).

A parallel to the investigations of churches worth noting was the increasing archaeological field work from the 1970s, heavily enlarging the corpus of excavated Iron Age and medieval houses, not at least in medieval towns, the latter a direct effect of the large-scale modernist renewals of Swedish city centres. The excavations of the medieval town of Lödöse in Västergötland triggered the building of dendrochronological reference series for Western Sweden, motivating the first samplings of churches made by engineer Alf Bråthen (1924–2017) (Bråthen 1979, 1982). In 1989 a cross-disciplinary Nordic symposium, "Medeltida husbyggande", was held in Lund. One of the lecturers, the medieval archaeologist Jan-Erik Augustsson, pointed in an article 1992 at the need for cross-disciplinary *Hausforschung* as made in Denmark and Germany.

European buildings archaeology grew strong in the 1970s and 80s at which time dendrochronology came into use as an important tool. Seminal for the study of archaeological timber were the excavations alongside the river Thames in London 1973–1990, published by Gustav Milne in 1992. Thanks to the use of dendrochronology and a new systematic approach to timber recording, vital information could be gained on medieval timber building and carpentry in London. Damian Goodburn participated as expert on archaeological timber, himself carpenter with experience from experimental archaeology. The mass material gave opportunities to make conclusions on introduction and distribution of techniques and tools. The material properties and conversion of the timbers gave an image of timber resources. These works point forth to the craft approaches to medieval timber constructions that were nascent (Milne 1992).

In France, the archaeologist Daniel Bontemps showed in a series of articles the vital importance of buildings archaeological study of roof structures, their joinery and markings in order to interpret and understand masonry buildings and how they ought to be restored (Bontemps 1984, 1995). As in most countries the carpentry had been overshadowed by masonry in research and restoration. From English horizon the writings of Cecil H. Hewett (1926–1998) obtained an almost legendary status. A former crafts man working in Historic Buildings and Conservation in Essex, he documented several historic timber structures and their techniques of assembly. Without the access to dendrochronology he used the techniques of joinery as criteria for dating (Hewett 1980). But the accuracy of his drawings and consequently his conclusions has recently been questioned (Ng & Campell 2018). Archaeologist J. T. Smith (1922–2016) have written several articles on medieval roofs, not just English, and has dwelled upon questions of typology, also using the distinctions *Romanesque* and *Gothic*, as Møller. Due to discoveries of hybrids he early on questioned all too linear models of classification and chronology (Smith 1958, 1977, 1982, 2004).

In Germany *Bauforschung* grew forth in the 1970s and 80s as an independent discipline, linking art history with study of historical building techniques (Grossmann 1993). For a long time it was not regarded as a field in itself, rather a methodology connected to either architecture, art history or conservation (*Denkmalpflege*). Related to – or a branch of – *Bauforschung* is the more ethnologic dominated *Hausforschung* which mainly concerns vernacular buildings (Bedal 1995). The "Arbeitskreis für Hausforschung" got established in 1950, in Britain followed in 1952 by the "Vernacular Architecture Group" with a focus on traditional buildings and their techniques. Even though buildings archaeology/*Bau-* and *Hausforschung* deal with issues of building techniques, it was long rare to see a pronounced crafts perspective or researchers with craft background, but this has started to change, making these forums more cross-disciplinary.

Bauforschung promoted an interest in roof structures and the actors behind building. Art historian Günther Binding published the overviews "Mittelalterlicher Baubetrieb" (1st edition 1978) and "Das Dachwerk" (1991), in the latter making a summary of development of church roofs in German-speaking Europe based on the research made since Ostendorf, meant to stimulate a more intense documentation of and research on a material that deserved a more conscious preservation. The 1980s and 90s saw a few profound studies into medieval German roof structures, for example Barbara Fischer-Kohnert's dissertation from 1992 "Das mittelalterliche Dach als Quelle zur Bau- und Kunstgeschichte". She uses in-depth-field studies made in Regensburg to enhance the importance of field investigations and accurate drawing, combined with historical sources and dendrochronology as well as an understanding of *la chaîne opératoire* (see p. 37 and fig. 28) to interpret the building as a whole and put it into context. Her thesis is also a critique of Ostendorf and all to schematic approaches (Fischer-Kohnert 1999).

With the increased focus on the actors behind church building it was natural that with time historical archaeologists and also art historians in Europe and Scandinavia came to address medieval building techniques and organisation. One of the first in Sweden was Barbro Sundnér with her thesis on Maglarp church (Sundnér 1982) and later on Gunilla Gardelin with a study on the organisation of medieval stonemasons in Östergötland, where the study of tool marks plays an important role (Gardelin 2006).

2.5 A Swedish crafts perspective

The study of built heritage got further broadened in Sweden of the 1980s and 90s with the establishment of the new discipline conservation, a response to the needs of the heritage sector (Wetterberg 2021). A driving force was the loss of practical know-how in traditional crafts, which posed a problem for restoration. Architect Ove Hidemark was in the 1970s one of the first to question the use of modern techniques and materials in historic buildings. This paved the way for a renewed interest in historic materials and techniques, an important ingredient in Hidemark's teachings at the Royal Institute of Art (Edman 1999). This was also reflected in the section for architecture at Chalmer's University of Technology with Finn Werne's thesis "Allmogens byggnadskultur" (Werne 1980) and Peter Sjömar's "Byggnadsteknik och timmermanskonst. En studie med exempel från några medeltida knuttimrade kyrkor och allmogehus" (Sjömar 1988), which inspired new studies on historic carpentry in Sweden. From once having been at the core of Swedish ethnology, rural wooden buildings got interesting for other fields, not least craft research. This evolved in the 1990s as a research field in its own right in Sweden and Norway (Kokko et al 2020), a development that has strong bearings to this thesis and therefore will be presented a bit deeper.

Sjömar had in his thesis criticized the lack of interest for building techniques in earlier Swedish research on historic buildings. He studied the work processes as they could be traced in standing buildings and the choice of materials:

I wanted to state possible assumptions on working methods, constructions, techniques in joinery and choice of timber. Through this I have found a way of analysing traces in buildings and combine these with information from crafts persons and literature. I am aware of the weaknesses in this approach – it easily happens that you analyse the past with the views and knowledge of recent times.
(Sjömar 1988:11, author's translation)

Sjömar showed that new perspectives and interpretations became possible when considering the *tacit knowledge* of craftspeople (Sjömar 2017). To visualize interpretations, Sjömar made use of analytic drawing, inspired by Norwegian architect Arne Berg and Danish architect Erik Hansen. Sjömar has pointed at the difference in documentation practices between Norway and Denmark on one hand and Sweden on the other. The former have a long tradition in documentation made by architects, whereas in Sweden the documenters were mainly art historians and ethnologists (Sjömar et al 2000).

In the 1990s Sjömar and fellow Norwegian architect Anders Haslestad from the Norwegian Board of Antiquities (Riksantikvaren) studied techniques in

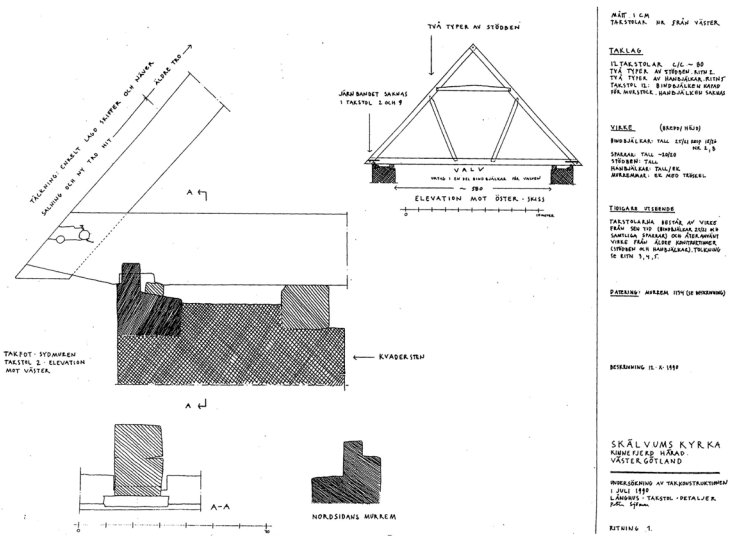


Figure 22. Analytic drawing of meeting between roof and masonry in Skälvum church, made by Peter Sjömar 1990. Diminished. Sjömar's collection, Dep. of Conservation.

vernacular timber houses. This helped establishing craft as a research field in both countries. The writings and teachings of forester and craft researcher Jon Bojer Godal, focusing on *action-based knowledge*, (Godal 2006) have also been influential, not least because his part in founding the Norwegian Craft Institute (Norsk håndverkinstitutt) in 1987, which has stressed the importance of using people with traditional craft knowledge as investigators, as well as methods of *practice-led-research*. Sjömar, Haslestad and Godal have inspired researchers as Harald Bentz Høgseth (Høgseth 2007) and Gunnar Almevik (Almevik 2012), which themselves further have promoted craft as research field in Sweden and Norway.

Sjömar's approach to investigating historic building techniques became a natural focus for the Craft School Dacapo in Mariestad, which he started together with Almevik in 1996 as a qualified education in building crafts. The intertwining of research and buildings conservation became pronounced with the program "Teknikhistoria för byggare" 1999 under the leadership of Sjömar and Almevik, with the aim to examine building history through building techniques (Almevik & Sjömar 1999:3). In this framework craft research came to develop on the Swedish scene, opening new possibilities of interpretation, evaluation and thus better foundation for decisions in restoration. The documentation and research on crafts made in Norway with the active involvement of crafts persons was an important inspiration, expressed in the Middle Age Project (Riksantikvaren) during the 1990s, and the Stave church program 2001–2015 (Bakken 2016). In Sweden the National Heritage Board headed the project "Tradition och byggproduktion" 1999–2001 aiming at raising the awareness of good buildings conservation, highlighting the bearers of traditional craft knowledge (Almevik 2012:56; Sjömar 2017).

Building investigations and model building were central tools in the education at the Craft School Dacapo in Mariestad, inherited from architectural studies. Three models of church timber roofs testify to the early interest in medieval carpentry. In 2001 the 14th century timber church of Södra Råda, Värmland, got destroyed in an arson. A research project got launched and the Craft School engaged for the reconstruction, with the main goal of regaining knowledge about 14th century building techniques.[2] Preliminary and continued research have up until the termination in 2021 produced a number of reports concerning hewing techniques, tools *et cetera*. A selection of preserved timber churches and roof structures became important references. As several of the participating carpenters took part in the diocese surveys of church roofs, the stock of references grew rapidly. These projects have cross fertilized each other, making the surveys and the full-scale experiment interdependent (Almevik & Melin 2015, 2017).

In 2005 the Craft school Dacapo became part of the Department of Conservation and in 2007 it became possible for craftspeople to undertake a PhD. Craft research as academic field has been defined as "a wide designation of investigations about, through and into craft" (Almevik 2017:7). The role of craft research inside the field of conservation at the University of Gothenburg got further strengthened with the establishment of the Craft Laboratory in 2010 as a national centre for documenting and promoting heritage crafts, aiming at implementing knowledge

2 https://sodrarada.se/; https://www.gu.se/forskning/sodra-rada-gamla-kyrka-0

from craft research in the heritage sector. The Craft Laboratory has initiated several research projects and invited craft specialists on scholarships.

The emergence of craft research in Sweden has shaped researchers trained in the crafts they investigate. This has been a driving force in broadening the study of historic buildings in Sweden and how they are restored, not least medieval timber roofs.

2.6 Present state of research on medieval roof structures

The above outlined development of archaeological and crafts oriented approaches to medieval buildings is a necessary background to present research on medieval roof structures. To understand how church roofs got into focus in the Nordic countries, we need to go back to the 1980s, when the corpus of Sweden was still hardly explored. In Denmark and Norway the situation was despite the legacy of for example Møller much the same (Vellev 1983). An informal interchange came about between Nordic architects and archaeologists as Peter Sjömar, Ola Storsletten, Barbro Sundnér, Markus Hiekkanen and Morten Sørensen (Storsletten 2002). In 1987 these church researchers formed a Nordic "roof group", which in a seminar on church archaeology in Danish Viborg 1993 presented an overview of research on roof structures (Hikuin 22 1995). In 1990 Sjömar made a compilation of published material on medieval Swedish roof structures and examined in the following years some 40 structures, several together with Storsletten. In two articles Sjömar pointed at the lacking knowledge of preserved medieval roof trusses in Sweden and showed their information potential, thus repeating Curman's call for research from 1937 (Sjömar 1992, 1995). Sjömar advocates a view of the constructions as primarily expressions of domestic carpentry traditions and material resources. In 2002 Storsletten put forth his thesis on the entire corpus of High Medieval church roofs in Norway, shaping a typology and discussing its characteristics and genesis, underbuilt by thorough field studies and dendrochronology. As Sjömar, Storsletten underlines the importance of domestic carpentry traditions, thus contrasting the views of art historian Roar Hauglid who regarded the open roof structures as borrowed from abroad, mainly England (Hauglid 1972, 1979).

Figure 23. The crew of Södra Råda test erecting the first truss on the reconstructed nave in spring 2020.

2.6.1 Recent research in France and Germany

Since 2000 documentation, research and evaluation of historic roof structures have been strengthened in Europe as a whole, leading to cross-disciplinary cooperations. The European Council Programme "Wooden culture" 2000–2001 gathered researchers and craft practitioners from several countries, enhancing the often neglected values of carpentry in historic buildings, aiming at augmenting the consciousness inside the heritage sector. A new programme, "Roofs of Europe", was held 2006–2007 under professor Pat-

rick Hoffsummer, University of Liège, which through cross-disciplinary workshops gathered participants from all of Europe. Hoffsummer edited in 2002 and 2011 two large volumes on historic roofs in Belgium and France, with articles from different fields, discussing typology, chronology, dendrochronology and craft techniques. The typology presented by Hoffsummer is very elaborate. From the French horizon, there has been several studies on medieval roofs, discussing questions of provision and treatment of timber, operational processes in tracing as well as execution and erection. Meanwhile not isolating the structures and their interpretation from the building as a whole and the society of which it was a product. Seminal in this respect is archaeologist Frédéric Épaud's doctoral thesis on the development from *Romanesque* to *Gothic* roof structures in Normandy (Épaud 2007) and his habilitation thesis on archaeological approaches to historic and pre-historic timber structures (Épaud 2022). Épaud's works resemble the approach of Storsletten but penetrate deeper into the questions of production, using multiple sources, combining buildings archaeology, dendrochronology, excavations, ethnology and experimental archaeology. He analyses the structures' production backwards all the way to the forest. In this Épaud's work has similarities with Milne and Goodburn (Milne 1992) but also Godal. Systematic surveys of church roofs have recently been made in some French regions[3], similar to the Swedish surveys. The question of the role of the forest as provider of timber has been raised in the anthology "La forêt au Moyen âge" (Bépoix & Richard 2019).

Also from a German horizon much has happened and is under way. Buildings historian Tilo Schöfbeck has given a thorough and dendrochronologically well founded analysis of the development of roof structures, their techniques and materials in his thesis on the medieval churches in Mecklenburg-Vorpommern (Schöfbeck 2014). Thomas Eißing has studied the roofscape of Thuringia as well as the question of timber transports and the information dendrochronology can provide on provenances (Eißing 2009, Eißing & Dittmar 2010). Burghard Lohrum has since the 1990s made several documentations, datings and analyses of preserved high medieval roofs in Southwest Germany. This just to mention a few works, which adhere to the overarching method *Gefügekunde*. It concerns the documentation and analysis of historic timber frame structures, their materials, techniques as well as their analogies and distributions in time and space. Apart from the buildings archaeological study it applies dendrochronology and when accessible also written sources. *Gefügekunde* is a vital method to state the historic values in a building and is closely related to the methods of *Bauforschung*.[4] Since 1997 a wide range of researchers, architects, *Bauforscher*, conservators and carpenters working with historic roofs gather in the network "Arbeitskreis für Dachwerke", a subgroup to "Arbeitskreis für Hausforschung", meeting at regular excursions. A product of this is the upcoming publication "Dachwerke vor 1230", for the first time jointly presenting the known corpus of roofs prior to the mid-13th century in Germany and adjoining regions, giving a long requested overview of international importance.

2.6.2 Recent research in Scandinavia

In Denmark the preserved church roofs of southern Jutland have been thoroughly documented and dated. They have been interpreted and published by medieval archaeologist and art historian Per Kristian Madsen, The National Museum (Madsen 2007, 2013). He points at the remnants of a highly developed domestic carpentry tradition open for new ideas from abroad. In an article on the roof of Arrild church he also tries to combine historical and archaeological sources to put the construction in a socio-political context (Madsen 2005). Inger Laigaard has in an article 2018 evaluated and dated tool traces and techniques encountered in Danish church roofs. In Norway medieval carpentry has been researched by among others carpenter and craft researcher Roald Renmælmo, Norwegian University of Science and Technology. There also exist research on Viking Age carpentry finds in Denmark and

3 Projet CharpCentre in Centre-Val-de-Loire 2012–2016.

4 See definition on the homepage of Denkmalwissenschaften, Universität Bamberg. https://www.uni-bamberg.de/iadk/denkmalwissenschaften/dendro/gefuegekunde-methode/

Norway, giving important references to understanding 12th century carpentry. The Viking Ship Museum (Vikingeskibsmuseet), Roskilde, is a cross-disciplinary research centre where crafts persons, academics and sailors work together in documentation and research using multiple sources and full scale experimental archaeology as important tools.[5] Since 2020 Finland has an on-going survey project on timber structures in their medieval stone churches.[6]

The systematic mapping of medieval church roofs in Sweden had to await the new millennium. The preconditions for documentation and research on Swedish churches came to a drastic change around 2000. In the 1990s the funding of "Churches of Sweden" was heavily shortened. With regard to the upcoming shift in relations between state and church in 2000 there was a need for a quantitative knowledge basis, leading to the project "Sockenkyrkoprojektet – kulturarv och bebyggelsehistoria" 1995–2003 at the National Board of Antiquities. This linked cultural geography with art history and identified regional characteristics (Dahlberg & Franzén eds. 2008). With the decentralization of research and heritage care concerning churches, the dioceses took responsibility for projects in order to attain the knowledge basis needed for managing this heritage, often in cooperation with regional heritage institutions (Dahlberg 2014). This started with *characterization projects* aiming at surveying the corpus of churches and their overall values, later on with more specialized projects on different aspects of ecclesiastical heritage. The foundation of the Craft Laboratory has provided a national platform for knowledge production related to building conservation, not least concerning churches.

The work started by Sjömar provided the basis for a database of medieval roof structures in Sweden in 2005 as part of a report on the State of the Art from the Department of Conservation to the Church of Sweden (Linscott 2007). Responsible for the report was architect Kristina Linscott, who with architect Anna Blomberg had documented medieval church roofs in Dalarna in the 1990s. Once more the lack of systematic surveys was pointed out. Following the appeal in this report, I headed the first survey project concerning medieval roof structures in 2010 in the southern part of Linköping diocese (Northern Småland). This small project was followed by bigger diocese projects in the southern half of Sweden, led by conservation officers and archaeologists at different regional museums as well as craft researchers.[7] I headed two of these projects in the dioceses of Skara and Gothenburg. Starting from broad surveys the projects narrowed in the following phases to case studies made together with craft researchers from the Södra Råda Project and dendrochronologists. A portion of these projects forms together with deeper investigations and restorations in a handful churches the empirical basis for my thesis. The somewhat wider project "Historic carpentry in the diocese of Lund" forms the basis for Karl-Magnus Melin's ongoing PhD in conservation. In the last 10 years the empirical information about preserved and traceable medieval roof structures in Swedish churches has seen a steady accumulation thanks to the projects run by the dioceses and the Craft Laboratory (Gullbrandsson 2021a).

The first thesis to treat medieval Swedish church roofs was made from the perspective of statics by engineer Carl Thelin at Chalmers in 2006, "Medieval timber roof structures. Conceptual methods for investigation and evaluation of structural behaviour". His aim was twofold: to provide better understanding of the structural behaviour to facilitate interpretation and preservation, and to develop methods for evalutation of the statics.

Architect Kristina Linscott's thesis "Interpretations of old wood. Figuring mid-twelfth century church architecture in west Sweden" (Linscott 2017) at the Department of Conservation is hitherto the first one dedicated to the architectural and archaeological study of a selection of preserved medieval church roofs in

5 The Viking Ship Museum has a publication series "Ships and boats of the North", https://www.vikingeskibsmuseet.dk/fagligt

6 Symposium at Livady Oy, Helsinki,28–29th February 2019.

7 Linköping diocese (Northern Småland) (Gullbrandsson 2011), Strängnäs (Eriksson & Borg 2014; Bygdén & Bellberg 2015, 2017; Eriksson & Torgén 2016; Taawo 2015, 2018), Skara (Gullbrandsson 2015; Gullbrandsson et al 2021), Västerås (Skanser 2019). Gothenburg (Gullbrandsson 2020), Lund (Melin & Ranta 2020).

Sweden. In-depht studies of five of the earliest dated church naves in Västergötland provide the empirical material for analyses of past architectures. Linscott has applied an architectural perspective based on buildings archaeological documentation. Analytical measured drawings are combined with a 3D laser scan and critical use of dendrochronology and ^{14}C, thus providing *hard facts* in contrast to the traditional stylistic analysis of art history. Linscott has drawn inspiration from the works and teachings of Erik Hansen and put emphasis on the actual process of measuring and drawing as a tool for production of knowledge not just a mere documentation. Drawing on the plausible assumption that the trusses were originally visible in the church rooms, they play an important part in her interpretation of how the church nave was designed and could have been perceived. Linscott draws on theories of architect Simon Unwin and apply three-dimensional *promenades* or architectural walks, also used by Gunhild Eriksdotter (Eriksdotter 2005). Linscott stresses the ambiguity of meaning in the church room and suggest that the trusses may be seen as *gates*, indicators of zones in the nave. One of her aims is also to strengthen the architectonical and archaeological perspectives within the field of conservation.

In an article from 2015 on the roof of the late 11th century convent church of Jumièges, Normandy, art historian Lynn Courtenay and buildings archaeologist Nat Alcock have tried to sketch the spread, character and chronology of a European common-tiebeam-roof tradition, also drawing on the newly surveyed material of Västergötland. They suggest a new typology, which is mainly concerned with internal bracing. A central conclusion is that the former Carolingian empire and its neighbours are at the centre of this roof tradition, establishing a link to the somewhat neglected view of Lundberg (Courtenay & Alcock 2015).

2.7 Summary and positioning of my thesis

It is apparent how medieval churches, and with time their carpentry structures, have been vital in shaping the different disciplines that study them. From a mainly aesthetic regard, rooted in contemporary architectural and societal needs, the study of medieval churches became professionalized round the turn of the century 1900, in Sweden shaping the new discipline of art history, whereas in Denmark and Norway much remaining a field for architects. For long the approaches were coloured by a positivist paradigm concerned with matters of origin, evolution and diffusion. The later 20th century strengthened a more archaeological approach, based on scientific facts. Following the demands of an expanding heritage sector, questions on work and materials behind the constructions gained importance, enhancing the value of wooden heritage. But for long the church research in Sweden ran parallel in different disciplines with little interchange (Nilsson 2011:43), a situation which started to loosen up around 2000 in the wake of a largely decentralized heritage care. Around the same time historic roof structures had become a focus area in several countries, offering a well apt arena for cross-disciplinary cooperation, in Norway and Sweden to a large extant incorporating craft research. Craft research has been a catalyst in making medieval carpentry structures into a contemporary research field in Sweden.

The practices of documentation and conservation have been central for the development of research since 1900. The study of medieval churches and also their roof structures has from the beginning been in steady interaction with the contemporary practices of buildings conservation, it has not been isolated to academia.

At the end some words on the positioning of my own thesis in relation to this historiography. As already mentioned, my research has grown forth from the surveys that started in 2010. It has been shaped by the practice of surveys, value assessments, investigations, planning and execution of restorations, in several cases in interaction with carpenters and craft researchers, but also through exchange with colleagues in- and outside of Sweden. With regard to this and the occupation with medieval timber structures in the cross-disciplinary milieus of the Craft school and the Craft Laboratory it felt natural to make my licentiate thesis in the field of conservation and not in historical archaeology or art history, where this material and its techniques have not yet been in focus.

What put this thesis apart from much earlier research on medieval roof structures in Sweden is the buildings archaeological approach incorporating methods connected to craft research, as important a tool as dendrochronology, also taking advantage of on-site discussion on observations together with craft practitioners from the Södra Råda Project. In that sense it could be regarded as continuing along the path first trodden by Sjömar (1988). Other inspirations have been the research of Fischer-Kohnert (1999), Épaud (2007) and Schöfbeck (2014), which aim at a both holistic and deep understanding of structures and their production through the use of multiple methods and sources, often crossing disciplinary borders. Also the forensic investigations into buildings and their remnants by Almevik (2012) and Høgseth (2007) have influenced my approach as a *Bauforscher*.

In Linscott's thesis the archaeological observations are the main sources, but while her thesis dwells upon spatial analysis from an architectural view and the once-upon-a-time-users potential experiences, my thesis focus on structuring the diverse ways of construction, with which techniques they were built and in which spatial and timely contexts. Unlike earlier Swedish researchers I have had the possibility to draw on a whole corpus of medieval roof structures from two regions, known from first-hand observations, a handful of roofs repeatedly revisited and studied in detail, in the case of Gökhem and Ransberg also during restoration, which revealed new details. As with my participation in the characterization project, the roof projects have been a process of gaining knowledge and experience of a material through own observations. With visits to far more than 200 church attics in Sweden alone and several abroad, this has enabled me to make conclusions not possible to draw before, due to the few objects studied at close hand. Often I have felt as an explorer in a pristine field in the same way as my forerunners must have done a century earlier. Since Lundberg no Swedish researcher has addressed the positioning of the High Medieval roofs of Sweden in a European context (unlike in Norway and Denmark), although Courtenay and Alcock have attempted this, but on a very overarching level. Participating in the excursions of "Arbeitskreis für Dachwerke", exchanging thoughts in this network and also making own study journeys has enabled me to make comparisons not just from literature or schematic section drawings. I try to bridge the opposing views in research on the roofs as either quintessentially Scandinavian or firmly rooted in a European context.

Chapter 3
Research design

Accompanied by the Rector's two sons, I entered the roof by a trap door over the north-east corner of the altar, and examined the timber with them by the light of candles and lanterns.
(Architect Dennis Chantrell on his visit to the roof structure of Adel church in York county 1847, Chantrell 1887:111).

Whenever we make something 'flat' and find it is not flat enough, we always find that by taking more trouble we can make it still flatter…
(Pye 1995:31)

After having presented the background, stated my objectives and outlined the research field of historic roof carpentry and its history of research I will proceed to present the design of my research. Central for this was the empirical fieldwork of surveys and case studies funded through the Church of Sweden. This chapter will discuss the conditions for my investigations, their methods and production of knowledge. Since research is a both practic and academic task I will start with some reflections on how knowledge rise from the meeting between the object of study and myself as archaeologist and buildings conservator. This is followed by a discussion on the cross-disciplinary cooperation between myself and craft practitioners and researchers. The conception and evolvement of my surveys in the dioceses will thereafter be presented as well as the methods used. Finally I will put forth concepts of interpretation that influenced my work on the third article.

3.1 Perspectives on approaching the unknown

Documenting and interpreting medieval trusses up in dark secluded attics meant for my sake at first meeting something quite unknown, with time something that could be related to an ever increasing set of own references and experiences. Revisiting roofs thus gave new insights. At the start, the diocese surveys had no outspoken theoretical framework, apart from the everyday *cultural historical* practice of an archaeologist or buildings conservator. But early on my fieldwork attained the characteristics of hermeneutical methodology in knowledge production. Knowledge and experience are products of practice (Polyani 1962; Molander 1993). The attics, their remains and the tools of documentation have an agency of their own that influenced the outcome. This has been the case with similar field investigations, be it archaeology, art history or ethnology, but seldom acknowledged (Jensen 2012; Gustafsson 2014). My research has a hermeneutical methodology built on a phenomenological understanding of the world (Heidegger 2013 [1927]; Merleau-Ponty 1999 [1945]; Gadamer 1997 [1960]).

3.1.1 Being inside the object

Buildings archaeology as well as craft research are disciplines where closeness to the empirical material cannot be overestimated. In the case of roof structures the researcher is standing, kneeling, climbing or crawling inside them. Investigating built heritage is never a purely intellectual task, it involves body and mind together. The importance of the body to grasp the world and the intertwining of subject and object through *care* are central to the phenomenology of German philosopher Martin Heidegger (Heidegger 2013 [1927]). His thinking has after 2000 influenced the *Material Turn* in archaeology, an *archaeology of the senses* and *post-humanist* theories, enhancing the agency of the material world and questioning the reduction of things to mere symbols of a society (Karlsson 1998; Olsen 2010; Kuijpers 2018:38). The material world affected both the once-upon-a-time-builders and affects the present investigators. For the crafts person as well as the archaeologist materials impose constraints and offer *qualities* (Kuijpers 2018:38ff, 268; Seiler 2020:37).

The fieldwork of qualitative in-depth studies, as in my research, is demanding and rewarding. With-

Figure 24. Going into the dark cave. Askeryd church, Småland 2010.

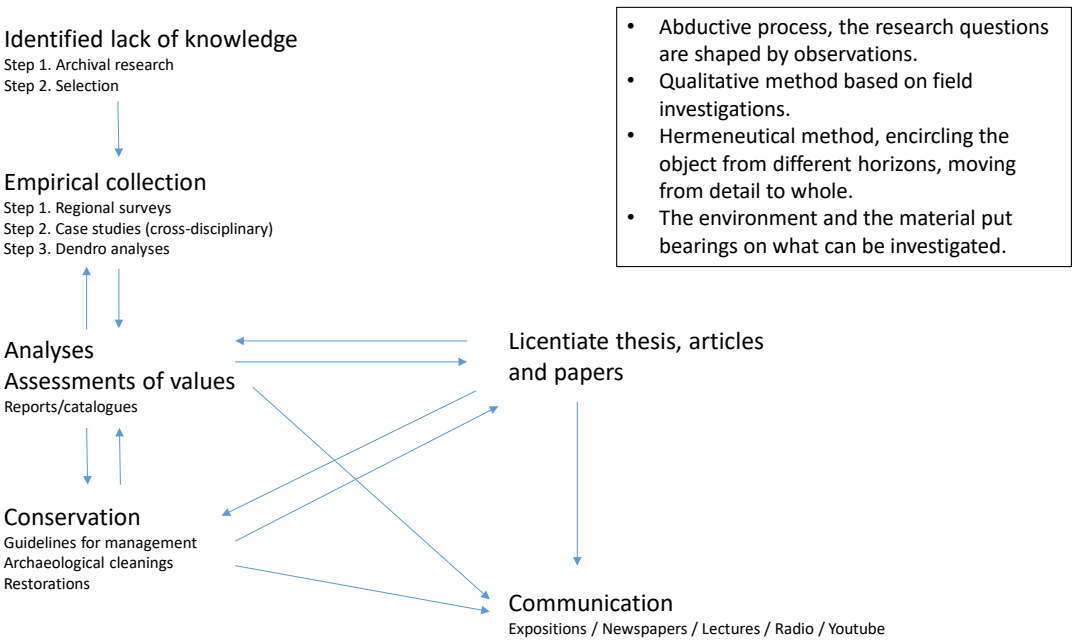


Table 1. Schematic presentation of the relation between my thesis and the diocese projects.

out being there, *Da-sein* according to Heidegger, interacting with (*Umgang*) and caring for (*Umsicht*) (Heidegger 2013:82–91, 157–164, 196–199) the historic structures, little knowledge would come forth. Investigating the attics is a process where the object and its environment affect the outcome in showing or hiding its secrets, it is an archaeological craft, a work of uncovering and shedding light. The spatial dimension is vital since the attics are dark, secluded, reached through a narrow opening in a masonry wall or a ceiling. This cave-like situation provides a different mind-set where you cannot rely solely on your eyes. There is a steady change back and forth from interaction with the object of study to a more distanced regard, much as archaeological fieldwork, recalling Heidegger's distinction between *Zuhanden* (*ready-to-hand*, the silent natural interaction) and *Vorhanden* (*present-at-hand*, the reflective gaze at a distance) (Heidegger 2013:88ff). Although often well preserved, the roof structures are seldom any clean specimen, at least not without work invested, they are not really *Vorhanden* to study without engagement and knowing what to search for. Part of the roof structures can be hidden under layers of insulation or bird nests and debris, surfaces covered by dust. Some features must be uncovered, or can due to time and circumstances be only partly observed, others are positioned without reach. Some features show themselves only through a certain state of decay or during a restoration, others we cannot physically get at nor see. Some we can feel, the shelf for an eaves board on a wall plate for example, or a hidden moulding or ornamentation. Even the smell can be a guide. Our present experience of the 12th century roof structures, once semi-open, is thus much different from how they were experienced when new. But the toolbox of today enables us to observe things better than our predecessors in research. Laser measurer, cross-laser and portable LED-flashlights have changed how we grasp and document the roof structures. For the case studies, portable ladders and lamps for common light have played a significant role in accessing and decoding the structures. Being able to work in general light has to some degree domesticated the *cave* and made it less enchanting, but meanwhile got us closer to the original conditions. In the context of a full-scale restoration, as in Gökhem

church, there was the singular chance to study the roof structure in full daylight, as once its builders. The conditions of light have strongly affected the quality of photographs, which well chosen, composed and illuminated can communicate more information than a drawing or text to an initiated viewer. But as our tools often help, they can also obstruct when failing, leaving us with things unobserved. And off course, our body and mind can also fail us.

3.1.2 A hermeneutical and cross-disciplinary approach

How do we draw knowledge from our observations? A student of Heidegger, German philologist Hans-Georg Gadamer (1900–2002) developed a hermeneutical model for analysing text, also suited for material culture and widely used in human sciences of the last decades (Gadamer 1997 [1960]). A roof structure can be read as a text where the letters are the fashioning of a timber, the joinery and so forth. Gadamer states that the relation between researcher and object is no *tabula rasa*, how the researcher approach the object of study is dependent on pre-knowledge or prejudice. Meeting the object means revision of this knowledge, a circular or rather endless spiralshaped process leading to deeper knowledge, oscillating between detail and whole (Gadamer 1997:137; Hodder 1999:32f; Høgseth 2007:141). For my research the hermeneutical model of knowledge production was so natural that it was not put into words in the survey reports. The need for questioning the researcher's *a priori* assumptions and gradually approach the object of study in an encircling process with progressing re-evaluations is for example just briefly indicated in Karin Andersson and Agneta Hildebrand's handbook "Byggnadsarkeologisk undersökning" from the National Board of Antiquities (Andersson & Hildebrand 2002:11).

According to Gadamer there can be no interpretation without pre-knowledge. Norwegian philosopher Jakob Meløe has written about the *knowing*, *unknowing* and *dead* gaze. How we observe is based on our experiences, thus linking phenomenology and hermeneutics (Meløe 1979). A historical building and its features can be read and interpreted in several ways depending on discipline and perspective. The investigation can be clinical or it can be made in a laboratory as the analysis of the dendrochronologist, the analysis of fungi or the calculations of statics. Thus a roof truss can take different shapes depending on perspective, it could be seen as historic architecture, load carrying structure, product of craft, product of a certain society and epoch, or just a piece of wood eaten away by fungi and insects. Each perspective would result in a different documentation, not to speak of renovation measures. Often enough historic timbers have been regarded with a *dead* gaze: as only rotten wood, replaced without proper documentation. Everyone just doing their *thing* with their *tools* pose a problem (Mol 1999:77). In my case studies buildings archaeologist, craft researcher and dendrochronologist worked together. This fit the multidisciplinary and holistic character of conservation as a discipline (Rosvall 1995) and the need for cross-disciplinary collaboration and methods in documentation of historic buildings (Almevik 2012:342). Much can be gained in the study of historic structures and artefacts when experts of different professions work together, making the gaze of each more *knowing*.

3.1.3 Cooperation between buildings archaeologists and craft researchers

With the *Material Turn* in archaeology the concern with crafts became pronounced, posing questions on quality, skill and technique. Crafts had already been focused upon in ethnoarchaeology (Lemonnier 1986, 1993; Wendrich 1999; Renfrew & Bahn 1996:178) and experimental archaeology (Outram 2008), trying to grasp the processes behind artefacts, on one hand in studying living traditions on the other in trying to reconstruct forgotten ones. But it is rare that the experimental archaeologist is both academic and craftsperson. Archaeologist Alan Outram has pointed at the importance of collaboration between different specialists, both academic and practical (Outram 2008). Archaeologist Maikel H. G. Kuijpers has in his thesis on Bronze Age metalworking acknowledged the *embodied* knowledge of professional craftspeople for a fuller understanding of the objects, their production and the levels of skills involved (Kuijpers 2018).

The acknowledgment of the *action-based* knowledge of craftspeople inside the diocese projects is in line with Norwegian and Swedish ambitions since around 2000 of linking crafts and academia to raise

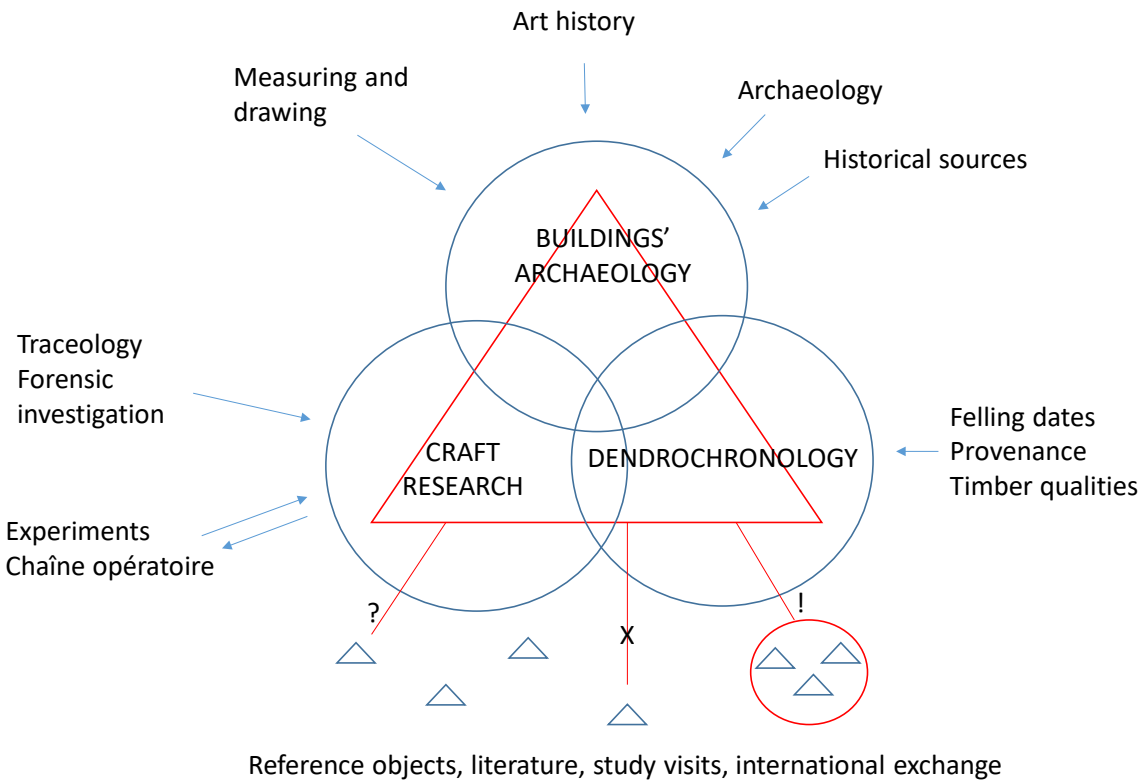


Table 2. Scheme of cross-disciplinary input and interchange in the case studies.

new questions and develop buildings conservation (Godal 2006; Bakken ed. 2016). As a matter of fact the diocese projects and the Craft Laboratory have evolved alongside since 2010. Almevik and Sjömar have written several texts on how to engage the crafts person as a producer of knowledge in investigations and restorations, drawing on the theories of Michael Polyani (Almevik 2012:31f; Sjömar 2017). Høgseth has underlined the similarities between the carrier of craft tradition and the buildings archaeologist as producers of knowledge inside buildings conservation and states that it is natural that they should co-operate, both are practitioners (Høgseth 2007:155; Jensen 2012; Groth et al. forthcoming). The cross-disciplinary milieus of the diocese surveys and the Södra Råda Project have been in steady interchange throughout the years, not least facilitated by craftspeople being active in both. Hypotheses from the surveys could be tested in full-scale experiments and observations could be used in the reconstruction of Södra Råda church (Eriksson & Torgén 2016; Almevik & Melin 2017; Melin & Ranta 2021).

The cooperation between buildings conservator/archaeologist, dendrochronologist and craft researcher/carpenter has inside my projects been characterized by the intertwining of expertise, not working alongside but with one another. A fitting term is *T-shaped practice*, a cooperation between *T-shaped experts*.[1] The T-shaped expert has the depth of knowledge but also – and as important – interests and experiences that go beyond this and facilitate the exchange with experts from other fields. The T-shaped approach can be regarded as a way of widening the interpretation of historical objects (Groth et al. forthcoming). The

1 The term T-shape got into use in business management in the 1990s, see interview with Tim Brown, https://web.archive.org/web/20110329003842/http://www.chiefexecutive.net (accessed on November 19th 2019).

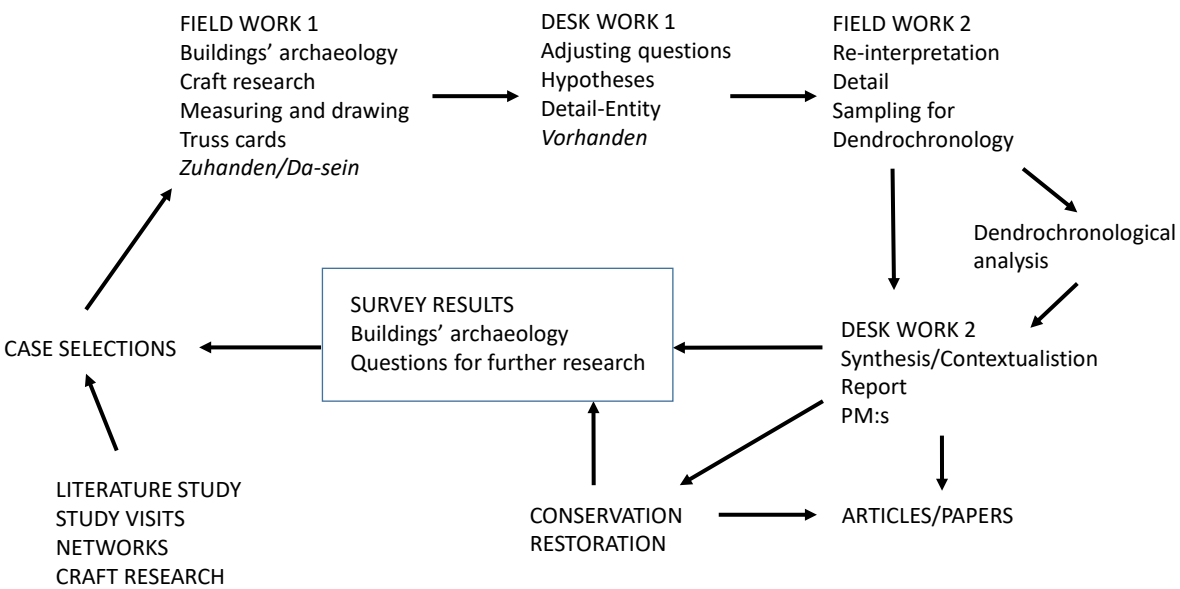


Table 3. Processual scheme of the case studies.

long experience of investigating and caring for medieval timber structures made our horizons meet and fertilize each other through dialogue pre-, on- and post-site. With time our knowledge and skills have more and more come to overlap, we could even talk of a blending of professional roles. If the surveys had stated what there were, the case studies were a in a sense excavations steadily discussed in an informal way. As project leader in the diocese investigations I acted as a spider in the web, answering for structure and record apart from participating in the documentation and investigation, forwarding or questioning assumptions, afterwards as main author and editor being responsible for the reports.

3.2 The fieldwork

The surveys in several dioceses were motivated by a since long identified lack of knowledge concerning the extant and character of preserved medieval roof structures in Swedish churches. In many a church no one knew about the age of the roof structure or its status, which meant a risk of heritage loss. Several caretakers had never been "up there", surprisingly few of the producers of maintenance plans neither. When I first ventured up on many an attic I did not know what to find, many structures were for the first time scrutinized by someone from the fields of conservation and archaeology. Questions rose from the empirical material with the progress of surveying. Patterns grew forth as well as anomalies. With time these got moulded into hypotheses that guided the selection of case studies in the second step of the projects. My research practice thus evolved through the growth of experience and the hermeneutical oscillation between detail and whole. My methodology can be regarded as an abductive and qualitative one since it depart from and return to field observations, reshaping the conclusions in this process. The phases of each diocese project I led can be structured as following:

1. Archival research and selection
2. Surveys
3. Reports and articles on the surveys
4. Case studies in cross-disciplinary cooperation
5. Case study reports, papers and articles

Figure 25. Making a sketch drawing in Kälvene church, Västergötland, 2014.

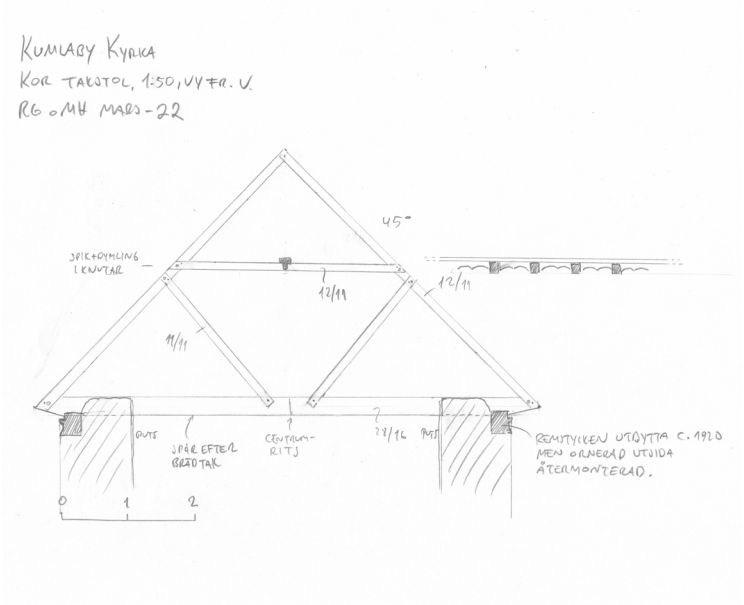


Figure 26. Measured sketch drawing of roof truss in the chancel roof of Kumlaby church, Småland, 2022.

3.2.1 Surveys

In the diocese of Skara I was faced with a total of 164 churches with medieval origins, to be surveyed by myself during two years. Some prioritization and selection had to be made before heading into field. A desk survey of the reports from the Church Characterisation Project[2] was made to single out churches that were rebuilt, altered or burned to an extent that no *in situ* preserved medieval roof structure could be at hand, thus reducing the number of churches to visit to 94. As became clear with a pair of visits outside the selection, important original elements could still be found, even despite historic mentions of fire. Thus, there are still churches that remain to be visited, the case is not closed and will probably never be, since reused material appear even in 19th century churches. For the churches chosen, material concerning the roofs as well as drawings of the building were gathered in the topographic archives of the regional museums.[3]

Since the aim of the surveys was to get an overarching grip of extant and character of preserved material, no exhaustive field studies were planned for. In general half a day was set of for each church, which demanded discipline and efficiency. One of the primary tasks after having got acquainted with the attic and its structures was the somewhat simplified plan drawing and a representative section. Apart from measured sketch drawings and photographs (views and details), the use of a checklist, soon turned into a more proper protocol, was an important factor of keeping order in an often disorderly environment. The field itself is thus a disciplining agent (Flyvbjerg 2006:235). Although the Craft Laboratory produced a model protocol, the diocese surveys have used somewhat differing versions, depending on the perspectives of the investigators. The key variables, though, were in common, such as noting species of wood, hewing techniques, joinery, dimensions *et cetera*, all these details that together shapes entities. It is notable that the protocols swelled from project to project, introducing new categories and features, directly reflecting the growing experience of the investigators. This testify to the dynamic of surveys, it is logic that framework, questions and tools develop underway, if not it would be to disregard both the researchers ability to learn and the material acting as a teacher. In this sense the research has been *practice-led*.

2 For the dioceses of Gothenburg and Skara these are accessible in the database "Bebyggelseregistret" of the National Board of Antiquities, https://bebyggelseregistret.raa.se

3 Jönköpings läns museum, Kulturlagret in Vänersborg, Västergötlands museum, sometimes incorporating copies from the archive of the National Board of Heritage (Antikvarisk-topografiska arkivet).

Figure 27. Scaled model of a Romanesque church with exposed roof structure, from the exposition "Hidden Rooms" (Västergötland's Museum 2015). The roof is modelled on the 1140s nave of Marum with some additions from other churches. The model enable an three-dimensional understanding of roof and church interior as a unity, which normally is not possible on-site. The model was used to test the impact of daylight and the actual visibility of the trusses for the medieval church visitor (see also p. 106).

An overarching knowledge from on-site-visits emerged, revealing patterns as well as features that did not fit into the picture. The results of the surveys in Northern Småland, Skara and Gothenburg dioceses were discussed in reference groups with fellow building conservators, carpenters from the Södra Råda Project and other researchers on historic roof structures. The results were presented in commented catalogues (Gullbrandsson ed. 2011, 2015, 2017) as well as two subsequent peer-reviewed articles (article 1 and 2). The surveys of Skara and Gothenburg were also presented as papers at the Annual Conference of European Association of Archaeologists in Vilnius 2016 and Budapest 2020 (Gullbrandsson 2018b and Gullbrandsson et al. forthcoming).

3.2.2 Cross-disciplinary case studies

If the surveys in Northern Småland and the dioceses of Skara and Gothenburg were quite solitary fieldwork for me, the following phases of case studies in Skara and Gothenburg meant cross-disciplinary ventures, producing knowledge with a small team of experts. This team consisted of myself, carpenter Mattias Hallgren (Gothenburg and Skara), craft researcher and fellow PhD student Karl-Magnus Melin (Gothenburg), assisted by buildings conservators from the regional museums. Also the dendrochronologists Hans Linderson and Anton Hansson of Lund University got engaged. Questions and hypotheses from the surveys were further specified and therefore apt study objects were chosen as case studies in discussion with the diocese conservators, testifying to the abductive nature of the projects (Johansson 2002). If the surveys had answered the questions *what* and *where*, the case studies addressed the questions *when*, *how* and *why*. In trying to grasp the multitude of historic carpentry we choose multiple case studies addressing different epochs and variants of constructions, some contained embedded cases (Yin 2009). For Västergötland these were:

- Early tiebeam roofs (prior to 1150), trusses assembled without upper face (Götene and Västerplana churches. Hagebyhöga church in Östergötland as reference).
- Tiebeam roofs (12th and 13th centuries), trusses assembled with upper face (Forsby, Gökhem, Göteve, Jäla, Ljungsarp and Marka churches. Herrestad and Kaga churches in Östergötland as references).
- Early hybrids between tiebeam-trussed roofs and purlin roofs (c. 1150–1200) (Edåsa, Eriksberg and Valtorp churches).
- 14th century roofs as breaking points between old and new techniques (Månstad and Ransberg churches).
- Late medieval timber towers (Kungslena and Marum churches). These are not referred in this thesis.

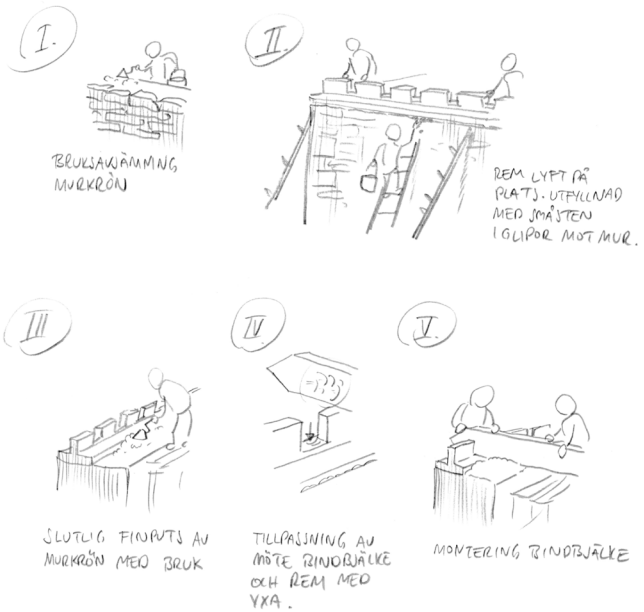


Figure 28. "Chaîne opératoire", interpretation of the intertwined work of masons and carpenters in building the nave of Gökhem church. Drawing by the author.

For each case I used historic protocols and accounts from the church archives[4] to find information concerning the actual roofs during the Early Modern Period. Apart from this the case studies were teamwork from beginning to end with myself as both fellow investigator and coordinator. Truss cards combined with photographic documentation were used to grasp material properties, the surfaces and their traces, also damages and repairs as well as timbers suitable for dendrochronological sampling. The protocols and photographs from the surveys and the truss cards from the case studies proved valuable in order to quantify *key features* in Excel, where and when they appear, which served as a tool for my third article.

After a first day in the church, going through each truss, I and my fellow investigators went home to structure our thoughts and assumptions, scrutinize our photos, putting our observations in relation to the set of reference objects in our heads and folders, stepping back to see and reflect on what was at hand. On the third day we returned to the attic with our sharpened questions and a new checklist, also aiming to find suitable timbers for dendrochronological sampling, which was the goal for the final field day. After the dendrochronologic analysis it often proved valuable to return once more to clarify certain things. But that was not always possible, in effect, the cases remain *open*, the hermeneutical spiral will go on when occasion is given (Flyvbjerg 2006:238). Each object was presented in detail in the report with text, photographs and documentation drawings together with more analytical ones. In such *thick descriptions* attempts were made to triangulate with written sources, the building as an entity, the place and its nature and history, earlier experiences and reference objects. As such it became a narrative or a story told about a roof, its actors and agents (Flyvbjerg 2006:237f; Gullbrandsson ed. 2020; Gullbrandsson, Hallgren & Hansson 2021). One of the case studies was presented on the 7th Congress of Construction History (Gullbrandsson & Hallgren 2021).

3.3 Methodology

The buildings archaeologist has to work on what is at hand, "on what there actually is" (Olsen 2010), and this has governed my investigations and their abductive character. A historical building contains a wealth of details, traces, overlapping layers of time, clues that need contextualization to be understood. Putting the bits together and triangulate with other sources or objects is necessary to create an interpretation or a narrative. The direct observation on site acts as point of departure, from which the investigator can "zoom out" to a wider horizon, searching for analogies or supplementary source material, the hermeneutical shift between detail and whole. And it does often not suffice sticking strict to one method, one discipline or one source material.

The investigator has to make pragmatic use of multiple methods and sources in approaching the *mute* objects, forwarded in Almevik's *forensic perspective* of building investigation (Almevik 2012:30). The blurred borders to neighbouring disciplines in the practices of buildings archaeology have been stated (Eriksdotter et al. 1998:69). As I pointed out in the Historiography the specific multisource and multi-methodological

4 Accessed via Arkiv digital, https://www.arkivdigital.se.

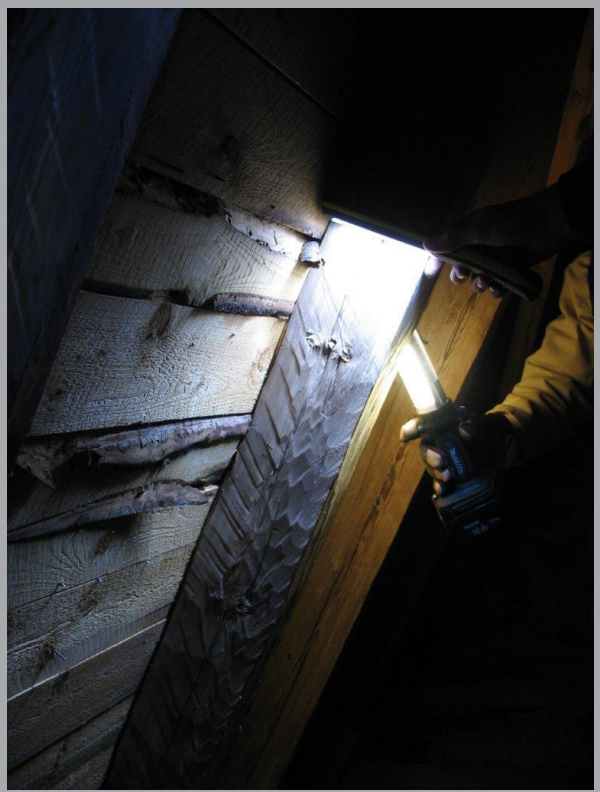


Figure 29. Examination of hewing pattern on a rafter in Knätte church which gives information on axe type and process. The carpenter has been working with a knifegrinded axe along the fibres on one side, shaping the "sprätthuggning" pattern, but then finishing off in opposite direction more diagonal with a smaller axe, maybe not even by the same carpenter.

Figure 31. Restoration as an opportunity of gaining knowledge and test encountered old techniques. Carpenter Mattias Hallgren finishing of a tiebeam replacement with broad axe for the nave roof of Gökhem, 2019, working according to the original hewing techniques.

Figure 30. Roof structures are seldom clean specimens to study without ineraction. Here excavation of an original wall plate in the nave of Västerplana church.

Figure 32. Experiencing and documenting 12th century trusses in daylight is seldom. This provides opportunity to recognize details hard or impossible to see otherwise. Here during the restoration works on the nave roof of Gökhem in 2019. Photo: Mattias Hallgren.

study of historic timber frames that the Germans call *Gefügekunde* apply well to what was done in my research, but more outspoken cross-disciplinary, regarding the muddled disciplinary borders as an asset for cooperation with experts from different fields.

3.3.1 Measuring, drawing and imagery

Measuring and drawing played an important part in surveys and case studies, both to grasp the constructions and to communicate them. An important outcome of the surveys was the production of rapid measured drawings, sufficient for the aim of stating what there were. Due to the time at hand these were measured sketches without any mounted grid laces. But still, even at this level, the act of measuring and drawing is a way of disciplined acquaintance with the study object, of transmitting a visual interpretation of observations. It is a steady shift back and forth between action (*Zuhanden*) and just observation (*Vorhanden*). Depending on the ambition level, the drawing can be more or less analytical, in the case studies the drawings tried to capture traces of production and alteration.

The importance of measuring and drawing as tool for knowledge production and not just documentation, have been stated by Erik Hansen as well as his Swedish pupils Kristina Linscott and Gunhild Eriksdotter. It has a long tradition in archaeology, architecture history and ethnology, reflecting different approaches, levels of rigour, representation, analysis, and also aesthetics (Fischer-Kohnert 1992:15f; Sjömar et al 2000; Eriksdotter 2005; Almevik 2012:85; Gustafsson 2014). The measuring and drawing is a subjective act where the investigator decides what should be visualized, "it is the observation in itself together with the measuring and drawing that has an analytical value" (Hansen 1978:104). The measured drawing is an interpretation, and as such it can always be questioned, the drawer can have missed or regarded certain features as unimportant, features that someone else with different views could find vital. The drawing is a reflection of the drawer's knowledge and position. The drawer can leave out recent additions, indicate the original position of a gone or moved part, in effect choose to make a true rendering of the present situation or interpret the original one, or even represent multiple time layers. The drawing can in one image grasp what on site demand several positions of view. The reading of the drawing has to be careful, but is hard to criticize without own observations since the object itself is the only corrective, if still at hand. Uncritical use of drawings is a common flaw in attempts to larger syntheses with a parade of sections.

Since measuring and drawing demands the active participation of several bodily senses it can hardly be replaced – but of course complemented – by techniques such as 3D laser scanning. In the end it is a different thing to interpret from an image instead of the physical object in its environment. If the drawing is a rendering filtered through the investigator one could think that the photograph would be unbiased. This is not true since the motif, the composition, the angle, the light and its direction has been selected, seldom haphazard if the photographer is skilled and knows the subject-matter. Meanwhile a photograph can contain a wealth of information hard to capture in a drawing. But the photograph also needs a viewer able to read its information, not easy when showing a small detail from a truss or the chaotic overview of an in several stages reinforced roof structure. Meanwhile it can reveal features not noticed in the act of documentation.

Models, digital and analogue[5], also provide possibilities of "returning" to the object, even viewing it in a fashion impossible in reality (even adding and removing time layers), which can give new insights apart from new ways of rendering and transmitting information. For the survey aims I got far enough with traditional measuring and drawing combined with photographs and text. As in most cases, time and budget is a decisive factor apart from the limitations of space.

5 See for example an exhibition of destroyed roof structures in Munich as analogue models, https://www.zimmerer-muenchen.com/nachrichten/die-daecher-muenchens-ausstellung-im-stadtmuseum.html (accessed 21st of October 2022). For the possibilities of digital modelling see Almevik & Westin 2017 on Hemse stave church.

3.3.2 Reading of traces from production and alteration

Just to focus on roof structures in terms of graphic renderings risk overseeing the wealth of information at hand (Fischer-Kohnert 1999:19). The awareness of this potential has grown since the end of the 20th century through buildings archaeology and craft research. Traces of tools, scribing, cord strikes *et cetera* provide detailed insights into the work of the otherwise *mute* workers behind the constructions. A closer reading of the structure can also detect later alterations. Observation and interpretation demand a trained eye and knowledge of techniques and tools.

An important method in archaeological study of craft techniques is the concept of *traceology* or the study of tool traces and use-wear. This method linked to criminology was developed in archaeology, first in post-war Soviet Union, mainly dealing with lithics (Olausson 2005). Seminal in regard to method was Rob Sand's study on tool marks on prehistoric timber (Sand 1997; Høgseth 2007). Wood as material is very rewarding since traces may remain in mint condition. Through close ocular and tactile study of for example medieval timbers information can be gained on which tools where used, in which order, the shape of their edge and in which direction, by which position and movement of the carpenter, also such things as scribings, cord strikes, drill holes provide information that put into the wider context of the timber, the truss or roof structure, or a corpus of roofs, gives clues concerning layout, production and later alterations (Bláha 2013). Traceology means to relate detail and whole, drawing on the embodied knowledge of the practioner. The traceological observations combined with material properties are suited for the method *chaîne opératoire*, which was developed by French archaeologist André Leroi-Gourhan (Leroi-Gourhan 1965) and popularized by Pierre Lemonnier (Lemonnier 1986, 1993). The chain reconstructs the strategic steps of production and is a useful method to understand systems and techniques, though one must have in mind that it is an interpretation, even when resting on full-scale craft experiments by craft practitioners.

Since the 2000s traceology has increasingly been applied in buildings archaeology regarding the works of masons and carpenters. The Viking Ship Museum in Roskilde, Denmark, has long analysed tool traces to reconstruct axe types.[6] Traceology is part of the *forensic* investigation model, put forth by Almevik (Almevik 2012, 2017). Referring to the *clue paradigm* of historian Carlo Ginzburg he demonstrates how to trace events in the built material through a close ocular – I would also like to add tactical – observation, leading on to ask why and when they took place (Almevik 2012:97). A pronounced traceology case is Almevik's investigation of the remains of the stave church of Hemse together with blacksmith Bertil Pärmsten and carpenter Magnus Sjöholm. The fragments are confronted with the preserved wood working tools of the contemporary findings from nearby Mästermyr, shaping a basis for craft experiments (Almevik, Pärmsten & Sjöholm 2020). Inside the Södra Råda project and the diocese projects of Lund and Strängnäs, traceological interpretations related to experiments have been made. An in-depth example of interdisciplinary documentation and interpretation of tool traces is the thesis of carpenter and archaeologist Harald Høgseth, "Håndverkerens redskapskasse", the first in Norway to study tool traces on archaeological building remains. He analyses Viking age hewing techniques aided by odontologists, computer technicians, carpenters and craft researchers, criminologists and choreografists (Høgseth 2007, 2012). As Høgseth and others have pointed out, it is even possible to identify individual axes through their *signatures* (shape and damages) as well as individual carpenters through their motions of work. Frédéric Épaud has also made use of traceology as part of an ethnoarchaeological approach (Épaud 2007, 2022).

Based on a traceological documentation linked to experiences from practice-led-research such as Södra Råda, methods were developed for deconstructing and reconstructing the roof structures. Even if we cannot reach into the minds of medieval people through their objects (Eriksdotter 2005; Linscott 2017), we can say, this is how it could have been done, since the

6 https://www.vikingeskibsmuseet.dk/en/visit-the-museum/exhibitions/previous-exhibitions/the-reconstructed-ship/viking-age-tools

study of traces lead to hypotheses that can be tested in experiments and thereafter falsified or revised (Karlsson 2013:25; Melin 2017:98; Seiler 2020:47). This hermeneutical motion deepens the knowledge of how things were made, and can also open perspectives on why. A rich body of own observations from a large corpus gives input enabling discussions on norms, skills, qualities and traditions in craft. In a sense we who have been working in the core of the diocese projects have developed an almost intuitive feeling for placing an object and its features in time and space, which not seldom could be proven by the dendrochronological analysis. You have in a way a reference library in your head and body.

The traceological approach forms an important part of the source criticism, since these are constructions that have been standing for several centuries and undergone reparations, alterations and degradation. What is part of the original construction? What is reused from an older? What is later added, when and why? What is the result of decay? What is the relative chronology of the construction and the space?

Knowledge of tool traces, the reading of material properties, as well as an understanding of the structure makes it possible to identify later alterations in the constructions, when possible also triangulated with historical protocols and accounts.

3.3.3 Dendrochronology

Related to the question of source criticism is the use of dendrochronology. Dendrochronology is a central method for buildings archaeological investigations. For long the commissioning archaeologists and art historians just focused on felling dates, not much scrutinizing the sampling or analysis, which was more or less left to the dendrochronologist alone (Fischer-Kohnert 1992:109f; Edvardsson et al. 2021; Lindblad 2021). Using the full potential of dendrochronology can allow for conclusions on organisation of the building project, material resources at hand as well as the character of forests. The sampling has to be well planned in order to have validity. What questions do we want to answer and which timbers could help in answering them? That means that a sufficient buildings archaeological assessment must be at hand, which has identified not only timbers relevant for the questions, but also such that have a chance of providing good samples, that has enough annual rings, waney edge or at least some rings of sap wood that allow for an estimation of rings missing. The common problem in High Medieval roof structures is the frequent lack of waney and often sap wood, since the carpenters choose timbers of such a quality that they could hew away most of the sap wood. The identification of true waney or sap wood is a thorough search. Another problem is the occasional use of spruce. Spruce has its own kind of growth, which differs from oak and pine, and can vary from one spot to another in a very small area.

For each sample a protocol was made and photographs of the timber taken, giving information on section and surface. Questions and hypotheses concerning the sampled timbers were posed, possible references listed, giving the dendrochronologists important input and ground for discussing preliminary results with us. Where the results plausible or were there something that did not make sense? Some results had to be secured with ^{14}C and *wiggle match*.

Churches in Västergötland were sampled by engineer Alf Bråthen in the 1980s and 90s (Bråthen 1979, 1982, 1995, 2000), a large part of his samples are archived at the Laboratory in Lund. They were reanalysed by the Skara diocese project, often validating his results but with a more rigour use of statistics of sapwood, leading to some adjustments.[7] In recent time samplings and analyses of timber from churches have also been made by Andrea Seim, Department of Geology, University of Gothenburg (Seim et al. 2015).

3.4 Interpreting techniques and traditions

Finally I will present some concepts and approaches that to varying degrees have inspired the interpretations made in my third article. They concern how we can look at carpentry, interpret and contextualize it.

7 In some cases his analyses proved wrong, some undated samples could with regard to present references be dated. Existing protocols have been valuable in order to get back and scrutinize the sampled timbers. A common flaw to the interpretations of Bråthen is that he was no buildings archaeologist. In his later correspondence on requests for samplings he repeatedly stated the need of antiquarian participation.

3.4.1 Building as language

Apart from being read as expressions of resources (material and economic), ambitions and social structures, buildings could also be read as systems of logic, of craft traditions, as texts where details shape letters put into words and sentences, attaining larger meaning. Some researchers have referred to ways of building in terms of language, grammar or dialects. This provides new spectacles in trying to recognize and understand patterns visible through the study of a large corpus of roofs, putting those details into context. In an article from 1989 for "Vernacular Architecture", Richard Harris wrote about the *grammar of carpentry*, introducing a view of carpentry solutions as expressions of language:

Building and language are comparable in that they are both cultural activities devoted to a practical end. They have to satisfy practical demands, but these demands do not themselves define the end result.
(Harris abstract for reprint 1999:27).

Contesting the intense English search for regional *carpentry dialects* Harris searched for more widespread and seemingly unchangeable carpentry features, asking why the carpenters were "free to change some things but not free to change others" (Harris 1989:1). Why did the carpenter not adopt alternate solutions that in principle were available? With examples of joining roof structure and wall, bay division and its relation to upper face of frames and the conversion of timber he tries to identify "the specific areas of 'un-freedom'" or as he chooses to name them "grammatical rules of the language of building". These rules or "systematic frameworks" are wherein regional dialects occur (Harris 1989:8). Language is thereby understood as a through generations established building system, open to a certain degree of variations.

Norwegian craft researcher, forester and tradition bearer Jon Bojer Godal and his colleague, carpenter and archaeologist Harald Bentz Høgseth, have used the term *craft dialects* to grasp differing solutions connected to geography, climate, material resources and traditions (Godal 2006; Høgseth 2007), which also was an approach taken by Sjömar (1988). They use dialect in a wider sense than Harris and acknowledge to a higher degree the agency of material.

Godal regards the building system as the primary tool for the builder. Concerning 19th century barn building he writes:

Every regional building tradition has a constructive principle, a system for building, a technique, a certain set of standardised procedures and traditions of shape. In addition to axe, saw and templates these are the tools, which the master builder uses in interaction with the material at hand, the actual place and the actual needs. Between some cultural geographical types there are large differences, between others small. /…/ Each building project gets the same melody. Meanwhile, each building project is an improvisation that gets its individual character.
(Godal 2006:177, author's translation).

Every project is a variation on a set of procedures or a system, "a well-known theme", determined by local resources, carpenter tradition, *shared abstractions* in imagining space and form and the negotiation between commissioner and master carpenter (Godal 2006; Høgseth 2012:75).

Sometimes languages mix, and create a *creole*, which architect Lars Roede uses as an explanation to oddities of early timber framed houses in 17th and 18th century Oslo. Their structures are the result of remoulding a borrowed system according to domestic traditions and techniques (Roede 2001).

These views of built heritage in terms of languages, craft dialects and creole clearly adhere to a hermeneutical methodology where the shifting from detail to whole enables us to understand (Hodder 1999:32f; Wendrich 1999:9). This shift can take place on very different levels, from the relation between a joint and a truss to the relation between a set of roof structures in a specific region and time to a wider span. I find that such a reading is fruitful for studying the corpus of roofs from Västergötland, especially when putting them in relation to material from other regions in Scandinavia and Europe.

3.4.2 Tradition, craftsmanship and skill

Another way of identifying and structuring patterns is through the concept of tradition. Tradition could be used as a parallel term to language and dialect. Tradition deals with continuity, the transfer of certain knowledge through several generations, in crafts rarely expressed in words (Rolf 1991; Planke 2001:10f). Norwegian anthropologist Mikkel Tin has written about tradition as the interplay between a set of rules and degrees of leeway. Without adherence to a certain set of rules and *habitus* the craftsperson would not get acknowledged by fellow artisans. But without leeway there would be no master, and consequently no development (Tin 2011). Høgseth adresses the meaning of *habitus*, unwritten sets of rules and shared abstractions (Høgseth 2012). He refers to the *action-based* knowledge as the mental and bodily *toolbox of the craftsman*, brought on in practice from master to apprentice through generations. He does not exclude the possibility that certain knowledge of contemporary *tradition bearers* could go back to the Middle Ages (Høgseth 2007). Gardener Joakim Seiler has for garden management pointed out that century-old practices could have lived on as long as technical, economical or esthetical circumstances did not change (Seiler 2020:45). Ethnologist Terje Planke has written about traditions in Norwegian boatbuilding where the rules of the builder "release a repertoire of actions", the rules and norms opens up possibilities and variation, levels of ambition, the best masters even push the limits and bring about changes inside tradition (Planke 2001:252). With this view on craft tradition there is always something normative framing variation, to compare with Harris' words on the *un-freedom* versus *freedom* of carpenters (Harris 1989:1).

Wood carver and theorist David Pye introduced the concept of *workmanship of risk* versus *certainty* that relate to rules and leeway. The workmanship of risk demands a high degree of skill and mastering of a material since the outcome depends "wholly or largely" on the workman's "care, judgment and dexterity", whereas that of certainty has a predetermined result (Pye 1968:20ff, 52). The workman of risk is no longer an apprentice, but a master and has the freedom to improvise, exhibit skill and put an individual stamp on the object. A workmanship of risk is present in High Medieval Swedish roof structures through a notable degree of improvisation or approximation from truss to truss. There have been few or no templates, which came with the development of Gothic carpentry, an embryo to the workmanship of certainty. But even in the 12th century steps were taken to limit risks, seen for example in the processes of building hybrids of purlin and trussed roofs. A pure workmanship of risk or certainty was not at hand in the Middle Ages, we talk about degrees.

Concepts of rules, leeway, risk and certainty can help define how norms evolved and changed in carpentry. Yet an aspect is what the society, of which the craftspeople were part, regarded as a work well done or "good enough".

> *An assessment of the general level of technical skill in a large assembly of artefacts, and especially the allowance for mistakes and faults, may give us some insight into what was regarded 'well enough made' to be accepted by society, and thus seen to have sufficient quality and/or suitability.*
> (Kuijpers 2018:43).

Kuijpers distinguish between a physical (aesthetic) quality and a mechanical quality, its usefulness (Kuijpers 2018:44). Kuijpers means that through a thorough study of a large corpus it is possible to trace a normative quality in a certain period, using the term *standard of the time*, trying to get beyond our present appreciation of skill and quality (Kuijpers 2018:76, 259). Kuijpers stress that the recognition of skill also was dependent on the general level of skill in society. As Scandinavia up until modern time has been a largely rural culture dependent on woodworking for tools and dwelling, there ought in the High Middle Ages have been common views on what was a work well done. Kuijpers makes conclusions on whether the maker was an imitating amateur, a trained craftsperson, a master or even a virtuoso forcing the boundaries of the normative. In the High Medieval roof carpentry of Västergötland one can recognize different levels of skills, from the just functional – or sometimes less so – to a longing for perfection in surfaces and joinery. There must have been a valuation of skill

by society, a reason to why a builder chose a certain team instead of those that were cheaper or closer by. A written testimony of such valuation is found in a court protocol from 1280, Bergen, Norway, which mentions that the best skilled crafts man could get up to the double in wage compared to a medium skilled one (Berg 1989:44).

3.4.3 Technological choices

My empirical material raises questions onto why some features and techniques were implemented and others not, or only to a part. Such questions can be addressed with help of the terminology forwarded since the 1990s in several archaeological studies on craft technologies. These have taken inspiration from the ethnoarchaeology of French anthropologist Pierre Lemonnier (Lemonnier 1986 & 1993). He introduced a set of terms related to the interpretation of *technological choices*, rooted in the writings of archaeologist André Leroi-Gourhan (Leroi-Gourhan 1945). These terms have become spread not only among archaeologists in studying development of techniques: *technical milieu*, *primary* and *secondary features*, technological choices as *innovation*, *imitation*, *adoption*, *adaption* and *rejection*. The terms give an entry into discussing the contexts of the choices made by carpenters, master builders and patrons.

A favourable *technical milieu* that value mastership, is a prerequisite for innovation and adoption of new techniques, that is a society open to new ideas and with both the needs and the means to bring forth innovations or adopt such. If not, the innovation remains unknown or rejected as unnecessary. Sometimes selected features are adapted into an existing system or technique, to compare with the above mentioned creole. A technique can have both primary and secondary features, the latter can be both functional and *stylistic*. The primary features relate to the concept of language by Harris or the dialects of Godal, the overarching norm or standard. Motives for adoption, adaption or rejection Lemonnier seeks in the sociocultural context. As Harris he stresses the importance of identifying which technological choices actually were open to the artisan. There is a danger in writing history backwards, in the light of later events and developments (Nilsson 1988), or to underestimate local conditions.

3.5 Summary

The diocese surveys that gave birth to my thesis have followed a hermeneutical progress, founded on direct on-site-observations. Theories and hypotheses were thus the result of discoveries, not the other way around. The practice has governed the research, as it did already for Curman and his disciples. The survey of a large empirical corpus gave birth to preliminary syntheses and research questions that guided cross-disciplinary case studies. In the end the results were contextualized on local, regional and international levels. The overarching method is essentially qualitative and abductive. The archaeological record in church attics was approached with body and mind and encircled in a process of evaluations, revisits and re-evaluations. The own observations have been central, derived from being on site after site, sometimes returning. The projects have developed through the accumulation of knowledge. The interplay between a micro- and macro-level has been necessary for the conclusions of this thesis, in that sense there is also a quantitative element. But it shall in this case be underlined that there is no quantification without own observations as foundation.

The buildings archaeological case studies have been cross-disciplinary cooperations between me as buildings conservator/archaeologist, craft practitioners/researchers, as well as dendrochronologists. Several methods and sources have been combined in order to approach the roof structures, their environment and techniques.

Chapter 4
Articles

1. Medieval roofs in churches of Northern Småland (Lund Archaeological Review Vol. 19 2013 pp. 77–94)

2. Västergötlands medeltida kyrkotaklag (Bebyggelsehistorisk tidskrift Nr. 74 2017 pp. 27–47)

3. Timber roofs from the High Middle Ages in churches of western Sweden – materials, techniques and influences (Vernacular Architecture upcoming)
Submitted June 2021, peer-reviewed June-August 2021 and accepted for publication in upcoming issue.

My three articles are not merely chronological arranged but represent in this order also the progress of my research. The first article presents a method of rapid buildings archaeological survey and its preliminary results. In effect basic research founded on field observations. The main objective is to present the corpus of preserved medieval church roofs in a limited area and raise some questions on their features and contexts. The second article presents the results of such a survey made in a larger and more homogenous region, the province of Västergötland. Here the large material allows for a discussion on systems and features that is somewhat deepened. The need for further studies for a selection of questions is identified. This has had a direct bearing on the third and final article that stems from cross-disciplinary case field studies in a selection of churches, chosen to highlight questions from the previous articles.

4.1 Medieval Roof Trusses in Churches of Northern Småland (Lund Archaeological Review Vol. 19. 2013)

Medieval Roof Trusses in Churches of Northern Småland

BY ROBIN GULLBRANDSSON

Abstract

Gullbrandsson, Robin. 2013. Medieval Roof Trusses in Churches of Northern Småland. Lund Archaeological Review 19 (2013), pp. 77–94.

The preserved medieval roof trusses of eleven churches in northern Småland (the old folklands of Vedbo and Sevede) were surveyed in 2010. They span from Romanesque types to late medieval, Gothic types. Preserved early medieval roof trusses comprise a heritage of international importance, since few wooden constructions of such age are preserved outside Scandinavia. Nonetheless, no total survey of the Swedish material has ever been made, thus making it uncertain how many objects still exist in the church attics. An aim of the project was to test the potential of quick surveys as a means to get a picture of the number and character of preserved medieval roof trusses in one determined geographical area. Romanesque roof trusses are present or traced in six churches. The churches of Bredestad and Norra Solberga in Vedbo have intact crossed strut-beam roof trusses of a type represented in the landscapes around Lake Vättern during the 12th century. Later examples of this type were encountered in the churches of Mellby in Vedbo and Pelarne in Sevede. Above the naves of the churches in Bredestad and Bälaryd is another type of Romanesque truss, the collar-beam roof truss, in the later church with decorated steering plates, which have identical parallels in western Östergötland and Värend in Småland. A pair of roof structures (Marbäck and Vireda) represents the transition between Romanesque and Gothic structures. The fully developed Gothic roof structure is intact only in the churches of Askeryd and Säby, which were converted into hall churches in the Late Middle Ages. It is suggested that the Romanesque roof trusses are part of a regional tradition present in the landscapes around Vättern during the 12th and the beginning of the 13th century.
Robin Gullbrandsson, Jönköping County Museum, Box 2133, SE-550 02 Jönköping, Sweden. robin.gullbrandsson@jkpglm.se.

Introduction

"It is now more clearly visible that in these roof structures the old domestic timber carpentry made its contribution to the Romanesque stone church, which otherwise was built according to imported models and methods" (Curman 1937, p. 194, translation by the author). In an article from 1937 concerning the Romanesque church roofs of Kumlaby on Visingsö and Garda on Gotland, the art historian and head of the National Board of Antiquities, Sigurd Curman, pointed out the unique corpus of preserved early medieval timber structures in the attics of Swedish churches. "A total survey thereof would perhaps give us greater opportunities to establish a better view of the timber carpentry which evolved and flourished in our country during the first millennia AD. […] [the] task of studying preserved old roof trusses in Swedish churches [is] unusually rewarding. I hardly believe it a

mistake to claim that in our churches, compared to other countries, we have an unusually rich and interesting corpus of medieval roof trusses preserved, awaiting their methodical investigation" (Curman 1937, pp. 194 f., translation by the author). As Curman implied here, preserved timber structures from early medieval times are rare in an international perspective.

Scandinavia has a large number of highly authentic churches from the period 1100–1350, a fact to be partly explained by the political and economic history in subsequent centuries. Reference has often been made, for example, to "the importance of the Swedish poverty" and the absence of large-scale war damage (Lindgren 1995, p. 28). Among the early medieval churches in Scandinavia are 22 stave churches and nine timber churches (Ullén 1983; Lagerlöf 1985; Anker 2005; Linscott 2007, p. 4),[1] which constitute a well-known heritage. It is less well known that above the thousands of – whole or partly intact – stone churches of the period there is a considerable number of preserved roof structures (Sjömar 1992, p. 57; Sjömar 1995, p. 207; Linscott 2007, p. 4).[2] Curman regarded the Romanesque roof trusses as testimonies of highly developed domestic carpentry (Curman 1937; Ullén 1995, p. 47). The 53 medieval church roofs in Norway have been surveyed and classified by Ola Storsletten (2002), but in Sweden no national survey has ever been made. It has nevertheless been assumed that the Swedish material may consist of some hundred Romanesque roof structures and probably almost a hundred Gothic structures (Linscott 2007; Linscott & Thelin 2008).[3] Since few geographically determined and methodical surveys of roof structures in medieval churches have been made up till now, our knowledge of the number of preserved objects is scarce and more or less random. In spite of this, it seems that the early medieval roof structures of churches in Götaland may comprise the largest preserved corpus of this kind in Northern Europe (Linscott 2007, pp. 35 ff.). This heritage is about to attain its proper importance as a source for the dating of churches and for understanding the processes behind their erection.

Object

The object of this article is to present a survey made by Jönköping County Museum for the Diocese of Linköping in 2010. The aim of the survey was to obtain a complete view of preserved medieval roof structures in the Småland part of the diocese. The investigation was made on an overarching level, as a basis for future and more complete documentation with dendrochronological analysis. Another aim was to test a method for quick surveys of a large material, in order to pinpoint the extent of preserved roof trusses. The survey covered eleven churches which were known or supposed to have medieval roof structures (Fig. 1). Nine of these were in the hundreds (*härad*) of Northern and Southern Vedbo (the old folkland of Vedbo on the border to the province of Östergötland) and two in the hundreds of Sevede and Aspeland further to the east (also bordering on Östergötland). It could be stated that these churches have roof structures that belong in shape and craftsmanship to a period from the 12th/13th century up until the beginning of the 16th century.

This article seeks to contribute to the mapping of different types of medieval roof structures in the provinces of Götaland, where they are to be found and how they have developed. The results of the survey will be presented here and compared with what until now is known or supposed concerning medieval roof structures around Lake Vättern. The questions dealt with are the following. Which different types of roof trusses are represented in the area of survey? What can be stated about

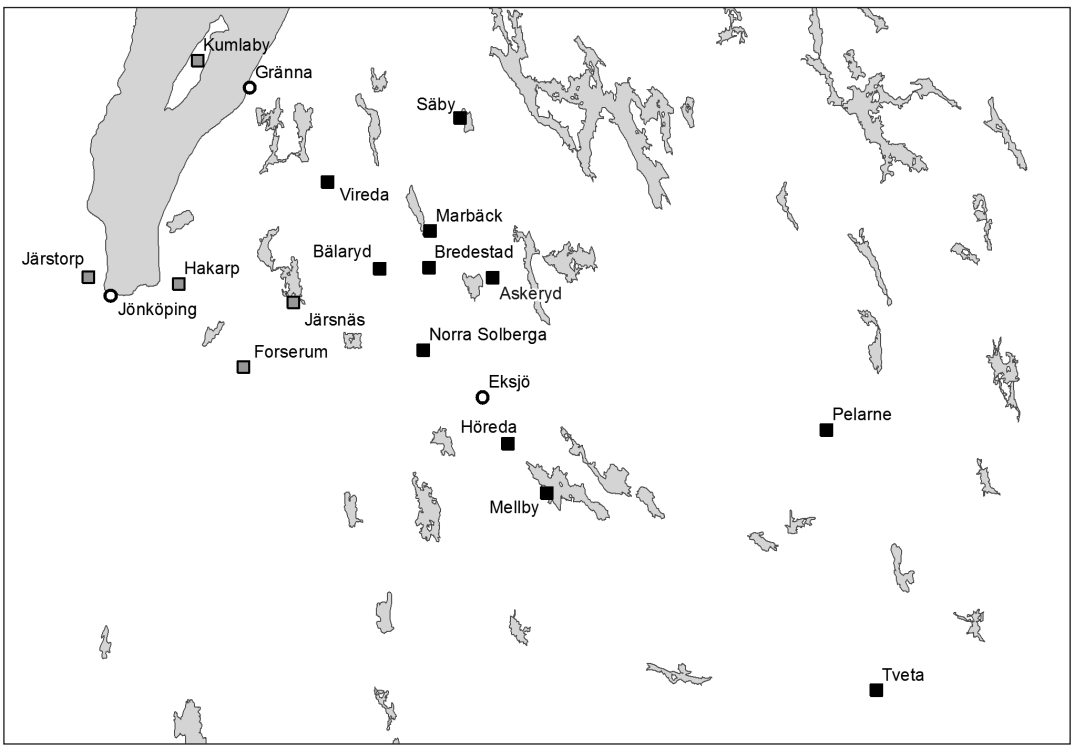


Fig. 1. Map of northern Småland with the churches of the survey marked in black, other churches mentioned in the article marked in grey. Map by Ingvar Röjder, Jönköping County Museum.

their belonging to different local or regional craft traditions? How are they spread in space and time? To what extent do they reflect changes in the spatial arrangement of the church interiors? A hypothesis is that the examined Romanesque roof trusses are more or less part of a coherent craft tradition that existed in the provinces around Vättern in the 12th and the first half of the 13th century. Another aim of the article is to present and evaluate the possibilities of a quick method for survey, enabling the mapping of a large body of material. This is an important task in order to create a foundation for research and to protect a heritage which easily could be damaged or destroyed out of ignorance, for example during a roof renovation.

Earlier research

The first attempts to interpret medieval roof trusses concerned some churches in Östergötland and were made by the art historian Otto Janse in 1902. He made observations that are still relevant, for instance concerning the lack of ceilings in the early Romanesque church interiors. The surveys made by the National Board of Antiquities in *Sveriges kyrkor* ("Churches of Sweden") during the 20th century brought new knowledge, but only studied a minor part of the total number of medieval churches. The approach to the roof structures was also quite limited, often consisting of just making a more or less schematic rendering of the type of truss in the drawn section of the church.

The art historian and architect Erik Lund-

berg took a vivid interest in timber architecture and presented quite daring conclusions concerning the origins and evolution of roof trusses, but on a scarcely recorded empirical foundation. He believed that the influences on the early medieval Scandinavian roof trusses came from the Continent, where the tradition from late classical antiquity could still be traced (Lundberg 1940, pp. 186–193; Lundberg 1949, pp. 128 f.; Lundberg 1971, pp. 31 ff., 40–48, 59–62, 202).

The emergence of dendrochronology in the 1970s and 1980s brought new interest to the medieval roof trusses as a means of scientific dating of buildings. Analyses were performed on samples from several churches in Gotland, Skåne, Småland, Västergötland and Östergötland by Thomas Bartholin, Alf Bråthen and Lars Löfstrand (Bråthen 1982; Gustafsson 1988; Sjömar 1992; Bråthen 1995; Eriksson 2006; *Braathen Dendrokronologiska Undersökningar*). With time the dendrochronological method has become widespread in archaeological practice, leading to a steadily increasing number of reference curves from different parts of Sweden and different sorts of wood. Much of this work is nowadays carried out by Hans Linderson at the Department of Geology, University of Lund. The oldest yet dated roof construction in Sweden belongs to the church of Herrestad outside Vadstena, erected around 1112 (Eriksson 2006, p. 43; Sjömar 1995, p. 207).

Beside the traditional perspectives of archaeology and art history, a new kind of approach is becoming established in the study of roof trusses and other timber structures from the Middle Age. This is a craftsman perspective and deals with questions concerning the process of construction. This perspective was introduced in Peter Sjömar's thesis from 1988, in which he investigated four medieval timber churches in Småland and Östergötland (Granhult, Pelarne, Tidersrum and Vireda). Sjömar was later to repeat the statement of Curman cited above, aiming to enhance early medieval roof trusses as an unexplored field of research (Sjömar 1992 & 1995). The craftsman perspective has found its application in the investigations and practical experiments carried out by the craft school Da Capo, nowadays Hantverkslaboratoriet (www.craftlab.gu.se), linked to the Department of Conservation, University of Gothenburg, and the Södra Råda Project, the reconstruction of a burnt-down 14th-century timber church in Värmland (www.sodrarada.se). The constructions are viewed through the eyes of the carpenter, evaluating the processes of their creation.

With the creation of a database in 2007, the architect Kina Linscott, Department of Conservation, University of Gothenburg, and Staffan Nordin, Timmerdraget, set out to map the known medieval roof structures in Swedish churches, an enterprise commenced by Sjömar for the National Board of Antiquities in 1990 (Linscott 2007, p. 2). This emphasized the need for methodological national surveys, in order to create a basis for scientific studies and to safeguard the future preservation of the delicate material.

Method of the survey

The survey presented here was carried out by the author of this article, mainly during the autumn of 2010. Here follows an account of the method. Thanks to the characterizations made of all churches in the area during 2004–2007, the churches with potential medieval roof structures could easily be sorted out (Bebyggelseregistret; Nordanskog 2010). The first step was to excerpt the archives of Jönköping County Museum and Antikvarisk-topografiska arkivet (copies in the County Administrative Board of Jönköping) for the eleven churches in question. The purpose was to find information on renewals of roofs and damage by fire. The time

available for the fieldwork consisted of four hours per church. The main task in the attics was to make a sketch of the truss types represented, in some cases just one, in other cases more when there were several different attics or different types in one single roof structure (and thus more time-consuming, not least regarding the physical transportation from one place to another). The positions of the trusses and the wall plates were marked on existing older plans. The sketches were made on cross-ruled paper with angles and measurements noted and afterwards drawn fair in 1:50 and 1:100. The measuring equipment consisted of a folding rule and a laser beamer. A portable coated lamp was also used, which enabled taking photographs without flash as well as oblique lighting of details such as tool marks and numberings on the surfaces. Wood species, dimensions, cutting, traces of reuse or alteration were noted. The results were finally compiled in a report (Gullbrandsson 2011). To get a grasp of the extent and character of the preserved material in a region, the method proved well suited, though it cannot be compared with the accuracy of careful measuring. Due to the limited time some hard-to-get measurements had to be estimated and details have almost certainly been overlooked (especially because tie beams and other lower parts can be covered with insulation). But the goal of obtaining an overview, as a basis for proper management and further research, was achieved. Similar surveys are being made in the dioceses of Lund, Skara, Stockholm and Strängnäs during 2013–2014. This offers the possibility to refine the method in order to obtain comparable results, which can then be imported to the database. An example of deeper studies is the investigation that Linscott has undertaken during 2012–2013 regarding five of the oldest dated (the first half of the 12th century) roof trusses around Skara (not yet published).

Romanesque roof trusses

The Romanesque roof structure did not only have the practical function of supporting the roof, but was also an integral part of the church interior originally and thus an important element in the architectural and liturgical aesthetic. After the 13th century, the trusses were commonly hidden by flat wooden ceilings (Ullén 1995, p. 48; Bonnier 2008, p. 141). The survey encountered intact roof trusses of characteristic Romanesque types in the churches of Bredestad (the only apse church), Bälaryd, Norra Solberga, Pelarne (timber church) and rebuilt in the church of Tveta (Gullbrandsson 2013). None of these churches has yielded any dendrochronological results, although samples have previously been taken in Pelarne (Ullén 1983, p. 185). The angle of the roofs varies between 45 and 55 degrees and the material is usually pine and to a minor extent fir.

The most "classic" of the Romanesque roof trusses consists of tie beam, rafters and 2–6 interlacing strut beams, thus named a "crossed strut-beam roof truss" (Thelin 2006, pp. 52 f.). The trusses rest on heavy wall plates, which are embedded in the top of the masonry, facing outwards. This position of the wall plates connects them in time with the building of the walls. The trusses stand tight, sometimes hardly a metre apart, and they usually lack other longitudinal support than the boarding, in some cases attached to the rafters with long wooden pegs. The different parts of the truss are joined by straight overleafing with wrought iron nails or wooden pegs. Usually there are wooden pegs in the joints with the heavy tie beam, the most important load carrier, and nails in the others. Sometimes these pegs are shaped like nails, as can be seen in Norra Solberga, indicating the exclusiveness of the iron. The crossed strut-beam trusses are well represented in Västergötland and Östergötland in the 12th century and have been

Fig. 2. The crossed strut-beam roof trusses above the nave of the old church in Norra Solberga. The joints with the tie beam have wooden pegs, whereas the others have wrought iron nails. Photo by R. Gullbrandsson.

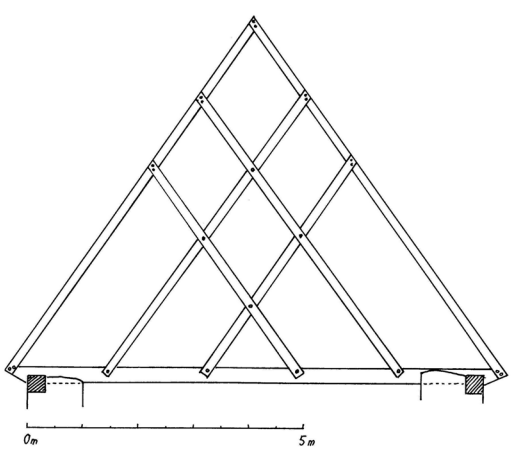


Fig. 3. Section of the roofing of the nave in Norra Solberga. Drawing by R. Gullbrandsson.

Fig. 4. Detail of tie beams above the chancel in Norra Solberga with wooden pegs shaped like nails. Photo by R. Gullbrandsson.

regarded as an early type of Romanesque roof truss (Linscott & Thelin 2008). In this survey they were found above the chancel of Bredestad church and above the nave and chancel in Norra Solberga old church (Figs. 2, 3 & 4), rebuilt above the nave of Tveta church.

Two other Romanesque types are represented above the nave of the churches of Bredestad and Bälaryd. These trusses consist of tie beam, rafters, collar beam and two strut beams, and can thus be sorted under the group of "collar-beam roof trusses" (Thelin 2006, pp. 52 f.). The collar beam is supposed to have been introduced during the 13th century (Sjömar 1995, pp. 210 f.; Linscott & Thelin 2008, p. 3) and this group is therefore regarded as younger than the crossed strut-beam trusses (Thelin 2006, pp. 52 f.). Is this an indication that the nave of Bredestad was erected later than the chancel? In Bredestad the collar beam is furnished with centred suspended beams (Figs. 5 & 6) which change place along a central axis (a steering beam) from truss to truss. Collar-beam roof trusses with this trait can also be seen in the church

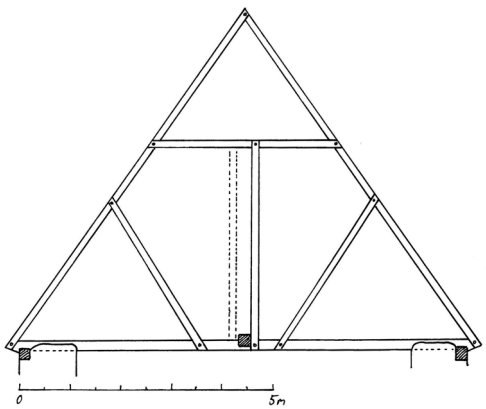


Fig. 5. Section of the roofing above the nave in Bredestad. A collar-beam roof truss with suspended beam, which shift position from side to side of a centred steering beam. Drawing by R. Gullbrandsson.

Fig. 6. The roof trusses above the nave in Bredestad. Notice the *sprättäljning* on the suspended beams, apparent in the oblique lightning. Photo by R. Gullbrandsson.

of Drev (dated to 1170) outside Växjö, in the old folkland of Värend.

Distinctive in Bälaryd are the two crossed strut beams above the collar beam (Fig. 7). This type of truss is almost identical with the one above Dädesjö church, not far from Drev. What is particularly interesting in the roof structure of Bälaryd is the presence of three decorated steering plates and one remaining piece of ridge purlin (Fig. 8). This practical and decorative concept can be found in Småland in the above-mentioned churches of Drev and Dädesjö, Jät church (dated to 1226; Thelin, *Historic Roof Structures*), also in Värend, and Forserum outside Jönköping. In western Östergötland it is present in the churches of Furingstad and Hagebyhöga (dated to the 1120s, Fig. 9). The same type of ridge purlin can be found in the church of Herrestad – where dendrochronology and marks show that it was reused from a 10th-century stave church (Eriksson 2006, pp. 7 & 43; the same might be the case in Flistad in Västergötland according to Eriksson 2006, p. 31) – and Väversunda (dated to 1158), both in western Östergötland, as well as in Kinne-Vedum (dated to 1188) in Västergötland.

The present chancel in Bälaryd was supposedly erected during the 13th or 14th century, with the same width and height as the nave. Until then there could not have been any inner ceiling. The trusses were created to be visible from below. Whereas the trusses of the new chancel are much simpler, this must have meant the creation of an inner ceiling to conceal the differing types of trusses. A dendrochronological analysis of the different trusses would surely be a rewarding way to pin down the introduction of the inner ceiling. What is also of interest in Bälaryd is the presence of the L-profiled truss of the old eastern gable of the nave, with decorated though simple furnishing and marks from a lost ridge decoration or ridge cap (Fig. 10, compare Lundberg's reconstruction of the gable peak

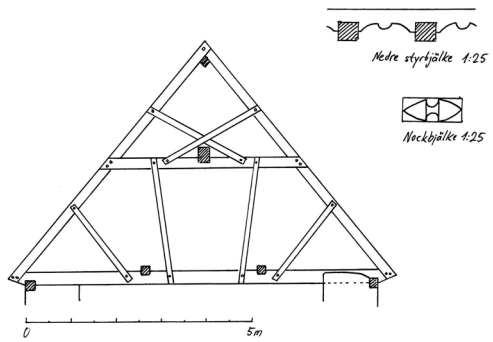
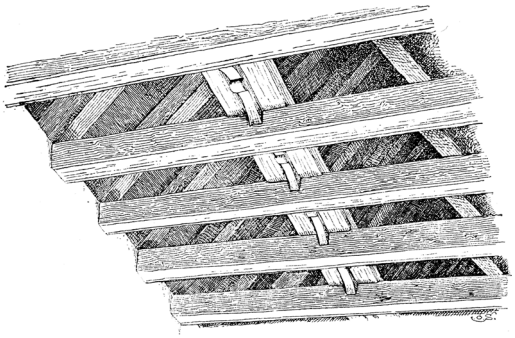


Fig. 7. Section of the roofing above the nave of Bälaryd with three decorated steering plates and ridge purlin. Drawing by R. Gullbrandsson.

Fig. 8. Decorated steering plate and ridge purlin in Bälaryd. Photo by R. Gullbrandsson.



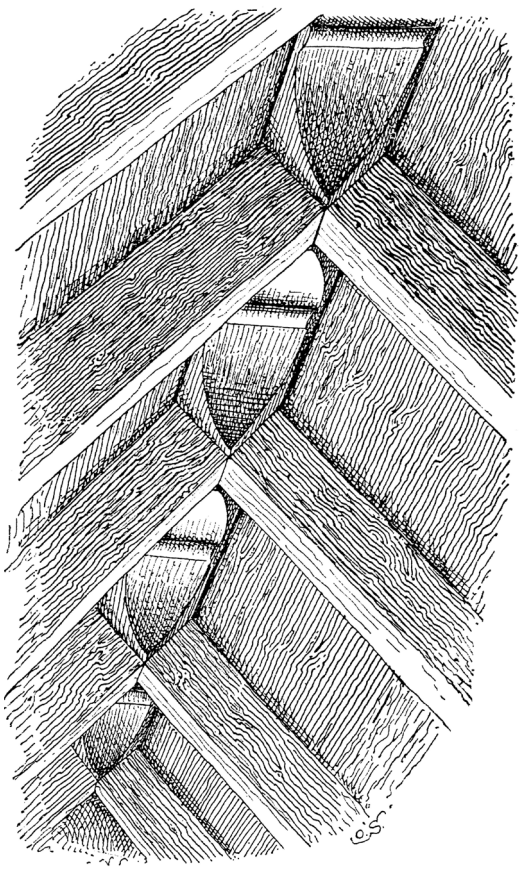


Fig. 9. Reconstruction of the roofing in the church of Hagebyhöga in Östergötland with decorated steering plate and ridge purlin. From Janse (1902).

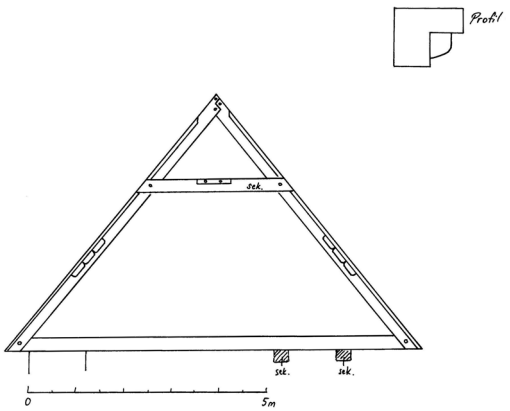


Fig. 10. The former east gable truss of the nave in Bälaryd with simple decoration and trace of a ridge decoration. The collar beam is secondary. Drawing by R. Gullbrandsson.

Fig. 11. Carpenter Mattias Hallgren, Traditionsbärarna, cutting boarding for the reconstruction of Södra Råda church, using the technique of *sprättäljning*. Photo by R. Gullbrandsson.

of Väversunda church in Lundberg 1971, p. 45). Above the timber church of Pelarne in the hundred of Sevede there is a simple version of collar-beam roof trusses consisting of tie beam, rafters, collar beam and two strut beams. Traces of painted decoration in the interior indicate that the church was erected before 1350 (Ullén 1983, p. 185).

A trace that all of these Romanesque trusses have in common is the technique of cutting. All elements are carefully cut to square angles with a special axe and technique, known as *sprättäljning*, leaving unmistakable traces, a type of fishbone pattern leaping in even bands along the whole piece (Fig. 11). Sometimes, for example in Pelarne, this pattern has vanished since the surface was planed with a draw-knife or *skave*. Hewing by *sprättäljning* has come to be regarded as a characteristic of early medieval timbering in Scandinavia (Sjömar 1988; Storsletten 2002; Linscott 2007; Linscott & Thelin 2008; Melin 2008). Sometime during the 14th century, however, it vanished and was replaced with a cruder technique, hard to distinguish from works of early modern times, thus making the pure stylistic dating of Gothic and Renaissance structures problematic. It has also been argued that *sprättäljning* could have been a prehistoric Nordic technique applied to the new churches, considering the fact that the techniques of handling the timber did not change from the earliest preserved objects up until around mid 14th century (Storsletten 2002).

Possible traces of the mounting of liturgical bells were noticed in two tie beams above the chancel in Norra Solberga and as small separate wooden arms above the chancels of Mellby (vertical on a tie beam) and Vireda (on a rafter foot). In Norra Solberga, any bells in such a position must have been visible from below, as is the case in the church of Kumlaby on Visingsö. In the other cases the bells could have functioned even with a separating ceiling.

Reuse of older roof trusses has been observed in some churches. When the medieval church of Tveta in the hundred of Aspeland was given a new vaulted ceiling during a neoclassical renovation, the old Romanesque crossed strut-beam trusses were remodelled using the old parts, thus allowing us to get an idea of the original construction. In building the 17th-century stone church of Hakarp, not far east of Jönköping, the parish took advantage of the material from a former medieval timber church (probably dating from the end of the 13th century, see Gullbrandsson 2012). The old trusses were reused and still bear traces of the former jointing (survey by Gullbrandsson & Traditionsbärarna 2012–2013). This means that older parts can be found in rebuilt roof structures, which enables us to reconstruct a probably original form (Sjömar 1995, p. 212). In the church of Järstorp, west of Jönköping, the presence of a reused Romanesque rafter allowed Sjömar to reconstruct a truss with crossed strut beams (Sjömar 1992, pp. 60 ff.).

As a summary it can be stated that there are three different types of Romanesque roof trusses represented in the survey area. The type with crossed strut beams is present in Bredestad (chancel), Norra Solberga, and altered in Tveta (nave). At least in Norra Solberga, traces of paint and a possible mounting for bells indicate that the trusses originally were visible in the church interior. The two other types, with collar beams, can be found in Bredestad (nave), Bälaryd and Pelarne. In the case of Bälaryd the trusses above the nave have decorated steering plates and part of a ridge purlin (of a kind represented in other parts of Småland as well as in Östergötland), whereas the later added chancel has simpler trusses. This illustrates well the shift from visible to hidden roof structures during the 13th century. These Romanesque roof trusses all bear the characteristic marks of *sprättäljning*.

Gothic and early Renaissance roof trusses

Gothic church construction brought about the differentiation and interaction between the roof trusses as well as the introduction of the rafter foot. This was made to divide the weight of the roof construction more evenly on to the walls, thus enabling larger wall openings and the vaulting of the church interiors. In the Romanesque structures each truss usually works on its own and there are few or no differences in shape. The joints in the Gothic trusses are more advanced than the Romanesque ones. We now find joints with notched laps, preventing withdrawal. Many of the joints are marked with carved numbering in the form of flags, lines or Roman numbers.

The consistent Gothic structures are few in the area of survey. Only two are completely preserved. The most imposing Gothic roofing is to be found in Säby, the largest of the preserved medieval churches in the area (Fig. 12). There are 34 trusses with an angle of 60 degrees and a span of almost 10 metres (almost the same in height). Here we find the types of trusses developed to coexist with a vaulted church room. They consist of rafter foots, double wall plates on top of the masonry, collar beam and scissor beams. In between every vault there is a truss with tie beam. All parts are marked with Roman numbers, indicating that the parts were completed and matched to another on the ground and then put together on top of the church according to the markings (compare Hallgren *et al*. 2013). This probably took place when the church was enlarged into a vaulted hall church in the 15th century. An enlargement to the east of Tveta church has remains of altered Gothic trusses.

Askeryd church boasts the only completely intact construction with longitudinal beams and king posts (Figs. 13 & 14). All parts are numbered carefully, with different systems for

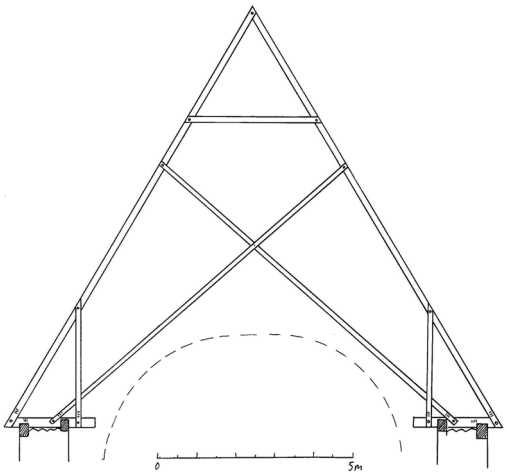


Fig. 12. Section of the Gothic roofing in Säby with characteristic rafter feet and scissor beams. Each part in the rafter foot was numbered before assembly. Drawing by R. Gullbrandsson.

north versus south (carved flags and lines). With the introduction of longitudinal supportive systems during the 13th century – for example, in France – the Gothic trusses and their hierarchy developed further, to reach a peak during the late medieval period, at which time the system got common in Scandinavia (*Kulturhistoriskt lexikon* XVIII 1974, pp. 68 ff.; Hoffsummer *et al*. 2011). The dating of Askeryd can be connected with the creation of a hall church in the 15th century. We also find trusses with longitudinal beams and king posts, though smaller in scale, above what seems to be a never-completed west tower for the church of Höreda. The church burned around 1400 and/or during the Danish campaign of 1520–1521 (Törnvall 1996; Ödeén 2008), and thus it could be argued that the construction belongs to the 15th or 16th century. A single truss from a similar construction has been noticed by the author above the old chancel of Järsnäs church.

In summary it can be stated that strictly Gothic roof trusses in the survey area only exist in the churches of Askeryd, Höreda and

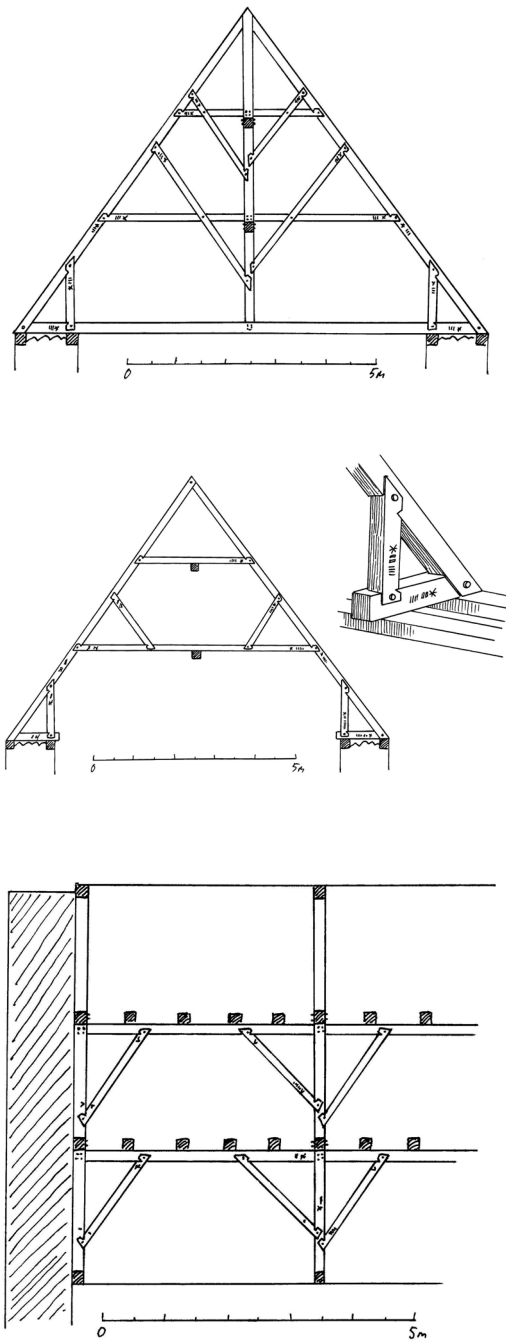


Fig. 13. Sections of the late Gothic roofing in Askeryd with longitudinal beams and king posts. A rare phenomena in medieval Götaland? Every part in the construction is numbered, with separate systems for north and south. All joints are notched. Drawings by R. Gullbrandsson.

Fig. 14. Detail of the roofing in Askeryd with the lower part of two king posts. Photo by R. Gullbrandsson.

Säby. They represent the evolved hierarchy in trusses, created to enable a vaulted church interior. Consistent markings reflect a different process in erecting roofs than was the case with the Romanesque churches. The structures in Askeryd and Höreda have longitudinal beams and king posts that make the roof structure into an entity with all the parts cooperating, thus representing the final stage of the Gothic system.

Transitional forms

The trusses of Marbäck church and the timber church of Vireda are interesting as transitional forms between Romanesque and Gothic. None of them have any obvious *sprättäljning* and both have numbering. Marbäck has many characteristics of the Gothic trusses: double wall plates, scissor beams and collar beam, but no strut beams between rafter and tie beam (Fig. 15). Probably the trusses of Marbäck can be linked to the extension of the church and the building of a new chancel of the same width as the nave during the second half of the 13th century. When the interior was vaulted during the Late Middle Ages some of the tie beams were cut, without rafter feet being inserted, and this weakened the construction. The form in Vireda is almost Romanesque, with "collar-beam roof trusses" (double collar beams and two strut beams). Shingles on the old chancel gable have been dated to 1344 (Ullén 1983, p. 134). The trusses above the hall church of Mellby are also

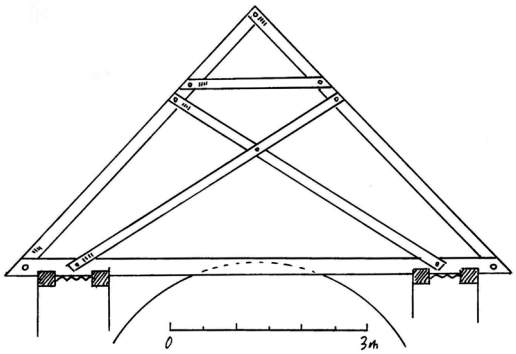


Fig. 15. Section of the roofing in Marbäck. A merger of Romanesque and Gothic traits. The tie beam is still in use but instead of strut beams we find scissor beams and the double wall plates, which are usually connected with rafter foots. Each part is numbered. Drawing by R. Gullbrandsson.

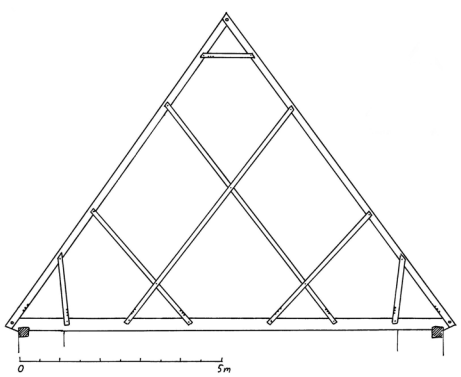


Fig. 16. Section of the roofing in Mellby. The trusses are Romanesque in shape but date to the end of the 13th and the beginning of the 14th centuries, probably going back to an older roof. Drawing by R. Gullbrandsson.

Romanesque in shape (Fig. 16). Some parts are clearly hewn by *sprättäljning* and there are two different systems of numbering, discretely carved marks on the edges versus simple lines. Dendrochronological analysis indicates that the roof structure was rebuilt in part or whole in the middle of the 14th century with re-used trusses, half a century older. The southern wall plate and a tie beam gave a dating to the 12th century, thus indicating an even older structure (Linderson 2010), maybe from an original wooden church (Ullén 2006, p. 74). Whether or not the flat wooden ceiling is medieval has not been investigated.

The roof trusses of the churches in Marbäck, Mellby and Vireda cannot be classified as strictly Romanesque or Gothic; they bear traits of both systems and should be regarded as transitional forms belonging to the 13th and 14th centuries. In order to put these roof structures in context, further surveys are needed in adjoining areas.

Discussion

The lack of complete surveys from Götaland, and the fact that a large number of churches have been torn down or rebuilt, limits the conclusions that can be drawn. Today we can only see a fraction of how widespread different types of roof trusses were in time and space. Nonetheless, an attempt is made here to sketch what can be stated about the surveyed roof structures from the present standpoint. The Romanesque crossed strut-beam trusses can be found in large parts of medieval Götaland. This type could be regarded as the most common of the early medieval ones. Some examples may be mentioned: in Småland the church of Forserum (the only Swedish church where the Romanesque trusses today are visible from the interior, due to the restoration by Erik Lundberg in 1935, Fig. 17), the timber church of Granhult (dated to 1217), Hemmesjö old church (dated to 1200) and the old church of Jät (dated to 1226); in Västergötland the churches of Forsby (dated to 1135), Gökhem (dated to *c.* 1130), Kinne-Vedum (dated to 1188) and Marka (dated to 1125); in Östergötland the church of Väversunda (dated to 1158). We can clearly state that this type of trusses were built in the

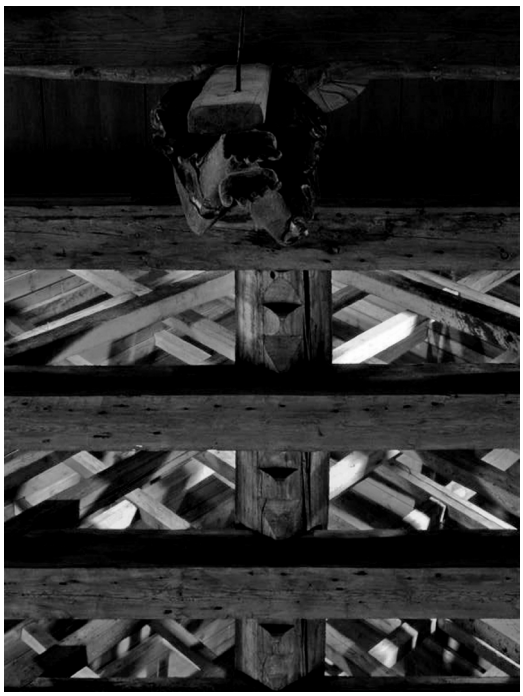


Fig. 17. The crossed strut-beam roof trusses above the nave in Forserum; since the architect Erik Lundberg's restoration in 1935 they are again visible in the church interior. Notice the decorated steering plate. Photo by R. Gullbrandsson.

provinces around Vättern during the whole of the 12th century. Among the now surveyed churches of northern Småland we find that the crossed strut-beam trusses also appears as late as the end of the 13th century and the mid 14th century in the church of Mellby, but with collar beam. The Romanesque form seems to have lived on for a long time in some parts of Götaland, sometimes merged with the new Gothic forms. Can this be explained by the long distance from the existing economic, political and religious centres around Vättern?

The Romanesque trusses of the naves in Bälaryd and Bredestad seem rare. The group of collar-beam trusses is substantial, but these two have traits with few known correspondences in Götaland. What is interesting is the little upper cross of strut beams in Bälaryd and Dädesjö and the suspended beam between tie and collar beam in Bredestad and Drev. According to Lundberg, the suspended beam was a means of reducing the pressure on the tie beam, a trait of the late Roman roof trusses (Lundberg 1971, p. 31). The crossed struts above the collar beam, as well as the centred suspended beam, can be encountered in the church of Saint-Loup-sur-Cher in France, dated to around 1200 (Hoffsummer *et al*. 2011, p. 98). Surely these traits were no local invention and maybe they once were more common. Identically decorated steering plates and/or ridge purlins can be found in Småland and on both sides of lake Vättern.

In the surveyed area and its surroundings it is hard to claim any clearly local traditions in the craftsmanship concerning Romanesque roof trusses. The diversity of shapes represented by the objects of this survey reflects differing traditions of form. But in comparison with the known objects in Västergötland and Östergötland, a regional continuity of different shapes can be seen around Vättern, the geographical centre of medieval Götaland. Sjömar recognizes the existence of several different "carpenter traditions" in Scandinavia (Sjömar 1988, p. 16). Is there a tradition or traditions that were typical of the provinces around Vättern? With complete surveys of preserved Romanesque roof trusses in all the provinces of medieval Götaland, a foundation could be laid to discuss questions concerning the emergence and spread in space and time of the different types of trusses. This could also help explain why we find Romanesque shapes as late as the 14th century in the trusses of Mellby and Pelarne.

The technique of cutting is a thing in common to most of Scandinavia during Early Middle Ages. The question of whether this technique goes back to prehistoric times has until now been left unanswered. Did local timber craftsmen merge with the imported

masons in the early building of Romanesque stone churches during the 12th century? It has been claimed that the use of roof trusses was an early medieval introduction in Scandinavia, a framework enabling the roof structure to span a broad space without other support than the outer walls (Lundberg 1971, pp. 40 f., 61; Andersson 2007, p. 6). Lundberg suggested that the early Romanesque roof trusses, the strut-beam and the crossed strut-beam types, were an import to Scandinavia, and that the local carpenters in the beginning did not fully understand the distribution of loads. He exemplified with a reconstruction of the 11th-century trusses of Saint-Germain-des-Prés in Paris with strut beams and suspended centred beam. The crucial suspended beam is lacking in the early Swedish trusses, such as Herrestad and Hagebyhöga, thus making it necessary to make the tie beam thicker in order to carry the load (Lundberg 1949, p. 128; Lundberg 1971, pp. 40 f., 61, 202). A preserved parallel to the Swedish crossed strut-beam truss is to be found above the northern transept of the church of Saint-Christophe (11th or 12th century) in Chabris in France (Hoffsummer *et al*. 2011, p. 88), which also exemplifies that this type was no Scandinavian invention. According to Lundberg, the strut-beam roof truss and the crossed strut-beam truss during the course of the 12th century were inherited by "local schools", which sometimes merged different forms and motifs (Lundberg 1940, pp. 188–193; Lundberg 1971, p. 61). It is plausible that the main elements of the early Romanesque roof trusses were introduced from abroad. But the scarcity of preserved early medieval roof trusses in Europe is a difficulty (Linscott & Thelin 2008, p. 6; Hoffsummer *et al*. 2011) and it would go beyond the aim of this article to further discuss the question here.

That the early Romanesque roof trusses were a visible part of the church interior is now regarded as a fact (Sjömar 1992, p. 66; Ullén 1995, p. 48 f.; Bonnier 2008, p. 141). Clear indications of this can be found in two of the investigated churches. The decorated trusses of the old nave in Bälaryd and the younger undecorated ones of the new adjoined chancel in the same church indicate this. The remains of limewash on trusses of Norra Solberga church also emphasize this. The observation of limewashed trusses was first made by Andreas Lindblom in Knista church in Närke (Lindblom 1910, pp. 190 f.). Traces of paint on trusses should be considered in coming surveys. Other phenomena marking the absence of ceilings are traces of the mounting of liturgical bells in the tie beams, which can be noticed above the chancel in Norra Solberga. The transition from open roof structures to flat wooden ceilings seems to have taken place during the 13th century as indicated, for example, in Bälaryd, Dädesjö and Hagebyhöga (Sjömar 1995, p. 226; Ullén 1995, p. 49).

With the Gothic renewal of some of the surveyed churches from the late 13th century up until the beginning of the 16th century – concerning new larger chancels and vaulting – completely new trusses were created. Whereas Gothic renewal was scarce in the rest of Småland, this area was obviously influenced by the proximity to Östergötland and the construction activity there (Ullén 2006, p. 73). The early examples, such as Marbäck, shows both Romanesque and Gothic traits, in fact being rather Romanesque in function. Only from the Late Middle Ages do we find completely Gothic trusses in the area, with a pronounced hierarchy and interaction between the separate trusses. The concept of longitudinal beams and king posts seems to have been introduced here around 1500. This type of construction was until recently regarded as mainly a Continental and south Scandinavian phenomena (Thelin 2006, p. 54). Consistent timber marking shows that the different parts were finished on the ground and mounted one by

one above the church. Romanesque trusses usually lack markings, though they are to be found in the trusses of Mellby (the same in Stenberga in Småland according to Andersson 2007, p. 31, the church dated to 1332) and Vireda. On a truss above the nave of Norra Solberga the runes " I þ" are found, although their meaning is unclear. Observations made by the carpenters connected to the Södra Råda project indicate that the parts of the Romanesque truss were assembled on the ground and mounted on the church walls as one piece (Andersson 2007, pp. 27 & 38). The introduction of numbering marks a change in the process of erecting church roofs. With Gothic and later trusses the different parts were joined first on top of the church, thus the need for a marking system.

The surveys to come will certainly enlarge the empirical material considerably, giving us a more complete picture of what has been preserved in the church attics. This will enable the modification of the present questions and form the basis for new ones. Further studies in specific roof structures, in combination with dendrochronological analysis, will yield important data for creating a typology and a chronology for the Swedish material. In the end, better knowledge may contribute to the preservation of a unique but long neglected heritage.

Notes

1 The preserved Scandinavian timber churches from 1100–1350 are all in Sweden: Granhult, Hammarö, Haurida, Jällby (dendrochronological analysis in progress), Pelarne, Stenberga, Tidersrum, Tångeråsa and Vireda. The timber churches of Brämhult and Älgarås are dated to the 15th century (Lagerlöf 1985; Ullén 1983).

2 In total there are 438 preserved and 821 partly preserved medieval churches in Sweden (Sockenkyrkorna 2008).

3 The grouping of roof trusses in Romanesque and Gothic constructions was used by Danish architect Elna Møller and has been acknowledged by later research. The grouping is made from a construction perspective and is not to be understood as a strict chronological one. Romanesque types of trusses can be observed even in Late Middle Ages (Møller 1953; Sjömar 1995 pp. 207 f.).

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4.1.2 Comments on "Medieval roofs in churches of Northern Småland"

This article is a summary of my first survey, which was a test pilot. Consequently there are several things that I have since re-evaluated in the light of other observations, exchange with other researchers, study visits and literature studies. But my main questions and themes appear already here and gets further problematized in the following articles.

The question of typology as well as the spread in time and space led to new questions on local and regional craft traditions. A hypothesis of a coherent craft tradition around Lake Vättern in 12th and 13th centuries is proposed. Here I find it plausible that the *Romanesque* trusses were introduced from abroad but stress the need of more profound comparative studies. The problem of the changes in carpentry during the 14th century is addressed under the heading "Transitional forms". It is also stated that the "Romanesque form" seems to have endured long after that.

In light of my later research I want to make some critical remarks to the article. My text is much influenced by traditional art historical notions of style and shape, apparent in my quite unproblematic use of *Romanesque*, *Gothic* and *Renaissance*, which I in effect rather have used as demarcations of epochs. The terminology I have problematized and revised in the following articles. Another flaw is the use of *Early Middle Ages* for the period c. 1100–1250, which is correct in a Scandinavian context but not in European historiography, were it belongs to the *High Middle Ages*.

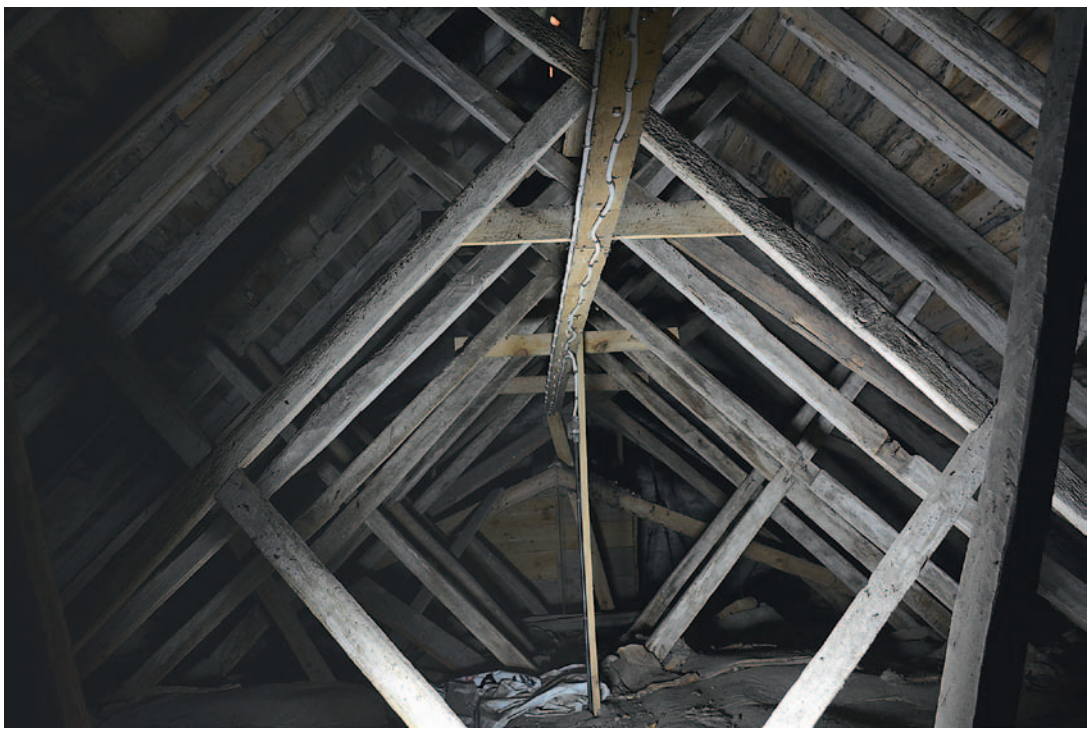
Some comments on a detail level will here be put forth in a bullet list :

• In this article I use the term "Romanesque crossed strut-beam trusses", whereas in my third article I have adopted the English term *lattice truss*, taken from Courtenay and Alcock (2015). When I propose that this truss type was no Scandinavian invention, it is only on the existence of one French roof that I only had seen as a section drawing, a very vague foundation for such a proposition. Since then more examples have shown up. (Page 81).
• The nave and chancel roof of Bredestad church could have been made by one and the same team of carpenters. These structures I only been visited once and they are not dated. They should merit a further investigation. (Page 82).
• The use of the term *ridge purlin* in Bälaryd and Herrestad should be *ridge steering beam*. This question is further discussed in the following articles. (Page 83).
• The church Flistad that is referred to is situated in Östergötland and not Västergötland. (Page 83).
• *Sprätthuggning* is a technique used already before Middle Ages, as seen in archaeological finds. One good example are oak beams from a bridge found in Ravning Enge, Denmark, and dated to 979/980 (d) (Jørgensen 1997; Melin 2008). (Page 85).
• When I write about the introduction of the *rafter foot* I should rather have used the terms *ashlar and sole pieces*. The introduction of *Gothic* constructions is further problematized in my third article. (Page 86).
• Regarding the roofs of Askeryd and Höreda I refer to them as *king post roofs*, more correct would have been *double-framing* or the German *Stuhl*, which I use later. It now seem that this kind of roof structures did not become common until the Late Middle Ages in medieval Sweden, and then foremost in more exclusive contexts as town and convent churches, but further studies are required. (Page 86f).
• *Numbering* should be called *carpenters' marks*. (Page 86).
• Revisiting Marbäck with new eyes made me aware of new aspects of the roof (the uniform scantling and use of broadaxed full timbers etc), these have though not been published apart from a short mention in a new church description (Gullbrandsson 2021c). This has further strengthened this roof as an example of the introduction of new techniques in the 14th century. (Page 88).
• New analysis of Vireda has shown that the structure ought to be dated after 1396 or in between 1361 and 1401 (Gullbrandsson 2020b). (Page 88).
• Some referred dendrochronological dates are wrong. Gökhem ought be 1140/41 and Marka 1155/56. (Page 89).
• I suggest that *Romanesque* trusses were assembled on the ground and mounted as a whole. The latter statement is is questioned in following articles. (Page 92).

4.2 Västergötlands medeltida kyrkotaklag (Bebyggelsehistorisk tidskrift Nr. 74 2017)

Västergötlands medeltida kyrkotaklag

av Robin Gullbrandsson



FIGUR 1. *Långhuset i Ugglums kyrka vid Mösseberg har tidigmedeltida takstolar av ek med fyra korsande stödben, typiskt för den taklagsgrupp som dominerar det medeltida materialet i Västergötland.* FOTO: *författaren.*

Våren 1913 var Kungliga Överintendentsämbetets unge arkitekt, den tillika nybakade professorn i arkitekturhistoria, Sigurd Curman på besök i Ugglums kyrka vid Mössebergs västsluttning. Han skulle upprätta ett nytt restaureringsförslag för kyrkan eftersom församlingens eget hade underkänts. Curman påtalade vikten av varsamhet med långhusets ursprungliga takkonstruktion av trä: ”Församlingen får vidare icke vidtaga några åtgärder, som skulle kunna skada de räster av äldre takkonstruktion, som finns i västra delen av kyrkan.”[1] När författaren till denna artikel en vårdag 101 år senare inventerade kyrkvinden i Ugglum stod de tretton tidigmedeltida takstolarna kvar med sina smäckra kryss av ek (fig. 1). Lite lappade, lite stympade, men likväl gjorde de tjänst efter mer än 800 år – kanske tack vare Curman.

Den blivande riksantikvariens besök 1913 sammanföll med uppvärderingen av det kyrkliga kulturarvet och skapandet av en ”svensk restaureringstradition”, två sammanlänkade fält där Curman var en drivande kraft.[2] De medeltida kyrkvindarna undgick inte restaureringsarkitekternas intresse, och i en artikel från 1937 pekade Curman på takstolarnas europeiska särställning och forskningspotential: ”Att det är den gamla inhemska timmerbyggnadskonsten, som just i dessa takkonstruktioner o. dyl. lämnar sina bidrag till den i övrigt efter importerade modeller och metoder uppförda romanska stenkyrkan, synes framstå allt tydligare. [...] Jag tror knap-

past, att jag misstar mig, då jag påstår, att vi i våra kyrkor hava ett i jämförelse med många andra länder, ovanligt rikt och intressant medeltida takstolsbestånd bevarat, som väntar på sin systematiska bearbetning."[3]

Trots den tidiga starten så har systematisk kartläggning av de medeltida taklagen i svenska kyrkor kommit att dröja till 2010-talet. De senaste åren har flera av stiften i södra och mellersta Sverige låtit genomföra eller står i begrepp att göra inventeringar av bevarade medeltida takkonstruktioner. Under åren 2014–2015 genomförde jag på uppdrag av Skara stift en snabbinventering av taklagen i stiftets medeltidskyrkor. Det övergripande syftet med projektet var kartläggning för att kunna säkerställa ett känsligt kulturarvs överlevnad. Samtidigt med inventeringen utarbetade restaureringsingenjören Ylva Sandin en handbok för förvaltning av medeltida kyrktak.[4] I den här artikeln presenterar och diskuterar jag resultaten av inventeringen. I vilken utsträckning finns de äldre trätakstolarna bevarade? Vilka olika typer av konstruktioner kan vi hitta och hur ser den geografiska variationen ut? Hur svarar det västgötska materialet mot vad som är känt från övriga Götaland samt grannländerna? Vad kan utläsas om inhemsk byggnadsteknik respektive utländska influenser? Först bör dock något sägas mer generellt om medeltida taklag och den kunskap vi har om dem genom tidigare forskning.

Forskningsläge

De första försöken att tolka medeltida takkonstruktioner i Sverige gjordes av konsthistorikern Otto Janse 1902 i en studie av några östgötakyrkor.[5] I viss utsträckning uppmärksammades takkonstruktioner också i det ambitiöst upplagda inventeringsverket *Sveriges kyrkor* (med start 1912), som hittills dock bara hunnit behandla en del av landets alla medeltida kyrkor. Även restaureringsarkitekten och konsthistorikern Erik Lundberg diskuterade i flera publikationer taklag och deras utveckling.[6] Dendrokronologins framväxt under 1970- och 80-talen ledde till ett förnyat intresse för taklagen, nu som naturvetenskapliga dateringsobjekt.[7] Fram till idag har flera kyrkor kommit att dateras genom dendrokronologi, ett tjugotal av dessa i Västergötland.[8] Med Peter Sjömars avhandling *Byggnadsteknik och timmermanskonst* från 1988 blev taklagen, och historiska träkonstruktioner generellt, framhållna som källmaterial för att utläsa hantverksprocesser. Denna läsart har applicerats i full skala i och med rekonstruktionen av Södra Råda gamla kyrka, påbörjad 2007. Timmermännen studerar och tolkar hantverksspår i bevarade konstruktioner, prövar tekniken och omtolkar i en dialektisk process. Genom detta har taklagens kunskapspotential blivit än tydligare, och vindarna har också börjat värderas som arkeologiska objekt.[9] Medeltida taklags konstruktiva verkningssätt har studerats av Ylva Sandin och Carl Thelin.[10] I dansk kyrkoforskning har taklagen varit uppmärksammade under lång tid och började systematiskt undersökas av arkitekturhistorikern Elna Møller; det arbetet har fortsatts av Per Kristian Madsen.[11] För norsk del har materialet (53 taklag från 1100–1350) kartlagts av Ola Storsletten.[12] I flera av de väst- och centraleuropeiska länderna finns idag forskare med historiska taklag som ämnesområde.

En första sammanställning av det svenska kunskapsläget gjordes 2007 av arkitekt Kristina Linscott, ett arbete påbörjat av Sjömar för Riksantikvarieämbetet 1990. Denna databas och rapport pekade på några hundra romanska och kanske ett hundratal gotiska taklag som är bevarade. Men den visade också att kunskapen om bevarat material var sporadisk och mer eller mindre slumpmässig. År 2010 gjorde jag en snabbinventering av medeltida kyrkvindar i smålandsdelen av Linköpings stift, en pilotstudie för att testa metod för översiktlig kartläggning av bevarat material.[13] Härefter har flera stiftsvisa inventeringsprojekt genomförts eller påbörjats.[14] På mindre än ett decennium har alltså kännedomen om bevarade medeltida taklag ökat markant.

Om medeltida taklag

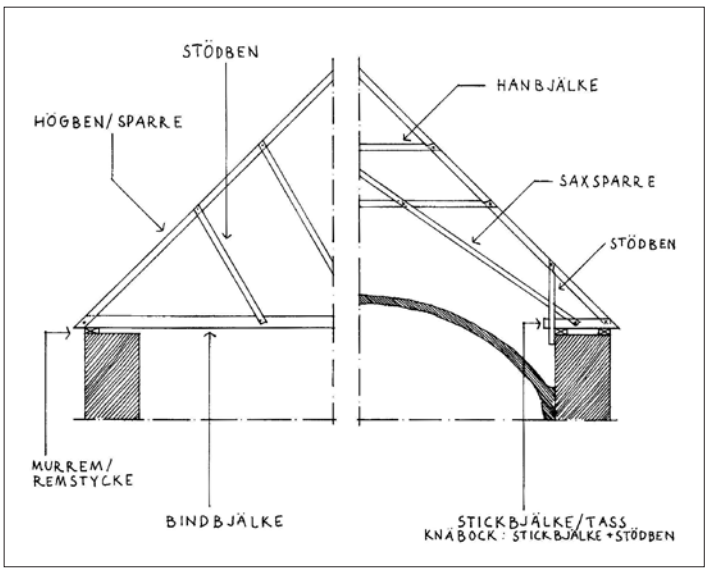
Med kyrkorna uppstod behovet att kunna åstadkomma fribärande takkonstruktioner över stora rum. För byggande i trä fanns gott om inhemsk kunskap och i tidigare forskning har de medel-

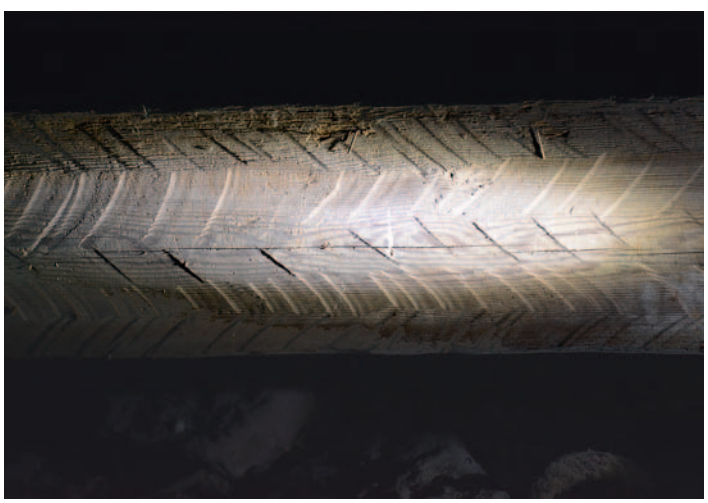
tida kyrktaken ofta setts som ett möte mellan nordiskt och kontinentalt kunnande.[15] Medan takstolar tillämpades för kyrkorna så täcktes större delen av den profana träbebyggelsen sannolikt av åstak, en enkel konstruktion där taket bärs upp av horisontella stockar eller bjälkar. Det är en teknik med med gamla rötter, inte bara i Norden. Vi kan jämföra med till exempel sydvästra Tyskland där forskningen urskilt två linjer i medeltida taklag, ”Pfettendächer” (åstak) och ”Sparrendächer” (taklag med takstolar). I huvudsak har åstaken där liksom i Norden tillämpats i profan bebyggelse.[16] Medeltida taklag har i tidigare forskning uppdelats i två huvudgrupper: romanska och gotiska, men senare forskning har oftare talat om tidig-, respektive hög- och senmedeltida taklag[17] (fig. 2). Mellan romanska och gotiska takstolstyper finns en påtaglig gråzon, taklag av båda grundtyperna har också tillämpats långt efter medeltiden.

Tidigmedeltida taklag

De tidigmedeltida taklagen har ett antal karaktärsdrag, vilka framhållits av forskare som Linscott, Sjömar, Storsletten och Thelin. Timmermännen har eftersträvat en slutprodukt med smäckra former och skarpa kanter, därför förekommer så kallad vankant (den yttersta årsringen) mycket sällan. Ett säkert kännetecken är behuggning i en teknik som kallas sprätthuggning (fig. 3). Denna teknik tillämpades i hela Skandinavien under tidig medeltid och innebär att timmermannen arbetar med yxan längs träets fiberriktning.[18] Detta ger i släpljus fiskbensliknande band. De enhetliga hantverksteknikerna i Skandinavien vittnar om timmermän som har verkat i en etablerad inhemsk tradition med likartade uppsättningar av verktyg.[19] Möjligen har sprätthuggningen rötter i förkristen tid, men den tycks av det till dags dato kända och daterade materialet ha tynat bort efter digerdöden.[20]

Det finns olika typer av tidigmedeltida takstolar i Sverige. Några gemensamma nämnare finns dock. Takstolarna inom ett taklag har alla ett likartat utförande och står till synes onödigt tätt, med ett inbördes avstånd på högst 0,5 m. För det västgötska materialet kan framhållas att långhustaken ofta består av 12 eller 13 takstolar.[21]

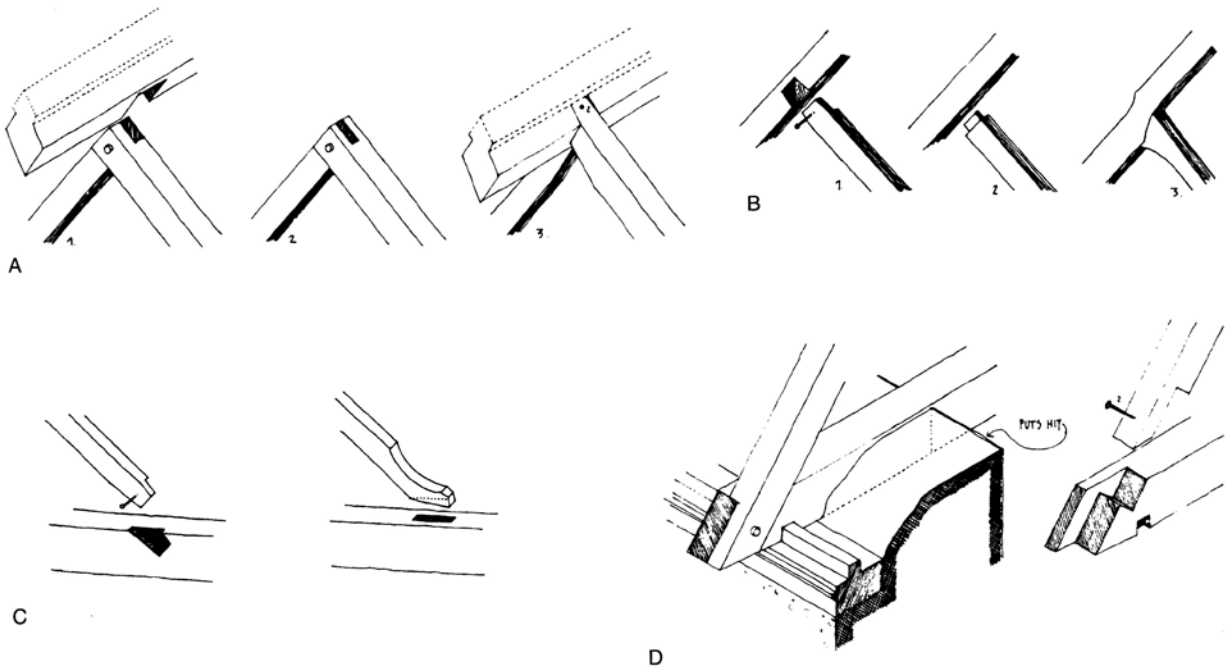




FIGUR 2. *Över: Terminologi för tidig- respektive hög- och senmedeltida taklag. Ur: Sjömar* 1995.

FIGUR 3. *Under: Karaktäristisk sprätthuggning i släpljus på bindbjälke i Kestads kyrka vid Kinnekulle.* FOTO: *författaren.*

Takstolarna står på remstycken, vågrätt liggande bjälkar på murkrönens utsida, ofta inmurade. Varje takstol bär enkom sig själv. Annan stabilisering i takets längsriktning än undertaksbrädorna är ovanlig, men nockåsar och på bindbjälkarna liggande styrbjälkar/plankor förekommer. För att klara av taktyngd och vindlaster måste varje takstol i basen ha en kraftig bindbjälke som inte deformeras, ofta är den inmurad i murkrönet. Från bindbjälkens ändar reser sig två högben



FIGUR 4. *Knutpunkter i tidigmedeltida takstolar. Skisser av Peter Sjömar.* **A:** *Nock med bladning* (1) *och tappning* (2) *samt längdförsträvande nockås vilande på takstolarna.* **B:** *Stödben med bladning och husad knut i högbenet* (1)*. Stödben tappat i högbenet* (2–3)*.* **C:** *Stödben med bladning och husad knut i bindbjälken respektive ansatsurtag.* **D:** *Möte mellan remstycke, bindbjälke och högben. Ur: Sjömar* 1995.

så att en triangel bildas, sällan brantare än 45 grader. Denna triangulära grundform är att betrakta som europeiskt allmängods under perioden.[22] Inom triangeln förekommer olika former av virken som syftar till att fördela tryck eller dra samman, till exempel stödben och hanbjälkar. Utifrån dessa försträvande virken är en typologisering utarbetad av Linscott.[23] Den förmodat äldsta varianten i Sverige utgörs av två eller fyra snett infogade eller snarare inspända stödben (BS). Den vanligaste varianten i Götaland uppvisar två till sex korsande stödben och kallas därför ”kryssad” (BX). En tredje variant inkorporerar en sammanhållande hanbjälke (BH). Knutpunkterna är en annan grund för gruppering (fig. 4). I de flesta taklag är de i form av urtag och rak bladning med en precis passning som talar för att virket varit torrt vid ihopknutningen. Dymlingar eller spik har använts för att låsa konstruktionen, det sistnämnda var exklusivt och brukar anses som ett tecken på hög ålder.[24] I en del fall har man istället för bladning tillämpat tappning, vilket bygger helt på tryckkrafter. I ett fåtal fall rör det sig om taklag med nockås som viktigaste elementet, egentligen ett åstak. Utifrån de olika verkningssätten så gjorde Erik Lundberg en gruppering: A är snedstöttade takstolar som verkar genom tryck i form av ansatsurtag och tappade knutar, i B är taklagens stödben istället knutade med bladning, i C är takstolarna kryssade med likaså bladade knutar.[25]

Merparten av de tidigmedeltida taklagen i Sverige var ursprungligen synliga från kyrkorummet och utgjorde en del av det arkitektoniska uttrycket.[26] Detta förklarar rent dekorativa inslag. Först under 1200- och 1300-talen tycks innertak av brädor ha introducerats i kyrkorummen. Ett plant innertak i Norra Solberga gamla

kyrka, Småland, har daterats till 1316–1346.[27] Orsakerna till denna rumsliga förändring känner vi inte. Var de praktiskt eller estetiskt motiverade? Sjömar har föreslagit att en mer självständig kyrka ville bryta med konsolideringsskedets mer inhemskt präglade rumsideal.[28] Under högmedeltiden förändrades kyrkorumsidealet i riktning mot salkyrkor med öppna kor, troligen av liturgiska skäl.[29]

Hög- och senmedeltida taklag

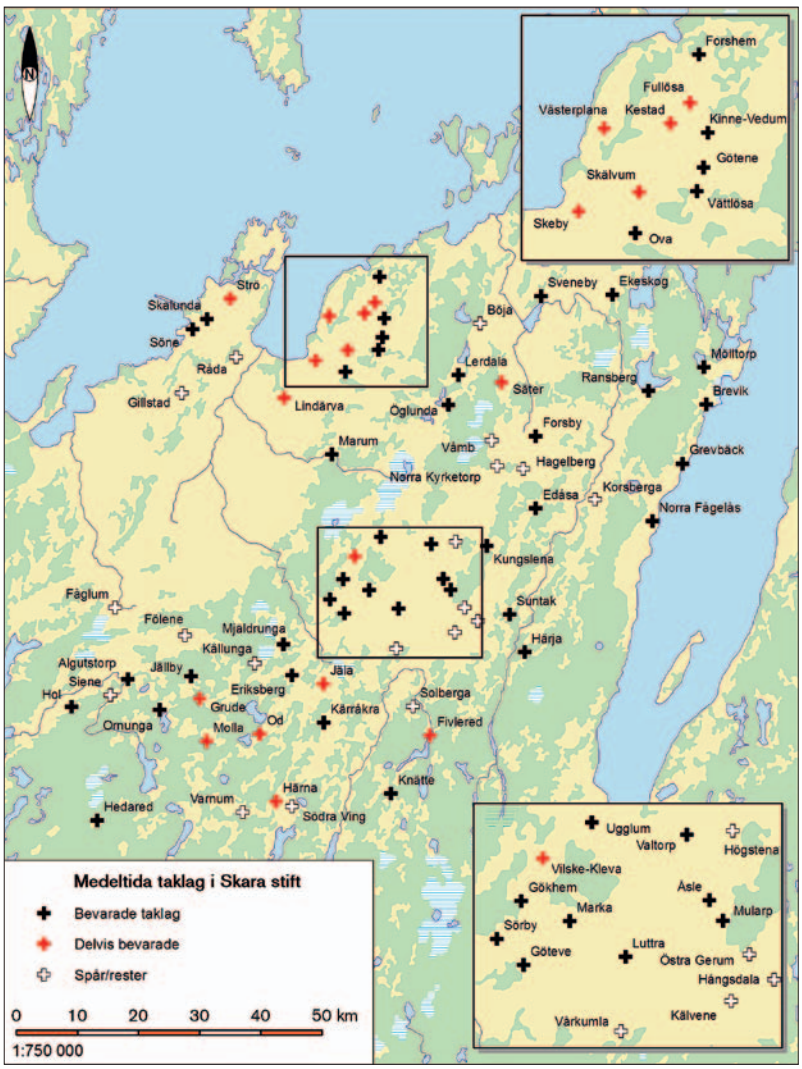
1300-talet var en brytpunkt avseende taklagen, vilken bottnade i samhälleliga och arkitektoniska förändringar. Pest och missväxt drabbade delar av Sverige hårt. Byggnadsaktiviteten bromsade in. Först under slutet av medeltiden utökades och valvslogs många kyrkor. Införandet av kryssvalv förutsatte en annan taklagstyp. Gotikens framväxt i Frankrike och Tyskland hade skapat nya takstolstyper som har olika funktioner och interagerar med varandra i fördelningen av krafterna. Måttet mellan takstolarna växte till en meter och takvinkeln blev brantare. De uppskjutande valvkapporna omöjliggjorde ofta bindbjälkar, vilket ledde till att krafterna från taket måste föras ned i murarna med hjälp av knäbockar (en vinkel bestående av stickbjälke och stödben vid högbenets fot) och vid behov kompletterande försträvningar som sparrsax (två korsande stödben). Dubbla remstycken på murkrönen låser knäbockarna i läge. Knutarna blev mer utvecklade med låsande nacke eller laxstjärt för att stå emot dragkrafter (vilket dock hade använts även tidigare på kontinenten). Under högmedeltiden blev det vanligt med märkning av takstolarnas olika delar, vilket visar att takstolarna höggs ihop på mark och sedan monterades samman på plats i enlighet med märkningarna.[30] Taklagen var inte längre en synlig del av kyrkorummet, men man eftersträvade ändå ofta skarpa kanter på bjälkarna. Behuggningen är utförd på tvärs mot fibrerna med bredbila, en teknik som med olika variationer fortsatt använts in i modern tid, något som försvårar ren okulär bedömning av tillkomsttid. Virke med vankant kvar blev vanligare efter medeltiden, särskilt under 1700-talet då det i landsbygdskyrkorna ofta rör sig om allmogebyggen.

Försvunna taklag

I många fall återstår endast rester av de medeltida taklagen till följd av senare seklers om- och nybyggnader. Det rör sig ofta om delar återanvända i nya konstruktioner, inte sällan med en ny funktion. De långa högbenen har ofta återanvänts, antingen som just högben eller nedkapade till stickbjälkar, hanbjälkar och stödben av olika slag. Även de kraftiga bindbjälkarna var tacksamma att återanvända. En viktig uppgift på kyrkvindar – och för den skull även i andra byggnadsdelar såsom golvbjälklag – är att kunna identifiera och bestämma återanvända delar. Högben känns som regel igen på att den gamla ovansidan har spikhål efter infästning av undertaksbrädor och/eller spåntäckning. Är de kvar i hela sin ursprungliga längd får man en bra utgångspunkt för att utifrån tapphål och urtag för bladningar till hanbjälkar och stödben rekonstruera utseendet på ett tidigare taklag. Även återanvända bindbjälkar bidrar till en sådan tolkning. Ibland påträffas lösa brädlappar och bjälkbitar som lätt kan försvinna vid en sanering, tilläggsisolering eller renovering. Det fordras således uppmärksamhet av antikvarier och hantverkare vid arbeten där man kan påträffa äldre konstruktionsdetaljer. Det förekommer att medeltida byggnadsdelar även påträffas i 1800-talskyrkor, återanvända i golv och taklag.

De medeltida kyrkotaklagen i Västergötland

Min inventering av kyrkotaklagen i Skara stift i Västergötland omfattade 94 av totalt 164 kyrkor med medeltida ursprung. I ett sextiotal av dessa (fig. 5) kunde medeltida takkonstruktioner eller rester av sådana påvisas (att jämföra med de knappt 30 som var kända 2007).[31] För de resterande 70 kyrkorna med medeltida ursprung, som inte inventerades, antogs inga bevarade konstruktioner vara för handen på grund av bränder eller omfattande om- och tillbyggnader. De kan dock mycket väl ha spår av och återanvända delar från äldre taklag. Många kyrkor har rivits, först under 1200-talets omorganisation, sedan efter reformationen och slutligen under 1800-talets nybyggnadsvåg.[32] Om vi utgår från



FIGUR 5. *Spridningskarta över helt eller delvis bevarade medeltida taklag i Skara stifts kyrkor.* KARTA: *Ingvar Röjder, Jönköpings läns museum.*

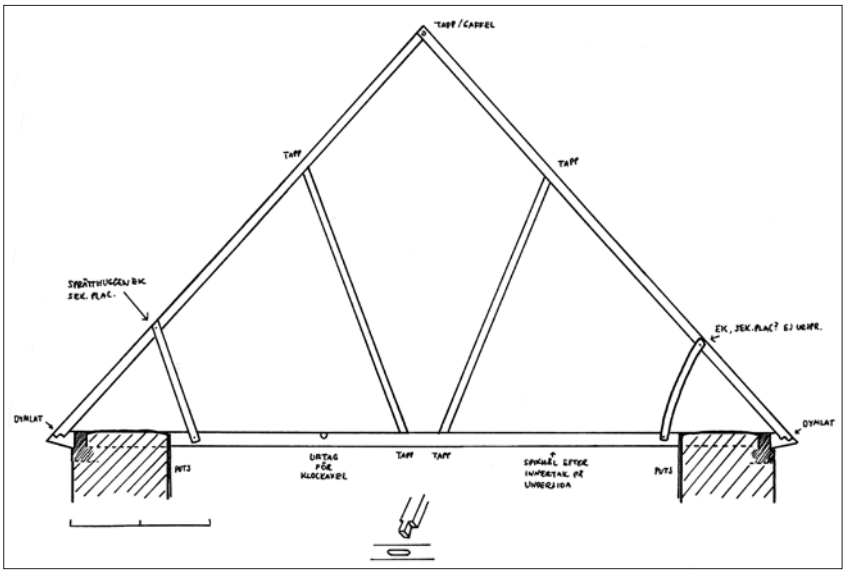
det bestånd av medeltida sockenkyrkor som fanns vid 1800-talets början kan vi nu efter inventeringen säga oss ha en bild av hur takkonstruktionerna ser ut eller har sett ut i ungefär en sjättedel av dessa.

I det följande redogör jag för det bevarade västgötska materialet. Betoningen kommer att ligga på tidig medeltid, helt enkelt eftersom landskapet har få hög- och senmedeltida kyrkor över huvud taget. Jag diskuterar de tidigmedeltida taklagen utifrån form och verkningssätt där knutpunkternas skiftande utformning beaktas.

Snedstöttade takstolar

I inventeringsresultaten framträder en liten grupp kyrkor med tydligt avvikande typ av takstolar med snedställda stödben. Dessa svarar mot Linscotts typ BS och Lundbergs typ A och B som antagits utgöra en äldre variant av taklag. Med undantag för Våmbs kyrka så befinner de sig alla kring Kinnekulle vid Vänern, ett område med flera kvaderstenskyrkor av sandsten från 1100-talet, motiverat av platåbergets lättbrutna sten. Det är ett av de områden i Västergötland där närvaron av världslig och kyrklig makt var särskilt påtaglig i övergången från vikingatid till medeltid.[33] Här fanns också flera sandstensbrott av betydelse för stenkyrkobyggandet. Takstolarna i åtminstone sex av kyrkorna kring Kinnekulle har eller har haft två snedställda stödben mellan bindbjälke och högben.

Över långhus och kor i Götene kyrka står ett fåtal intakta takstolar (fig. 6). Korets ena remstycke av ek är dendrokronologiskt daterat till 1125.[34] Kyrkan är uppförd av tuktad sandsten, vilket av tidigare forskning tolkats som det första skedet i stenkyrkobyggande i Västergötland, före kvaderstenskyrkorna.[35] På korsidan av långhusets östra gavelröste finns avtrycket efter takfallen på en mindre byggnad, möjligen gaveln på en stavkyrka, kring vilken koret byggdes.[36] Takstolarnas stödben sitter med tappar i bindbjälke och högben. Tapphålen har en karaktäristisk långsmal form med rundade ändar som förklaras av att de stämts ut mellan två uppborrade hål. Dymlingar eller spik saknas helt här. Låsande dymling finns i nockens gaffelformade möte. Den blixtformade knuten mellan bindbjälke och högben som vi ser i just Götene saknar hittills kända motsvarigheter. Den har låsts med en dymling från utsidan, vilket bidrar till förståelsen av hur resningen av dessa takstolar kan ha gått till. Bindbjälken fanns på plats från början, stabilt inmurad i murkrönen. Först sattes ena stödbenet och högbenet ihop och låstes i takfot, därefter de andra. Ett taklag med tappade stödben liknande Götenes kan man se resterna av på långhusvinden i Skälvums kyrka. Här har stödbenen varit tappade i högbenen och stått i ansatsurtag i bindbjälkarna. Den dendrokrono-



FIGUR 6. *Över: Skissuppmätning av takstol med snedställda stödben i Götene kyrka (d 1125) vid Kinnekulle. Stödbenen sitter med tappar i högben och bindbjälke.* RITNING: *författaren.*

FIGUR 7. *Under: Långhusets taklag i Forshems kyrka (d 1131–1157) vid Kinnekulle med smäckra stödben bladade i högbenen.* FOTO: *författaren.*

logiska dateringen av långhusets ena remstycke gav fällningsår 1134–1135.[37]

Ett helt intakt taklag finns i Forshem kyrkas långhus (fig. 7), men där är knutpunkterna i form av spikade bladningar i husade (ej genomgående) knutar. Därtill finns en avancerad utformning av takstolarna med mycket smäckra stödben och dekorativt gestaltade högben som utvändigt indikerar någon form av brytning i takfallen. Bindbjälkarna är tjockare på mitten än i ändarna, sannolikt i syfte att kompensera för trycket från stödbenen. Utifrån de dendrokronologiska dateringarna har långhusets taklag tillkommit någon gång mellan 1131 och 1157.[38]

I Kestad kyrkas kvaderstenslånghus finns rester av takstolar där stödbenen varit tappade i högbenen, men bladade i bindbjälkarna med husade knutar och spik. Här har ett remstycke av ek daterats till 1131.[39] Västerplana kyrkas långhus har också kvar bindbjälkar och remstycken i ursprungliga lägen (odaterade). Dessa är av omsorgsfullt sprätthuggen ek. De tunna remstyckena med smal kam har spår för infällning av takfotsbrädor. De plankformade högbenen sitter idag som stödben, men känns igen på sina typiska genomgående tapphål. Här noterades också det tappformade mötet mellan bindbjälke och högben som saknar motsvarigheter i det västgötska materialet före senmedeltiden (men är känt från Tyskland, se nedan). I Vättlösa kyrkas kor (odaterat) är stödbenen bladade och

FIGUR 8. *Över: F.d. bindbjälke (?) med hyvlade profiler längs kanterna, på vinden i Fivlereds kyrka.* FOTO: *författaren.*

FIGUR 9. *Under: Detalj av de återanvända bindbjälkarna (nu upp- och ned) i Våmbs kyrka med tapphål och ansatsurtag för stödben.* FOTO: *författaren.*

spikade, respektive dymlade i såväl högben som bindbjälke.

På långhusvinden till Våmbs kyrka vid Billingen (odaterad), uppförd av tuktad kalksten, är några av gruppens elegantaste bindbjälkar bevarade, detta trots uppgifter om brand. De fem högsmala bindbjälkarna, nu återanvända i samma funktion, har slutbehandlats med hyvel, skave, och har längs varje hörn försetts med en hyvlad profil, en skålad yta omgiven av två v-formiga spår. Sådana här profiler är kända från 1200-talet i Norge, mestadels i profana byggnader. Andra varianter på profiler förekommer där i såväl stav- som stenkyrkor under 1100-talet.[40]

Denna profil finns i ett fåtal objekt i Västergötland. I Gökhem kyrkas långhus finns den längs nederkanten på två bindbjälkar i linje med ett igenmurat sydfönster och i Od kyrkas långhus finns den på alla bindbjälkars nederkant åt väster. Som lösfynd finns på kyrkvinden i Fivlered en mycket fint hyvlad bjälke med svärtade profiler längs alla kanter (fig. 8), troligen en sedan tidigare återanvänd bindbjälke, oklart är om den kommer från det befintliga taklaget med kryssade takstolar eller från en rest av en äldre konstruktion. Kring porten till den brunnna 1300-talstimmerkyrkan i Södra Råda fanns profilen också.[41] Var och en av bindbjälkarna i Våmb uppvisar tre typer av möten med stödben. Ytterst är två ansatsurtag, därefter två tapphål med rundade ändar och i mitten ett runt tapphål. (fig. 9) Tydligen har takstolarna haft fyra stödben i en solfjädersform. Mitthålet kan härröra från en mittstolpe eller styrplanka. Tyvärr saknas bindbjälkarnas ändar. Äldre bindbjälkar i Östra Gerums kyrka tycks ha återanvänts i ett par omgångar och kan i ett äldsta skede ha haft fyra stödben med ansatsurtag. De har dendrokronologiskt daterats till mellan 1127 och 1150.[42]

Takstolar som de ovan beskrivna, med två till fyra snett ställda stödben som stöder mot bindbjälkens mitt, är påvisade i kyrkor i Gotland, Skåne, Södermanland och Östergötland samt i Danmark, Tyskland och Belgien.[43] Det äldsta dendrokronologiskt daterade taklaget i Sverige – ca 1112 – finns i Herrestad kyrkas långhus, Östergötland. Det har fyra stödben som likt Forshems är bladade och spikade i högben och bindbjälke. Den profilerade nockåsen är återanvänd från ett äldre taklag.[44] Den närmaste släktingen till takstolarna i Forshem återfinns i Garde kyrkas långhus, Gotland, med en datering till 1120-talet.[45] Här finns samma utvändiga avsats på takfallen. Men stödbenen är avslutade mot högbenen med en gaffel och står i ansatsurtag i bindbjälken.

Rester av ett taklag snarlikt det som bör ha funnits i Våmb har konstaterats i Härad kyrkas långhus, Södermanland, med fyra stödben i solfjädersform som har varit bladade i högbenen.[46]

I Skåne finns rester av liknande takstolar i Ravlunda och Vitaby kyrkor med ansatsurtag i bindbjälken. I Norra Mellby kyrka finns en äldre bindbjälke av ek med förtjockad mitt och urtag för två stödben, dendrokronologiskt daterad till 1130-talet.[47] I dagens Danmark finns takstolstypen dokumenterad i Randerups kyrka på Jylland med två stödben som är tappade i högbenen och bladade i bindbjälken (troligen 1100-tal).[48] Ett likartat taklag finns det rester av i Söndrums kyrka i Halland, i form av återanvända högben i ek med såväl tapphål som urtag för spikad bladning, vittnande om takstolar med fyra stödben.[49]

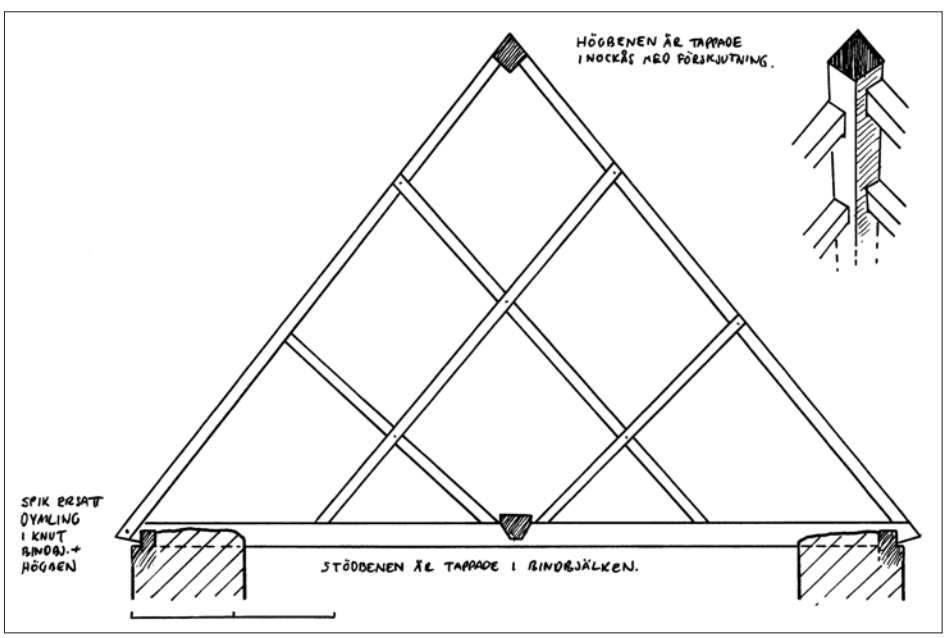
I Tyskland finns snedstöttade takstolar belagda i huvudsak i Rhenlandet, en region som hade betydelse för det tidiga stenkyrkobyggandet i åtminstone södra Skandinavien som förmedlare av stenmästare.[50] Den äldsta dendrokronologiska dateringen är från stiftskyrkan i Münstereifel (daterad 1107), vars nu rivna tak hade fyra stödben och en ovanligt flack takvinkel på enbart 30 grader. Bevarade är däremot takstolarna från 1132 över Stiftskirche St. Martin i Sindelfingen, som hör till de brantare med 43 grader. Ytterligare exempel kan anföras från 1100-talet, däribland klosterkyrkan i Billigheim bei Mosbach (daterad 1180/90) med fyra stödben. I samtliga dessa fall sitter stödbenen i husade knutar. I St. Martin och den odaterade Stiftskirche St. Lubentius i Dietkirchen (1100-talets andra hälft) är högbenen liksom i Västerplana tappade ner i bindbjälken. I klosterkyrkan Marienthal bei Helmstedt i Niedersachsen, är även stödbenen tappade (efter 1150).[51] Vi känner igen arten att mura in bindbjälkarna, vilket även förekommer i Danmark, Norge och Frankrike, ibland ända upp till undertaket. Intressant är att avståndet mellan takstolarna är det dubbla i det danska och tyska materialet.[52] Motiverade större snötyngder i Sverige tätare avstånd? Även från Vallonien finns ett par exempel på de flacka snedstöttade takstolarna.[53]

De snedstöttade takstolarna skulle jag vilja tolka som den första generationen av taklag i Västergötlands stenkyrkor, kanske i södra Skandinaviens stenkyrkor överlag. De dateringar som är för handen ligger till stor del under 1120- och 30-talen. Anmärkningsvärda är exemplen på stödben med tappning. Som Lundberg skrev så bygger konstruktionen med inspända stödben på tryck för att fungera. Han menade att typen var ett ”egenvilligt försök att tillämpa verkligt takstolstänkande i uråldrig inhemsk byggnadstraditionell anda” och jämförde med tidiga kyrkotak i Italien och en kvarlevande romersk tradition.[54] De nämnda exemplen från Tyskland visar att bladning där förekommer tidigt. Som vi ser i det följande så kom den snedstöttade takstolstypen – med tapp och/eller bladning – snart att samexistera med andra typer. Kompletterande undersökningar och dendrokronologiska analyser vore av värde för att närmare kunna utreda denna fragmentariska taklagsgrupp.

Taklag med bärande nockås

Inventeringen kunde uppmärksamma en mycket liten grupp av västgötska taklag – enbart tre stycken – som avviker genom att de egentligen är åstak, trots att de vid en snabb blick ser ut som konstruktioner med takstolar. Alla har de korsande stödben, som gruppen kryssade takstolar (mer om denna nedan). Möjligen har också en del av de idag fragmentariska snedstöttade taklagen haft samma åskonstruktion. Det särpräglade i dessa tre kyrkotaklag (Edåsa, Valtorp och Eriksberg) är förekomsten av en fribärande nockås, i vilken högbenen skjutits in i tapphål (fig. 10). Nockåsen vilar på de murade gavlarnas krön och bär således tillsammans med bindbjälkarna högbenen. I ett vanligt åstak hade det funnits ytterligare en eller två åsar längre ner på respektive takfall, som tillsammans med remstycket bär hela taket. Här har timmermännen i stället valt att tillämpa högben, bindbjälke och stödben, något som annars hör hemma i en konstruktion med takstolar. Med tanke på frånvaron av innertak så kan estetiska motiv ha spelat in i tillkomsten av denna hybrid mellan ås- och takstolstak. Detta fenomen är föga beaktat i tidigare forskning.

De odaterade taklagen över långhusen i de närbelägna Edåsa och Valtorps (fig. 11) kyrkor,



FIGUR 10. *Över: Nockås med intappade högben i Valtorps kyrka.* FOTO: *författaren.*

FIGUR 11. *Under: Skissuppmätning av takstol med högben intappade i bärande nockås, Valtorps kyrka.* RITNING: *författaren.*

söder om platåberget Billingen, är nästan identiska i utförandet. Högbenen är tappade med viss förskjutning i en rombisk nockås. Som försträvande element sitter fyra stödben som korsar varandra utan knutar. De är bladade och spikade i högbenen och står på bindbjälken i ansatsurtag. På bindbjälkarna rider en centrerad styrbjälke. I Edåsa saknas idag nockåsen, men där finns å andra sidan en bevarad nockkam av ek. Det tredje taklaget finner vi över kor och långhus i Eriksbergs gamla kyrka, det är av ek och dendrokronologiskt daterat till 1153.[55] Här sitter tapphålen i högbenen i linje. Fyra stödben korsar varandra, de är tappade i högbenen och bladade i grunda knutar i bindbjälken med låsande spik.

Konstruktioner med bärande nockås kan även påvisas i Skåne, Småland, Södermanland och Östergötland. I Hagebyhöga kyrkas långhus, Östergötland, är högbenen tappade i en nockås, vilket noterats av Sjömar. De fyra profilhyvlade stödbenen – två korsar varandra – är tappade i högbenen och står med små ”fötter” i ansatsurtag i bindbjälken. Taklaget är dendrokronologiskt daterat till efter 1119.[56] Långhustaklaget i Skepperstads kyrka, Småland, har en nockås (sedermera utbytt) som bärs av en mittstolpe i vardera änden, stöttad av dekorativt utformade strävor i taklagets längdriktning. Högbenens intappning ligger förskjuten. De fyra korsande stödbenen är bladade i högbenen och tappade ner i bindbjälken, och på denna rider liksom i Edåsa och Valtorps kyrkor en centrerad styrbjälke.[57] Taklaget är dendrokronologiskt daterat till ca 1160.[58] Långhustaklaget i Härads kyrka, Södermanland, har en profilhuggen nockås där högbenen är intappade med förskjutning. Nockåsen vilar på gavelröstena och en mittre takstol.[59] Samma lösning är känd från koret i Ravlunda kyrka, Skåne.[60]

Åstaket som konstruktion förefaller ålderdomlig i sammanhanget och anses ha förekommit redan i förhistorisk tid i stolpburna konstruktioner. Byggnader med me-

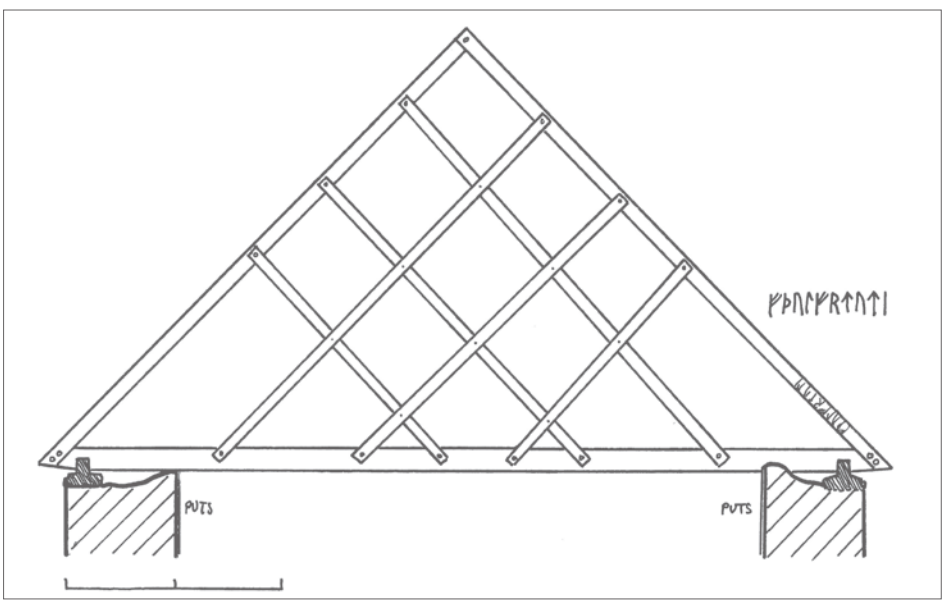
sulakonstruktion, nockås buren av mittstolpe, har förekommit långt fram i tiden i Norden, det var ett enkelt sätt att lösa takproblemet.[61] Är de härmed att betrakta som ett utslag av inhemsk byggnadsteknik?

Kryssade takstolar

Den vanligaste typen av tidigmedeltida takstolar i västgötska kyrkor har två till sex korsande stödben. Dessa är som regel bladade i högben och bindbjälkar med husade knutar och dymling, ibland spik. Inventeringen har visat på 23 kyrkor med bevarade taklag av denna typ (de tre taklagen med bärande nockås är inte inräknade), tio kyrkor där de finns kvar i ombyggd form och minst sju kyrkor med spår eller återanvända fragment. Utifrån de dendrokronologiska undersökningar som har gjorts genom åren spänner deras tillkomsttid från 1130-talet (Forsby 1135) till mitten av 1200-talet (Ornunga efter 1247).[62] Motsvarande taklag med kryssade takstolar finns och har funnits tämligen väl representerade i övriga landskap kring Vättern.[63]

Den enklaste varianten har två korsande stödben, till exempel i timmerkyrkan Jällby. Flertalet har fyra korsande stödben (fig. 12). De mest avancerade takstolarna har sex stödben, vilket inte kan ha varit motiverat rent statiskt, men däremot estetiskt, som ett utpräglat flätverk, (fig 13). Dylika finns i Forsby (daterad 1135), Gökhem (daterad 1140), Marum (daterad 1140-tal) och Mjäldrunga (daterad efter 1201) samt ombyggda i Jäla (odaterad) och Ods (daterad ca 1140) kyrkor.[64] Takstolarna i Gökhem kyrkas långhus uppmärksammades tidigt av forskningen, de är de enda kända i sitt slag med sin dekorativa utformning av stödbenens knutpunkter med olika korsformer (fig. 14). I den närbelägna kyrkan i Jäla lägger man märke till de mycket omsorgsfullt bearbetade delarna av plankmässigt tunn ek. Att stödbenen fästs med spik är regel, utom i det betydligt senare taklaget i Mjäldrunga kyrka.

I Norge finns inga motsvarigheter till ”flätverket”. Däremot förekommer typen i Danmark



FIGUR 12. *Över: Takstolar med fyra korsande stödben i Sveneby kyrkas långhus.* FOTO: *författaren.*

FIGUR 13. *Under: Skissuppmätning av takstol med sex korsande stödben i Marums kyrka med runristat högben (fÞ ulfr tuti).* RITNING: *författaren.*

under 1100-talet. På Jylland finns tre dokumenterade kyrkor med fyra korsande stödben, varav det i Vestre Nebel kyrka daterats till efter 1155.[65] Men en sådan koncentration av bevarade kryssade taklag från tidig medeltid som finns i landskapen kring Vättern saknar motstycke. I Tyskland är mig veterligen inga exempel kända.[66] I Frankrike finns bara ett dokumenterat taklag med sex korsande stödben, i ett tvärskepp till St. Christophe i Chabris, som antas vara hemmahörande i 1100-talet. Liksom i andra medeltida franska taklag är de bladade knutarna utförda med laxning. Takstolstypens för Frankrike främmande karaktär understryks i den franske taklagsforskaren Patrick Hoffsummers tolkning, där han benämner den ”grillage scandinave” (skandinaviskt nät).[67]

FIGUR 14. *Takstolar med sex korsande stödben och dekorativa knutpunkter i Gökhem kyrkas långhus (d* 1140*).* FOTO: *författaren.*

De knutar i form av tappning som förekommer hos de snedstöttade takstolarna finns även hos några av de kryssade. Tekniken med stödben tappade i högbenen var i bruk länge. Den tillämpas så sent som 1197–1199 i Söne kyrkas långhus (daterat remstycke) och i Fullösa kyrkas långhus 1203–1205 (daterat remstycke), båda med två korsande stödben.[68] Även i Ova kyrkas långhus (odaterat) finns korsande stödben tappade i högbenen. Nockåsen levde också kvar, särskilt i Småland och Östergötland, men enbart som ett dekorativt och stabiliserande inslag. Nockåsen rider här enbart på takstolarna och syftar inte som i de tidigare beskrivna egentliga åstaken i Edåsa, Valtorp och Eriksberg till att bära taket, ibland består den bara av lösa sektioner mellan takstolarna. Ofta har nockåsen en huggen profil med segmentbåge och vulst. De enda kända exemplen på sådana nockåsar i Västergötland finns i Kinne-Vedum kyrkas långhus (daterat remstycke 1186–1188)[69] och i långhuset till Ljungsarps kyrka (odaterat, fig. 15). I Mjäldrunga kyrkas långhus finns en mycket förenklad variant (daterat efter 1201). I övrigt är nockåsarna odekorerat rombiska. Den profilerade nockåsen i Herrestad är enligt dendrokronologin återanvänd från ett äldre taklag, troligen 1000-tal.[70] Motivet är också förekommande på nockåsar i Skåne, som till exempel i Ravlunda och Övraby kyrkor.[71] Formen med segmentbåge och vulst tycks ha varit i det närmaste europeiskt allmängods. Motivet är vanligt förekommande i eftermedeltida timmerarkitektur på landsbygden från Östersjöområdet ner till de rumänska Karpaterna.[72]

De kryssade takstolarnas uppkomst i Götalandskapen är en ännu obesvarad fråga. Lundberg menade att de kryssade takstolarna representerade ”inträngandet av fackverkskonstruktion av högkvalitativt slag, låt vara med inmängda primitiva drag”, således ett utifrån introducerat koncept.[73] Detta kan jämföras med hur engelska byggmästare introducerade nya taklagsformer på det norska Vestlandet under

FIGUR 15. *Nockås med uthuggen segmentbåge och vulst i Ljungsarp kyrkas långhus.* FOTO: *författaren.*

tidig medeltid.[74] Sjömar å sin sida menar att de bevarade taklagen från 1100-talet ”pekar mot en regional och platsbunden byggnadskonst. Först fram emot 1200-talets mitt förändras bilden och takkonstruktionerna kan tydligare ordnas in efter kontinentala förebilder så som vi känner dem.”[75] Oavsett varifrån de ursprungliga impulserna kom så talar den idag kända spridningsbilden för att en regional tradition tog form i landskapen runt Vättern mot mitten av 1100-talet och ägde bestånd ännu hundra år senare. Detta kan jämföras med den diskussion som Storsletten för om uppkomsten av långlivade regionala trätraditioner i Norge.[76] Faktum är att de kryssade takstolarna kopierades så sent som på 1700-talet vid ombyggnader av kyrkotak i Västergötland.[77] Landskapen kring Vättern har haft mer som förenat än som skiljt åt under tidig medeltid. Sjön var mittpunkten mellan de maktcentra som fanns i Väster- och Östergötland; byggmästare och hantverkare bör ha rört sig mellan båda landskapen. Till skillnad från Västergötland uppvisar dock Östergötland och Småland fler lokala variationer i hur taklag utformats, med inslag av hanbjälkar och andra placeringar av stödben.[78]

Andra tidigmedeltida takstolstyper

En annan variant av tidigmedeltida takstolar har hanbjälke och två stödben (Linscotts typ BH). Den har i Västergötland bara kunnat påvisas i koren i Marka[79] och Suntaks[80] kyrkor, ombyggd i Vilske-Kleva kyrkas kor samt över odaterade västliga förlängningar av långhusen i Eriksberg och Forsby kyrkor. I Småland[81] och Östergötland är hanbjälkar vanligare, liksom i Norge och det medeltida Danmark. En karaktäristisk östnorsk takstolstyp med ”undersparrar” har konstaterats i Ljungsarps kyrka i södra delen av Västergötland (Göteborgs stift), och har uppenbarligen varit frekvent i det tidigare norska Bohuslän.[82] Kanske kan ytterligare prov på dylika takstolar spåras i de ännu oinventerade medeltidskyrkorna kring Göta älvdalen.

Taklaget som del av kyrkorummets arkitektur

De rent dekorativa inslagen i de tidigmedeltida

FIGUR 16. *I förgrunden urtag för klockor i bindbjälkar i Kinne-Vedum kyrkas kor.* FOTO: *författaren.*

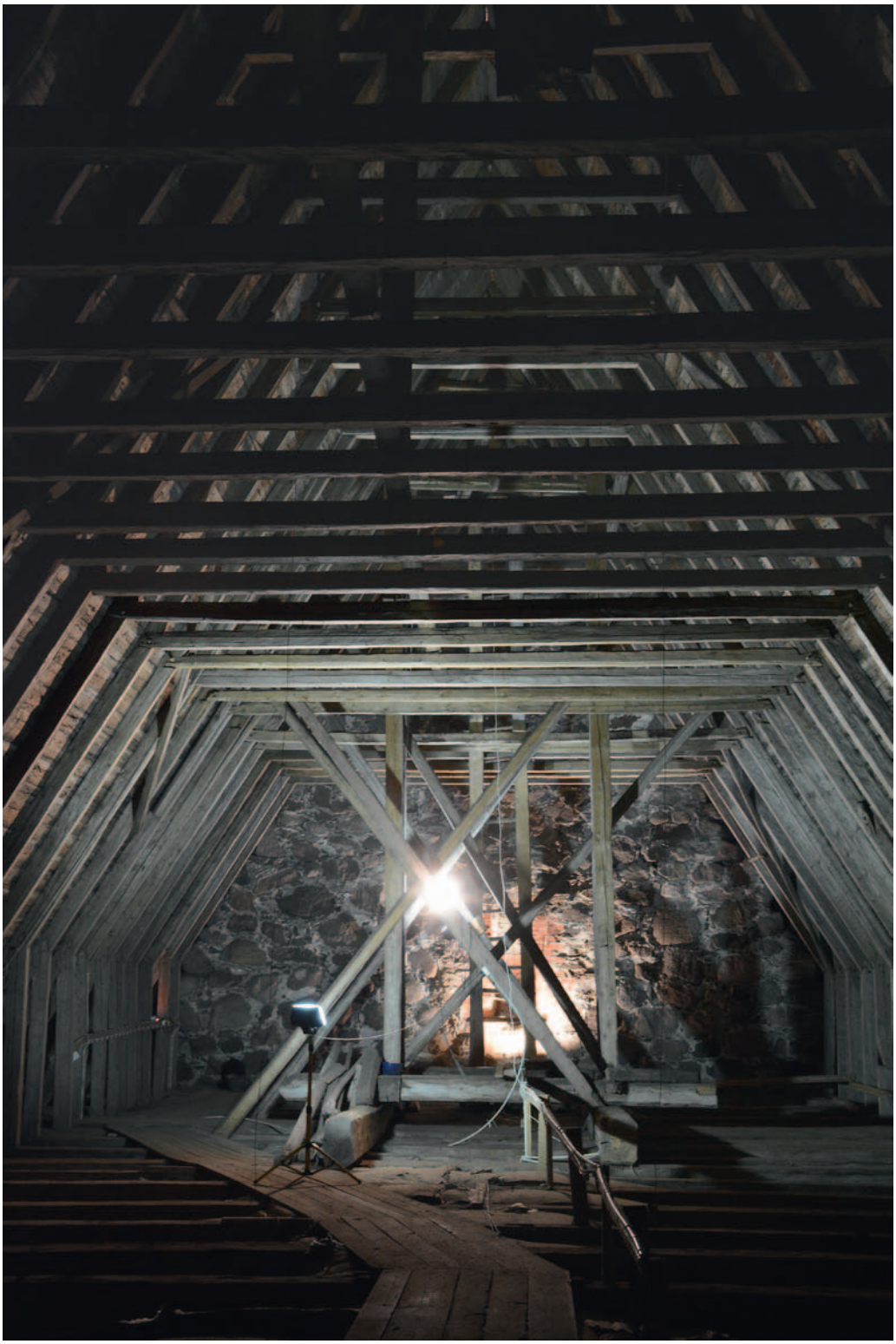
taklagen har jag på flera punkter berört ovan. De mot kyrkorummet öppna takkonstruktionerna har framhållits av forskare sedan förra sekelskiftet i Skandinavien. Taklagen var en integrerad del av kyrkorummets arkitektur. Uttryck för detta är till exempel profilhuggna nockåsar och krysstakstolar av den typ som Patrick Hoffsummer benämnt le ”grillage scandinave”. Det har i flera kyrkor noterats att bindbjälkarna är finare bearbetade än de högre belägna delarna av takstolarna. I en del fall har de slutputsats med bredbila, i andra fall hyvlats släta med en skave, ibland getts en dragen profil. Storsletten menar för det norska materialet att sprätthuggning tillämpades på de delar som inte var synliga från kyrkorummet. Han menar att flera av de norska taklagen i stenkyrkorna hade vindsgolv lagda ovanpå bindbjälkarna.[83] En liturgiskt betingad företeelse är de urtag som kan ses i ovansidan av bindbjälkar, tolkade som upplag för små liturgiska klockor (fig. 16).[84] Klockupphängningar är kända från hela det medeltida Götaland. I Götene har två klockor hängt i långhusets sydöstra hörn och två stycken i korets sydvästra. Alternativt har långhusets klocka/or hängt i dess nordvästra del. I många taklag finns spikhål och ibland enstaka spikar kvar på bindbjälkarnas undersida, vilket vittnar om plana brädtak som satts upp före valvens införande. Även exteriört var taken föremål för dekor. Enstaka remstycken med upphöjd eller ristad dekor (fig. 17) respektive takfots- och vindskivebrädor har överlevt (Kinne-Vedum, Skalunda, Marum, Forshem).[85] Många remstycken kan säkert ha haft en nu försvunnen målad dekor. Av prydande nockkammar återstår enbart spillror (Edåsa, Grevbäck, Marka).

Hög- och senmedeltida taklag

Västgötska taklag från hög- och senmedeltid har avsatt få spår i Västergötland avseende taklag. Detta hänger samman med en låg byggnadsaktivitet i landskapet, delvis att förklara med pest och missväxt samt en gradvis centralisering av

FIGUR 17. *Remstycke med romansk relief på Skalunda kyrkas kor.* FOTO: *författaren.*

makten till Mälardalen.[86] Vi ser inte samma utvecklingslinjer som i det danska Halland-Skåne och Mälarlandskapen där flera kyrkor moderniserades kraftigt till att bli valvslagna salkyrkor genom förlängning eller nybyggnad under framför allt senmedeltiden.[87] Även i förhållande till Östergötland hände mycket lite i Västergötland. En motor i utvecklingen kring Vättern var klostren i Alvastra och Vadstena. Det sistnämnda hade betydelse för kyrkornas valvslagning och målningsutsmyckning under 1400-talet.[88] I Västergötland försågs flera kyrkorum med relativt låga valv, oftare av lättbruten kalksten än av dyrbart tegel. Detta betydde att man som regel bara anpassade befintligt taklag genom avkapning av ett par bindbjälkar och insättning av nya stödben och hanbjälke i dessa takstolar. De stora gotiska taklag som ännu finns kvar i bland annat Halland, Skåne och Mälardalen är därmed ovanliga i Västergötland. Ett intressant undantag är den lilla grupp av salkyrkor som tillkom längs Vättern under hög- och senmedeltiden, mark som till stor del ägdes av Alvastra kloster: Brevik, Grevbäck, Mölltorp, Norra Fågelås och Ransberg.[89] Taklaget i Mölltorp har daterats till 1378/79 och Norra Fågelås till 1518 (fig. 18), då troligen den andra generationen av tak.[90] Även i Algutstorp, Kungslena, Lundby, Luttra, Månstad och Åsle (kor) kyrkor förekommer taklag som jag tolkar som hemmahörande i hög- och senmedeltiden. Några av dessa vore intressanta för fördjupade undersökningar och dendrokronologisk analys, eftersom dessa sekel är så dåligt kända vad gäller kyrkobyggande i Västergötland. Intressant är förekomsten av malltakstolar för tillhuggning av de olika delarna på mark, till exempel i Mölltorp.[91] Spärrthuggning förekommer inte, allt är bearbetat med bredbila på tvärs mot fiberriktningen. I enstaka fall förekommer kransågade ytor som i Lundby gamla kyrka på Hisingen.[92] Detta taklag och det över koret i Åsle kyrka är de enda som är utpräglade gotiska i sitt verkningssätt, det vill säga med knäbockar istället för bindbjälkar.



FIGUR 18. *Resligt gotiskt taklag i Norra Fågelås kyrka från* 1518. FOTO: *författaren*.

Avslutning

Hur representativa är de takkonstruktioner som har bevarats på vindarna i Västergötlands medeltidskyrkor? Många kyrkor har rivits, särskilt under 1800-talet. Om vi utgår från det bestånd av medeltida sockenkyrkor som fanns vid 1800-talets början har vi efter inventeringen en bild av hur takkonstruktionerna ser ut eller har sett ut i ungefär en sjättedel av dessa. Denna artikel har skissat en bild av hur det under 1100-talets första hälft fanns en mångfald av taklösningar i de första stenkyrkorna och hur det sedan utkristalliserade sig en regional byggnadstradition med likheter i de andra landskapen kring Vättern. För Västergötlands del är andelen bevarade hög- och senmedeltida taklag ringa och inbegriper oftast bindbjälke, i övrigt inordnar de sig i de gotiska typer som vi känner från andra delar av landet och kontinenten.

Åtminstone fyra typer av taklag har förekommit i Skara stift under tidig medeltid. Äldst tycks en liten grupp av takstolar med snedställda – ofta intappade – stödben vara. Tillsammans med exempel från Skåne och Östergötland hör gruppen utifrån de dendrokronologiska analyserna hemma under 1110-, 20- och 30-talen. Intressant är att de västgötska exemplen med ett undantag återfinns invid Kinnekulle, ett centrum för världslig och kyrklig makt under övergången från vikingatid till tidig medeltid. Bergets lättbrutna sandsten var av stor betydelse för stenkyrkobyggandet, här finns också några av de äldsta stenkyrkorna i landskapet.

En mycket liten grupp med idag endast tre bevarade exempel vittnar om förekomst av kyrkotak med en bärande nockås i vilken högbenen tappats in. Konstruktionen har likheter med äldre och senare stolpkonstruktioner. Även här finns exempel från Skåne och Östergötland, men även Småland och Södermanland. De få dateringarna spänner från ca 1120 till ca 1160. Denna hybrid mellan ås- och takstolstak kan tolkas som ett möte mellan gamla inhemska byggnadstekniker och nya influenser. Det till nock öppna kyrkorummet skulle uppenbarligen krönas av kryssade takstolar som en del av ett estetiskt ideal. Men timmermännen har egentligen skapat något som utgår från en väl inarbetad tradition med åstak och gett detta drag av takstolstak.

Från 1130-talet har vi de första daterade exemplen på de kryssade takstolar som kom att resas över flertalet av de kyrkor som byggdes i Västergötland under resten av seklet och långt in på 1200-talet. Från 1130-talet och in på 1150-talet tycks alla tre ovan nämnda typer ha funnits samtidigt och delvis påverkat varandra. Men från 1100-talets mitt dominerar de kryssade takstolarna. Dessa tycks ha blivit det vedertagna sättet att skapa ett kyrktak. Likheterna med taklag i övriga landskap kring Vättern tyder på en regional timmermanstradition både i former och detaljer. En större variationsrikedom finns dock utanför Skarastiftet. Takstolar med stödben och hanbjälke är till exempel bevarade i högre grad i Småland och Östergötland. Som en anomali framstår i dagsläget ett exempel på en takstol av östnorsk typ i södra Västergötland, i Göteborgs stift.

De snedstöttade takstolarna har motsvarigheter i bland annat danskt och tyskt material. Möjligen ser vi här mötet mellan ett utifrån introducerat koncept och en långlivad inhemsk träbyggnadstradition. Var de första impulserna till de kryssade takstolarna kommit ifrån återstår att utreda, men nedslagspunkter finns åtminstone på Jylland i Danmark.

&

TAKSTOLARNA SOM STÅR UNDANGÖMDA på våra kyrkvindar är några av de äldsta träkonstruktionerna som finns bevarade i Sverige idag. Många gånger fyller de fortfarande den funktion de haft sedan kyrkorna byggdes under tidig medeltid. Trots detta har de som framhållits här av Robin Gullbrandsson först på senare år börjat uppmärksammas på allvar inom forskningen.

Kartläggning och inventering utgör en viktig del i processen att lyfta fram detta okända kulturarv. Bevarandeproblematiken utgör en annan. I samband med inventeringen i Skara stift som behandlats i artikeln ovan utarbetade restaureringsingenjören Ylva Sandin en handbok för förvaltning och underhåll av takkonstruktionerna. I idé- och debattartikeln *Vårda och be-*

vara historiska trätakstolar – utmaningar och lösningar på s. 116–127 i detta nummer, beskriver Sandin de hot som finns och föreslår konkreta handlingsplaner för att de ska kunna bevaras för framtiden. (Red. anmärkning.)

ROBIN GULLBRANDSSON är född 1980 i Örslösa och bosatt i Trevattna utanför Falköping. Han är fil. mag. med arkeologi som huvudämne. Gullbrandsson är verksam som byggnadsantikvarie vid Västergötlands museum. Tidigare har han arbetat vid Jönköpings läns museum och bland annat svarat för utgivandet av *Grevars och bönders tempel – En bok om Brahekyrkan på Visingsö*. Kyrkorna i Västergötland har varit ett återkommande tema sedan arbetet inom Skara stifts kyrkoinventering 2004–2005. De medeltida taklagen har varit ett forskningsintresse sedan en första provinventering åt Linköpings stift 2010.

robin.gullbrandsson@vgmuseum.se
Västergötlands museum
Box 253
532 23 Skara

Noter

1 Curman, yttrande den 24 maj 1913 ang. fastställt restaureringsförslag, ATA.
2 Edman 1999.
3 Curman 1937.
4 Sandin 2015.
5 Janse 1902.
6 Lundberg 1940, 1949, 1971.
7 Bråthen 1982; *Dendrokronologi och medeltida kyrkor* 1988; Sjömar 1992; Bråthen 1995, Eriksson 2006.
8 Bråthen 1982, 1995; Linscott 2007.
9 http://craftlab.gu.se/kunskapsbank/publikationer/sodra-rada-projektet; http://timmermanskonst.se/, http://traditionsbararna.se/
10 Sandin 2005 och Thelin 2006.
11 Møller 1953; Madsen 2007.
12 Storsletten 2002.
13 Gullbrandsson 2011.
14 Göteborg, Karlstad, Lund, Skara, Strängnäs och Västerås stift.
15 Curman 1937; Lundberg 1971; Sjömar 1995.
16 Lohrum 2004, s. 256f.
17 För Norden brukar den tidsmässiga indelningen vara 1050–1250 för tidig medeltid, 1250–1389 för högmedeltid och 1389–1520 för senmedeltid.
18 Se t.ex. Storsletten 2002 och Linscott 2007.
19 Storsletten 2002, s. 8.
20 Linscott 2007, s. 14; Storsletten 2002, s. 8, 316.
21 Gullbrandsson 2015. Har man medvetet anammat samma antal takstolar som apostlar? 12 ansågs som ett heligt tal inom kyrkan.
22 Thelin & Linscott 2008.
23 Linscott 2007, s. 31.
24 Lundberg 1971, s. 61.
25 Lundberg 1971, s. 43f. A kallas för ”Gardetyp” och B ”Herrestadstyp”. Lundberg tog även upp en typ D, vilket avser de norska 1100-talsstavkyrkornas takstolar utan bindbjälke, vilket kompenseras av saxsparre och hanbjälke, Lundberg 1971, s. 78–81.
26 Curman 1937; Linscott 2007; Sjömar 1992, 1995.
27 Gullbrandsson 2016.
28 Sjömar 1995, s. 227f.
29 Nilsen 1991.
30 Linscott 2007; Lundberg 1971; Sjömar 1992, 1995.
31 Linscott 2007.
32 *Västergötland – landskapets kyrkor* 2002.
33 Dahlberg 1998.
34 Bråthen 1995, s. 92.
35 Dahlberg 1995, s. 173f.
36 Gullbrandsson 2015.
37 Bråthen 1995, s. 94.
38 Bartholin 1998; Bråthen 1995, s. 91; Seim et al. 2015, s. 46.
39 Bråthen 1995.
40 Storsletten 2002, s. 40, 241.
41 Lundberg 1971, s. 16.
42 Bartholin 1999; Sjömar 1999.
43 I Frankrike finns typen, men med hanbjälke och laxad mittstolpe/hängvirke belagt i Saint-Germain-des-Prés, Paris (1044? Lundberg 1971, s. 202), Saint-Gérmain, Allouis, d 1124/25 (Hoffsummer 2011, s. 87). I båda fallen närmast en solfjäderform, jmf. Härad och Våmb.
44 Eriksson 2003, s. 43f.; Sjömar 1992, s. 64ff.
45 Bråthen 1995, s. 68–73; Lundberg 1971, s. 43f.
46 Hallgren 2014; Taawo 2015, s. 64–67.
47 Melin 2015.
48 Madsen 2007, s. 154.
49 Gullbrandsson 2017.
50 *Den romanska konsten* 1995.
51 Binding 1991, s. 25–31. Andra exempel (som saknar dendrokronologiska dateringar) omnämnda av samme författare är klosterkyrkan St. Ägidius, Mittelheim (troligen mitten av 1100-talet, revs på 1900-talet) och St. Luzius, Essen-Werden (ca 1100).
52 Binding 1991, s. 27; Madsen 2007.
53 Binding 1991, s. 29; Linscott 2007. Det rör sig om St. Hadelin i Celles och Ste. Gertrude i Nivelles (d 1046).
54 Lundberg 1971, s. 44.
55 Bråthen 1990; Seim 2014.
56 Sjömar 1992, s. 64ff., 1995, s. 222.
57 Besiktning och skissuppmätning 2015 av Gullbrandsson.
58 *Småland – landskapets kyrkor* 2006, s. 62.

59 Hallgren 2014; Taawo 2015, s. 67.
60 Melin 2015; Sjömar 1995, s. 221.
61 Storsletten 2002, s. 359.
62 Gullbrandsson 2015.
63 Bevarade i t.ex. Mosjö, Norra Solberga, Kumla och Väversunda kyrkor.
64 Dendrokronologiska dateringar enligt Bartholin 1998, Bråthen 1995 & 2000, Linderson 2012 och Seim et al. 2015.
65 Madsen 2003.
66 Storsletten 2002.
67 Hoffsummer 2011, s. 88, 323ff.
68 Bråthen 1995, s. 91, 95f.
69 Bråthen 1995, s. 92.
70 Eriksson 2006, s. 43 f.
71 Melin 2015.
72 Kundziņš 1952; Lundberg 1971, s. 177.
73 Lundberg 1971, s. 143.
74 Lundberg 1971; Storsletten 2002, s. 8.
75 Sjömar 1995, s. 226.
76 Storsletten 2002.
77 Gullbrandsson 2015, t.ex. i Högstena, Kälvene och Sörby kyrkor.
78 Gullbrandsson 2011 & 2014; Thelin 2006.
79 Ett högben med insektsangripen vankant har daterats av Hans Linderson till 1130–1160. Remstycket har av Andrea Seim daterats till 1155/56 vilket svarar mot hennes datering av långhusets taklag. Dock är det tydligt att långhuset är byggt påtagligt senare än koret att döma av stötfog och reparationer på första takstolen i koret, som utförts före långhusbygget, se byggnadsarkeologisk redogörelse i Gullbrandsson & Hallgren 2017.
80 Taklaget odaterat, men virke i portal daterat av Bråthen till 1135-1138.
81 Taklag i Kumlaby av denna typ daterat av Linderson till 1142–1172, sannolikt 1145–1155, se Gullbrandsson 2017b.
82 Gullbrandsson 2017a. Typen finns även i Torslanda kyrka på Hisingen, men tolkas där som högmedeltida.
83 Storsletten 2002, s. 188f., 315f.
84 Sjömar 1992 & 1995.
85 Karlsson 1977.
86 *Västergötland – landskapets kyrkor* 2002.
87 *Sockenkyrkorna – kulturarv och bebyggelsehistoria* 2008.
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89 Gullbrandsson 2015.
90 Linderson 2014.
91 Bygdén & Hallgren 2014.
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Medieval church roof structures in Västergötland

By Robin Gullbrandsson

Summary

This article discusses the results of a survey of medieval roof structures in the churches of Skara diocese in Västergötland carried out in 2014–15. The presence of extant medieval structures has been known since the early 20th century, yet only in the 2010s did diocese-wide inventories begin to be made. In Skara diocese 164 churches date, at least in part, from the Middle Ages. In around sixty of these church attics, complete or partly complete medieval structures were observed. The majority are ascribed to the 12th and 13th centuries (twenty or so have been subject to dendrochronology), whereas only a small group of 12 belong to the 14th and 15th centuries.

A feature common to the 12th- and 13th-century group is the form of the truss, where a substantial tie-beam forms a base for two rafters, a type known from various other European countries at this time. The timbers are sharp-edged, hewn along the grain using a technique called *sprätthuggning*, which was common throughout Scandinavia in the early Middle Ages. The trusses are located roughly half a metre apart. The supposed earliest type is supported by angled strut beams. This type of truss is found in six churches located around the Kinnekulle plateau, along with one church at the Billinge plateau. Kinnekulle was an early centre of ecclesiastical and secular power in the Västergötland region. Surviving roof structures at the churches of Forshem (dated 1131–57) and Götene (dated 1125) feature two struts per truss, whereas reused tie-beams at Våmb church bear witness to at least four strut beams. Struts were often pegged in place. The type is known from Denmark and Germany, although here they are usually lap jointed. A very small surviving group of three structures are in reality purlin roofs, although at first sight they appear to be truss roofs with crossed struts. The three all feature a ridge purlin resting on the masonry gables, with the rafter tops pegged in place, perhaps a fusion of an early domestic post-building tradition and a later, introduced roof-truss concept. Angled-strut roofs and roofs with ridge purlins both have parallels with extant, or partly extant, roof structures in Scania, Småland, Södermanland and Östergötland.

Twenty-three roofs with crossed trusses form the largest cohesive group of medieval roof structures in Skara diocese. Of these, the earliest dated roof is from 1135 at Forsby church; the latest, at Ornunga old church dates from 1247 or later. These structures are characterized by trusses with between two and six crossed strut beams, which are usually lap jointed. This type of truss was probably once quite common in other counties bordering Lake Vättern. The type is also known in Denmark, and one specimen is found in France. These crossed trusses point to a regional timber-building tradition in the Götaland region in the 12th and 13th centuries. Isolated examples of roof trusses with collar beams are known in the diocese too.

All the types discussed here would have been visible components of the church interior: tie-beams have often been given a smooth finish and are sometimes decorated with profiles; ridge beams have decorative profiles; and notches have been cut into tie beams to hang bells. Nail holes and nails on the underside of tie-beams bear witness to later ceiling boards.

Keywords: Medieval roof structures, church architecture, Romanesque roofs, Gothic roofs, medieval churches

4.1.2 Comments on "Västergötlands medeltida kyrkotaklag"

The second article is a presentation and discussion of the survey in Skara diocese. As my first article this also has a focus on typology and the spread in time and space, using distribution maps. The representativeness of the remaining material is discussed. On this basis the lattice truss is put forth as a dominating *classic* type, in my third article called a *standard* or *normative* one. The question of origins is continued from the first article, this time with further international examples from literature. The lattice type is proposed to have evolved to a regional tradition in the provinces around Lake Vättern from the mid-12th century. The use of the terms *Romanesque* and *Gothic* concerning roof structures are questioned since structures of these types lived on after the Middle Ages. The trusses that apply struts with tenon and mortise are suggested as early phenomena, in accordance with the view of Erik Lundberg. This question gets further investigated in my third article, revising and deepening the interpretation. Through the discovery of three roofs being a hybrid between rafter and purlin roofs, I propose these as traces of domestic systems. A discussion on the differences between ridge steering beams and ridge purlins is started, but more profoundly addressed in my third article. The observations of very refined tiebeams fortified the statements of earlier researchers on the lack of ceilings. A knowledge gap is identified concerning the transition from High Medieval to Late Medieval roof structures and the change in techniques.

Also here there are some critical detailed remarks:

- The interpretation of the nave roof in Skälvum church is revised in my third article. (Page 32).
- The decription of the nave roof in Hagebyhöga is based on Sjömar's reconstruction which to part is an interpretation. Visiting Hagebyhöga it was clear that the present rafters, struts and ridge purlin date from an alteration later in the High Middle Ages. It is thus not proved if the original roof structure had a ridge purlin or not. (Page 36).
- The sawn quarter timbers in Lundby old church could later be dated to the early 17th century (Gullbrandsson ed. 2020), but the type of construction is representative of *Gothic* trusses, it could be a *copy* of an older structure. (Page 41).

4.3 Timber roofs from the High Middle Ages in churches of western Sweden – materials, techniques and influences (Vernacular Architecture upcoming)

Timber roofs from the High Middle Ages in churches of western Sweden – materials, techniques and influences

Robin Gullbrandsson[a,b]

[a] Department of Conservation, University of Gothenburg, Gothenburg, Sweden
[b] Museum of Västergötland, Skara, Sweden

This article deals with church roofs from c. 1100–1350 in the west Swedish province of Västergötland. Based on qualitative field studies of joinery and traces of operational processes three different systems in building tiebeam roofs are discussed, beyond existing typologies.

The church roofs of Sweden during the High Middle Ages were part of a European tradition of tiebeam roofs, but show a diversity ranging from structures closely related to continental contemporaries to those with more domestic characteristics. The large corpus of Västergötland illustrates how the techniques of the trussed roof got mixed with domestic know-how in the first stone churches and how the European tiebeam truss grew into a normative and enduring system for church roofs in the region. Meanwhile the innovations of Gothic carpentry took time to get adopted due to the Late Medieval crisis and decline in demand.

Keywords: medieval roof structures; medieval carpentry; typology; tool traces

Introduction

The period 1050–1350, in the wake of Christianization, marked radical changes for Scandinavian societies. Clerical organisation emerged alongside centralized kingdoms with new social structures, changing mentalities, agricultural developments as well as increasing populations. In short, Scandinavia turned European.[1] The well preserved medieval churches of Sweden are sources to this transformation and several retain substantial parts of their original roof structures. Some 160 known roof structures predate the mid-13th century, many in the west Swedish province Västergötland, representing a rare cluster in Europe (Fig. 1). With its corpus of c. 60 roofs, of which half are intact and 48 dated, Västergötland is most appropriate for studies into High Medieval carpentry.[2]

The presence of High Medieval roofs has been known since the early days of Swedish antiquarian research around 1900 with minor studies by Otto Janse, Andreas Lindblom and Sigurd Curman.[3] Their conclusion that the 12th century roofs were originally visible parts of the church interior is still relevant. Curman advocated the view that these roofs were expressions of a meeting between Scandinavian carpentry traditions – especially manifest in Viking Age boatbuilding – and masonry techniques introduced from the Continent. A disciple of Curman, architect Erik Lundberg, instead regarded the Swedish roofs as firmly placed in a European tradition with roots in Late Antiquity and Carolingian times.[4]

The study of historic roof structures has emerged as a vital part of buildings archaeology in Europe since the late 20th century, often linked to dendrochronology.[5] In the 1990s, architect Peter Sjömar proposed a typology for medieval Swedish roofs and pointed at the need of surveys. He introduced a crafts perspective to interpret the work behind the constructions, which he regarded as products of local and regional preconditions such

1 Harrison 2004; Nilsson 2004; Myrdal 2004; Brink 2017; Lindkvist 2020.
2 Gullbrandsson 2021.
3 Janse 1902; Lindblom 1910; Curman 1937.
4 Lundberg 1940 & 1971.
5 Bråthen 1982 & 1995; Binding 1991; Fischer-Kohnert 1999; Bontemps 2002; Hoffsummer (ed.) 2002 & 2011; Épaud 2007; Schöfbeck 2014.

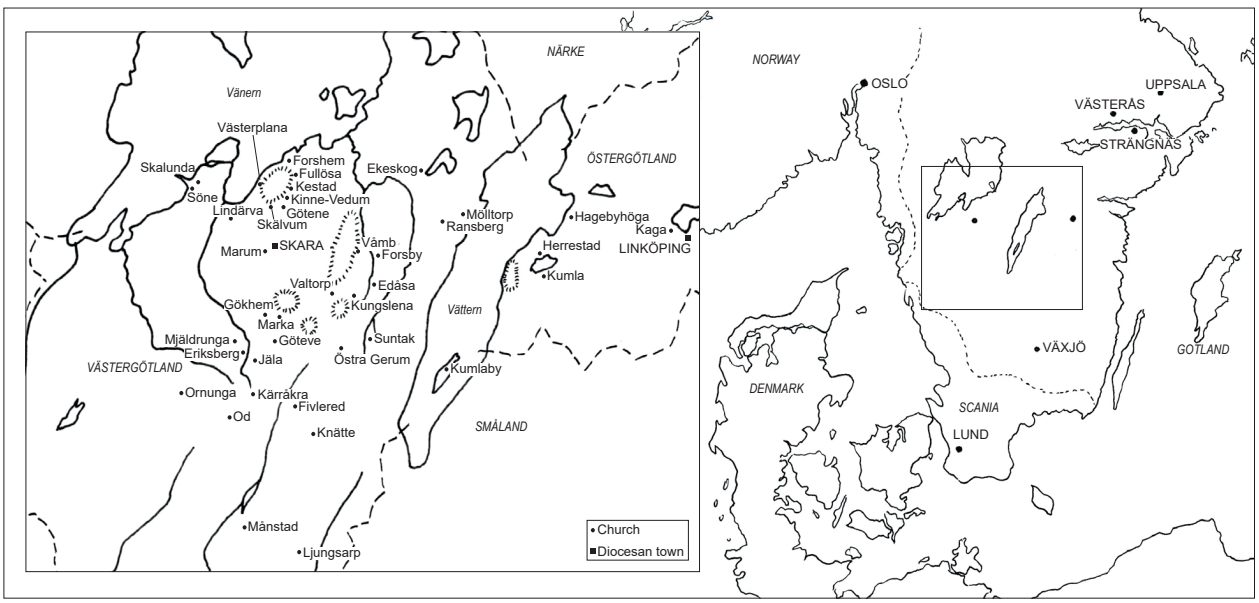


Figure 1. Map of Västergötland and western Östergötland showing the church roofs related in the article. The medieval borders between Norway, Denmark and Sweden are indicated. Map by the author.

as material resources and carpentry traditions.[6] This inspired craft research after 2000, with the reconstruction of a burnt 14th century timber church in Södra Råda, Värmland, as an important driving force.[7] Architect Kristina Linscott refined Sjömar's typology and discussed in her thesis the relation between roof and church interior, based on detailed studies of five 12th century roofs in Västergötland.[8] Still, few Swedish church roofs were sufficiently documented before the start of surveys around 2010, many unrecognized as medieval constructions.

Objectives and approach

The first large scale surveys of medieval roofs in Swedish dioceses began in 2010 and have since provided a wealth of empirical material.[9] This article springs from the author's field surveys in the diocese of Skara, Västergötland, and neighbouring areas as well as qualitative buildings archaeological case studies of 14 churches in the province[10], made in cooperation with craft researcher and carpenter Mattias Hallgren, member of the Södra Råda project. The forensic interpretation of tool traces and the "chaîne opératorie" was an essential part of the investigations, to note variations in techniques.[11] This shaped questions prior to dendrochronological sampling and analysis.

The case studies combined with the research in the Södra Råda project and the advancing state of surveys not only in Sweden, gives reason to new interpretations with regard to typology, techniques and transfer of ideas.

The aim of this article is to examine the diverse applications and features of trussed church roofs in western Sweden during the High Middle Ages, against a European backdrop. A closer reading of joinery, tool traces and operational processes suggests a taxonomy beyond the typologies hitherto used. A development

6 Sjömar 1988, 1992 & 1995 p. 224f.

7 Almevik & Melin 2015 & 2017. https://sodrarada.se/. The craft network "Traditionsbärarna" has made several documentations on historic techniques.

8 Linscott 2007 & 2017.

9 Gothenburg, Linköping (parishes in Småland), Lund, Skara, Strängnäs and Västerås. Växjö started in 2021.

10 Gullbrandsson 2015, 2018 & 2020 (ed.); Gullbrandsson, Hallgren & Hansson 2021.

11 Lemonnier 1986 & 1993; Almevik 2012; Høgseth 2012; Bláha 2013.

is proposed, from a meeting between domestic and borrowed techniques to a normative – with time conservative – system that indicate the presence of specialized church carpenters. Motifs behind some technical choices are discussed.

The author wants to enhance Swedish material as a potential point of reference for international comparisons and bridge the partly opposing views on the material in earlier research. The evidence suggests that the High Medieval Swedish church roofs clearly belong in a European context, albeit with domestic features.

The province of Västergötland

Västergötland, between the lakes Vänern and Vättern, was together with western Östergötland, east of Vättern, key areas of the emerging medieval Swedish kingdom in the 12th century. The central landscapes, shaped by the Cambro-Silurian, have a long prehistoric continuity. Christianity gained a foothold during the late Viking Age and influential families erected stave churches. Here, Skara was the first Swedish diocese to be founded in the early 11th century, but first loosely organized.[12] Access to lime- and sandstone from the plateau hills of Väster- and Östergötland facilitated the building of masonry churches from around 1100, first in crude stone, but from the 1130s also in sandstone ashlars. Present research regard these projects as initiatives by local aristocracy, kings and bishops, initially as private churches, later to become parish churches. Architectural influences have been suggested from Denmark, Westphalia, the Rhineland and Norman territories. In the course of the 12th and 13th centuries a parochial structure took shape, so that the parishioners themselves soon managed the building of churches, first in timber and later stone.[13] In 1234 the structure of parish churches in Västergötland was so dense that some were abolished by papal command.[14] During the 12th century Cistercian monasteries were founded and in the 13th century, mendicant convents in the towns Lödöse and Skara. Around the mid-13th century the royal and clerical power began to centralize to the provinces around Lake Mälaren. This in combination with the Agrarian Crisis and Black Death of the 14th century led to Västergötland gradually losing its former political and religious role. As a frontier to the Danish kingdom it came repeatedly under threat. Few alterations were made to the churches, Gothic traits are rare in comparison to the provinces around Mälaren. The Reformation in the 16th century impoverished the parishes, so that many churches were not altered until the 18th and 19th centuries.

Beyond the common-tiebeam roof – different systems

Medieval trussed roofs have commonly been grouped into "Romanesque" and "Gothic" types regarding the principles of construction. The former apply similar shaped independent trusses with tiebeams, on which the internal bracing takes support, the latter has secondary trusses with sole and ashlar pieces allowing for vaults.[15] Frédéric Épaud has for Normandy pointed at the strong link between roof construction principle and the characteristics of Romanesque respectively Gothic stone architecture.[16] Since Romanesque trusses were used throughout the Middle Ages and later in Scandinavia, the use of such stylistic terms has been questioned.[17] If we label roofs as Romanesque or Gothic, the author means that it should also be in terms of differing sets of techniques.

The major corpus of medieval roofs in Västergötland belong to a widespread European tradition of tiebeam roofs, characteristic for Romanesque churches.[18] Reused tiebeams from the 1060s in Norra Mellby church,

12 Nilsson 2004; Sockenkyrkorna 2008; Tollin 2012; Lindkvist 2020.
13 Claesson 1989; Dahlberg 1998; Nilsson 2004; Sockenkyrkorna 2008; Svanberg 2011; Bonnier 2012; Brink 2016.
14 517 churches are listed in an attachment to the Old Law of Västergötland. Västergötland – landskapets kyrkor 2002, p. 14.
15 Møller 1953; Sjömar 1992 & 1995, p. 207f.; Thelin 2007.
16 Épaud 2007, p. 135f.
17 Madsen 2014, p. 8.
18 Binding 1991; Hoffsummer 2002, p. 264; Épaud 2007, p. 135ff; Courtenay & Alcock 2015.

Figure 2. Ornated steering-beam riding on the rafter tops of Herrestad church, Östergötland. It has a dating post 966 and is reused from an earlier stave church with trussed roof. Photo by the author.

Scania[19], show that trussed roofs were applied in 11th century stave churches in southern Scandinavia. This is also the case with preserved wall plates from the stave church of Hemse on Gotland (1092–1145 d) with trenches for tiebeams.[20] The reused steering beam from a probable stave church (post 966 d) on the ridge in the nave of Herrestad church, Östergötland, shows the existence of coupled rafters (Fig. 2).[21]

In an article on the roof of the convent church Jumièges in Normandy and the tradition of European common-tiebeam roofs, Lynn Courtenay and Nat Alcock sketched a chronological typology for these roofs in medieval Europe.[22] With so much new material being dated and published, their summary remains incomplete, but still gives relevant conclusions on a distribution centred to the former Carolingian Empire. The typology takes as a precondition the internal bracing of the trusses, which comply with the Swedish typology.

The field studies in the diocese of Skara made it clear that some roof structures have features that go beyond existing typologies. Use of joinery, ridge purlins and traces of the operational process implies different co-existing carpentry systems in churches of the region during the 12th century. This material and the features that constitute the proposed different systems will in the following be presented. Contexts and possible reasons behind these solutions will be addressed in the discussion.

19 Melin 2015 & 2017, correspondence.
20 Eckhoff 1914; Almevik, Pärmsten & Sjöholm 2020.
21 Eriksson 2006.
22 Courtenay & Alcock 2015.

Figure 3a&b. Västerplana, nave. Isometric reconstruction of the original trusses (1120s d) and interpretation of rafter foot. Trenches in the tiebeams indicate the presence of a small bell or a cover for the font. Drawings by the author.

Trusses assembled without upper face

The two earliest dated roofs in Västergötland, with substantial remains, differ from the typical High Medieval tiebeam roofs since their trusses rely only on tenon and mortise without dowel for the internal bracing, kept in place only by the weight of the rafters and the outer boards. The trusses are assembled without an upper face and have timber dimensions as well as other features which set them apart from later structures. These roofs, from the 1120s, are found in the churches of Götene and Västerplana by the plateau hill Kinnekulle, wherefrom crude lime- and sandstone was taken for the masonry. The roofs have tiebeam trusses with two canted struts supporting the rafters, the type of bracing regarded as the earliest one in Swedish church roofs.[23]

The small nave and chancel of Västerplana were built in one phase and their roofs retain several original parts (Fig. 3). The oak timbers lack waney edge, but sapwood in some samples gave a felling date between 1120 and 1128. The chancel has only fragments of tiebeams, in the nave they all remain in situ and have a narrow section. Some rafters and one strut are reused. The rafters are boardshaped (c. 7 cm high and 14.5 broad) with mortise for a strut (Fig. 4). None of their end joints are preserved, the tiebeam ends now have an open mortise without dowel. But a rafter on the eastern gable is still in place, standing on a notch across the tiebeam (Fig. 5). A loose tiebeam end from the chancel has a dowel hole and impressions from a flat rafter which probably had a lap joint without halving. The rafters were supported by one canted strut each, also boardshaped, but higher than broad. They stood in shallow mortises on the middle of the tiebeam, where a trench is left from a lost steering-plate (Fig. 6). The internal bracing of the chancel trusses is unknown.

The wall plates of nave and chancel in Götene preserve waney edge dated to 1125 (Fig. 7). The rafters are thicker than in Västerplana but still slightly broader than high. The rafter foot joint has a double notch across the tiebeam, fixed with a dowel from the outside (Fig. 8). This type of joint is unknown among Swedish church roofs, but is a version of the single notch found in Västerplana, adapted for a thicker rafter. The ridge joint is bridled. The canted struts are tenoned into mortises in rafters and tiebeams (Fig. 9); in the chancel only nailed to the bottom of the rafter. The first truss of the nave have lap joints for the struts,

23 Gullbrandsson 2021.

Figure 4. Västerplana nave, flat rafter of oak with mortise for a strut. Photo by the author.

Figure 5. Västerplana, nave, east gable. Rafter foot with a notch on the tiebeam. Note the high hook for the wall plate cog. The bottom of the protruding tiebeam is angled upwards, a characteristic feature in 12th c. roofs. Photo by the author.

this clearly being an alteration in the process due to the presence of a half-made mortise in the tiebeam.

The features of these roofs have a few counterparts in Sweden from the first decades of the 12th century. The undated chancel roof of the nearby small lime stone church in Lindärva has flat rafters with bridled top and lap joints doweled to opposing sides of the

Figure 6. Västerplana nave, tiebeam middle with shallow mortises for struts. The trench for a steering plate is here hidden. Photo by the author.

tiebeam.[24] Just across Lake Vättern, in Östergötland, stands Hagebyhöga church.[25] Its chancel roof (post 1084 d) has flat rafters nailed to a notch on the tiebeam (Fig. 10). The two canted struts are also board-shaped and stand in mortises on the tiebeam, but have lap joints with the rafters, which are halved in the ridge (Fig. 11). The original decorate struts of the somewhat younger, but altered, nave roof (1119–1120 d) stood with a foot in a mortise and had tenon in the top (Fig. 12). The rafter feet have lap joints. On the tiebeams rode three steering plates. Similar are the nave roof of Garde on Gotland (1120s d) and the chancel roof of Torpa in Västmanland (undated but prior to the nave roof dated post 1106 d), both with a centered steering plate.[26] Unlike Västerplana and Götene, the rafter foot with lap joint gives these trusses an upper face. The same techniques were applied in two younger roofs close to Kinnekulle, Söne (1195–1206 d) and Fullösa (1202–1213 d), with two crossing struts and bridled ridge joint, built by a group of carpenters that maintained solutions from the first stone churches in the area.

Some reused tiebeams in Västergötland indicate the presence of further roofs of the same type as Götene and Västerplana, all in small limestone churches in the Cambro-Silurian area. Old tiebeams in Våmb

24 This assembly from opposing sides is stated in the nave roof of Mularp and the chancel roof of Vättlösa, both in Västergötland and undated. Maybe a link between the Götene type and the common trusses assembled with upper face.

25 The church was erected on a presumed royal domain, built of crude limestone as one of the largest Romanesque structures in Östergötland, the chancel predating the nave. see Sjömar 1995; Eriksson 2006.

26 Garde, see Curman 1937; Lundberg 1971; Smith 2004. Torpa, see Skanser 2019.

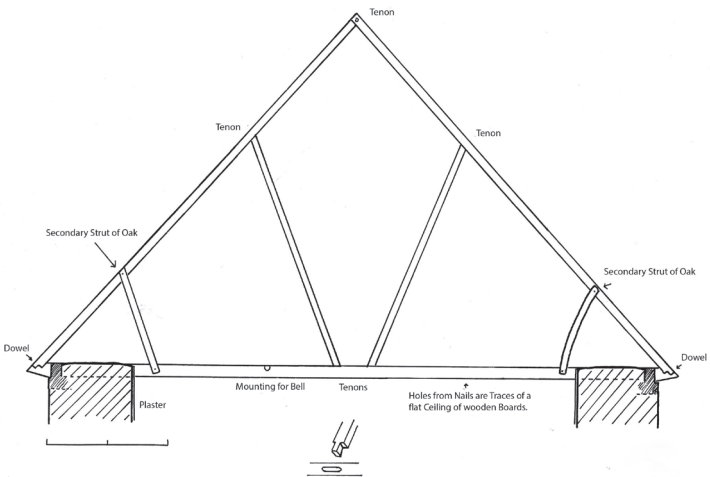


Figure 7a&b. Götene church (1125 d), exterior and section of nave truss. Photo and drawing by the author.

Figure 8. Götene, nave. Rafter foot with double notch and dowel from the outside. Photo by the author.

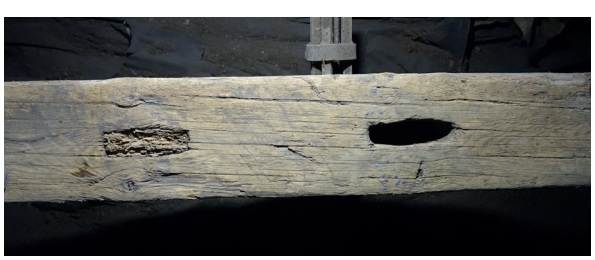


Figure 9. Götene, nave. Mortises for struts ontop of the tiebeams. Photo by the author.

Figure 10. Hagebyhöga, chancel (after 1084 d). The flat rafters meet the tiebeams with a single notch, nailed from the outside. Photo by the author.

(undated) and Östra Gerum (1127–1150 d) have mortises for four canted struts, the former also a trench for a doweled steering-plate. In Scania some reused tiebeams and struts from 12th century indicate the same solution.[27] All mentioned roofs lack carpenters' marks.

The flat rafters in Västerplana and the struts with undoweled tenons suggest that these trusses were not assembled on the ground as a normal frame. The rare trusses of Götene and Västerplana reflect a different operational process and know-how than the large

27 Bjäresjö, Ravlunda, Vitaby, see Melin 2015, 2017.

Figure 11. Hagebyhöga, chancel. The tiebeams are completely embedded in original masonry. The flat rafters are supported by boardshaped struts with tenon in the bottom and nailed lap jont in the top. Photo by the author.

corpus of tiebeam roofs in medieval Sweden. After mounting wall plates and tiebeams on the masonry, the rafters and struts had to be put in place simultaneously, a process facilitated by the notched rafter foot.

Trusses assembled with upper face

Most High Medieval Swedish church roofs have tiebeam trusses with straight lap joints nailed or doweled into an upper face. This is the case in the earliest dated and preserved church roof of medieval Sweden, the nave of Herrestad, 1107–1117 (d), a limestone church in western Östergötland.[28] The low pitched

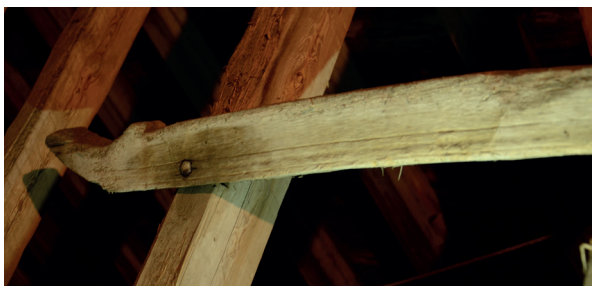


Figure 12. Hagebyhöga, nave. Original strut with decorative foot and mouldings made with plane. Photo by the author.

roof (40°) has sturdy tiebeams with two canted struts of slender proportions supporting each rafter. Rafters and struts are fixed with doweled lap joints in trenches (Fig. 13). Although close in space and time to Hagebyhöga the carpenters at work here had a different know-how, indicating that they came from outside the region. Similar trusses were applied in the church of Kaga (after 1115 respectively 1119 d) in central Östergötland. Reused tiebeams (1060s d) from a stave church in Norra Mellby, Scania, indicate trusses with an upper face.

The oldest dated trusses in Västergötland with lap joints into an upper face belong to the 1130s and show three different types of internal bracing, all churches are situated in the Cambro-Silurian area. Forsby is a small apse church of crude limestone. Its trusses, dated to 1134 (d), have multiple crossing struts with doweled lap joints, in the nave also a steering plate (Fig. 14). From the same decade are the churches of Forshem, Kestad and Skälvum by Kinnekulle, which are the first examples in the province of high quality masonry of sandstone ashlars, which marks the introduction of a truly Romanesque architecture, probably under influence of the cathedral fabric in Skara. Yet the trusses are quite different. The nave trusses of Kestad (1131/32 d) have rafters bridled together, once supported by canted struts with tenon in the top and lap joint in the bottom. The apse church of Skälvum (1134/35 d) boasts the most refined Romanesque stone sculpture in the province, signed "Othelric".[29] Reused timbers in the nave roof show that it had ashlar pieces and

28 Eriksson 2006.

29 Suggested to have been a Westphalian from the cathedral fabric of Lund in Scania, Dahlberg 1998; Svanberg 2011, p. 26.

Figure 13. Herrestad, nave (1107–1117 d). Thin struts with lap joints. The timbers are perfectly boxed and flattened with broadaxe. Photo by the author.

concave collar beam. Whereas the rafter foot had a lap joint, the ashlar pieces stood in shallow mortises with a foot. Both roofs thus show features from the system used in Götene and Västerplana (Fig. 15). The bracing and the concave collar beam correspond to trusses from the 1130s in the chancel of Norra Mellby in Scania.[30] Through its reliefs, the church of Forshem has a connection to the first Romanesque stone cathedral in Skara, finished around 1150.[31] The nave roof is dated 1135–c. 1140. The trusses with canted struts resemble Garde with an external notch on the pitch and rafters thickened at the meeting with the slender struts (Fig. 16 & 17). However, the

Figure 14a. Forsby church (1134 d), exterior. Photo by the author.

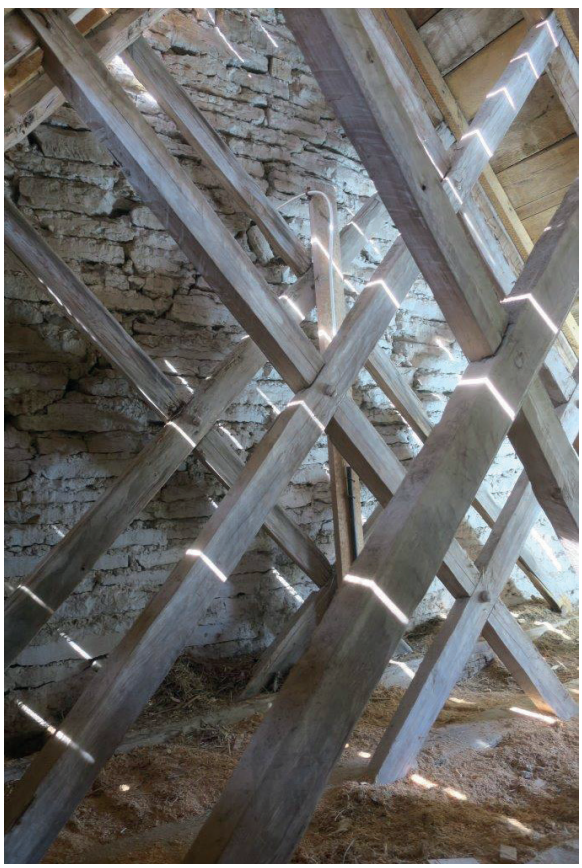


Figure 14b. Forsby, chancel. Trusses with crossing struts, on the upper face finished with plane. Photo by the author.

30 Information and sketches by Petter Jansson and Karl-Magnus Melin.

31 Svanberg 2011, p. 42.

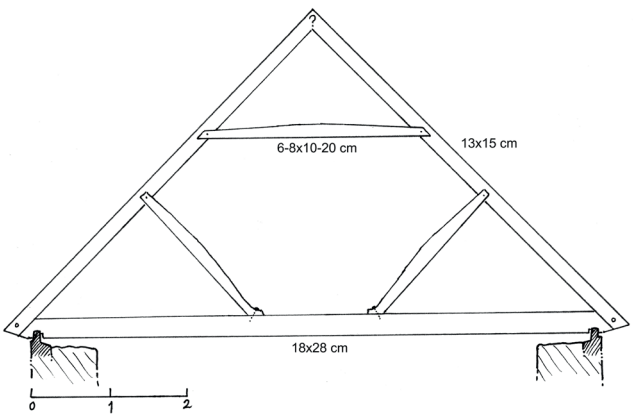


Figure 15a&b. Skälvum church, exterior and reconstruction of original nave trusses (1134/35 d). Photo and drawing by the author.

trusses of Forshem have only lap joints, all of them fixed with iron nails. There are traces of temporary supports for the rafters before the cladding with outer boards. Angled trenches with dowels in wall plates and on the upper side of the rafters testify to this, a circumstantial solution not seen in other roofs, maybe an indication of its novelty. Although these three churches represent the new ashlar masonry technique and were built in a limited space and time, they employed carpenters working with differing solutions.

The truss with crossing struts is the most common type in Västergötland, stated in 43 churches. The simplest version has two crossing struts, the more elaborate four or six, forming a lattice (Fig. 18). The crossing struts give a more even partition of the loads onto the tiebeam and a greater stiffness. Already around 1140, the lattice truss with lap joints seem to have become a norm in the churches of Västergötland. There are variations in the positioning of the struts, whether they meet the rafters on their upper half or more evenly portioned. The pitch varies between 45 and 50 degrees. The lap joints show small differences. All of this reflects a degree of leeway. The trusses have the largest variety in features up until the mid-12th century, such as the use of bridled ridge joint in Göteve (1136–1143 d) (Fig. 19) and Marka (1155/56 d), the decorate struts of Gökhem (1140/41 d) or the more expensive use of nails instead of dowels for fixing the struts. The younger examples are plainer and rather standardized. Lattice trusses were in Västergötland still preferred by the mid-13th century as shown by the example of Ornunga post 1247 (d) (Fig. 20). Late examples from the 15th centuries onwards are clearly modelled on older ones by local carpenters.[32] The lattice truss is represented in the neighbouring provinces of Närke, Småland and Östergötland as well as a few examples around Lake Mälaren and in Scania, where most churches were altered during the Late Middle Ages.[33] In total the type is documented in c. 70 churches in present Sweden. This gives the

32 For example Eriksberg sacristy 1435–1445 d.Gullbrandsson, Hallgren & Hansson 2021.

33 Among the few High Medieval roofs in Närke and adjoining areas east thereof, the solution with struts attached to the rafter with unfixed tenon is at hand, the other rafter joints bridled or lap jointed. Eriksson & Torgén 2016; Skanser 2019.

Figure 16. Forshem, nave roof (1135–c. 1140 d), view from west. Photo by the author.

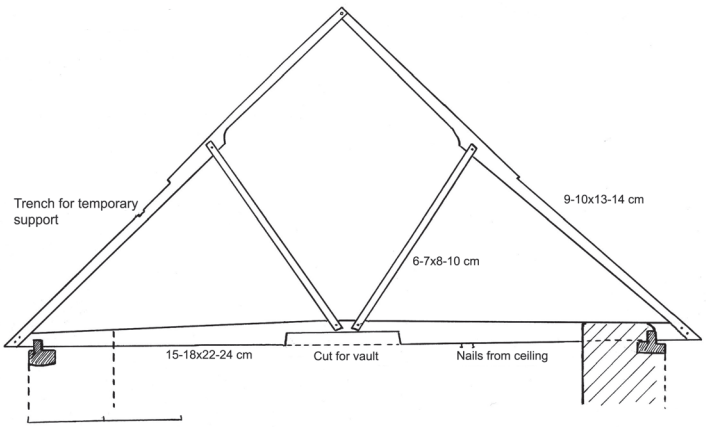
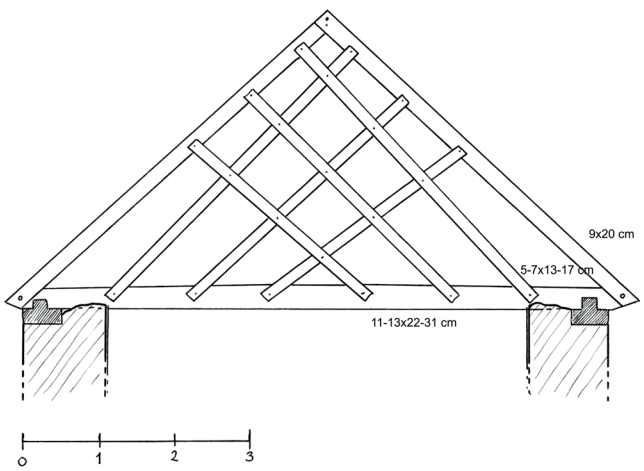


Figure 17. Forshem, nave roof truss, view from west. Drawing by the author.



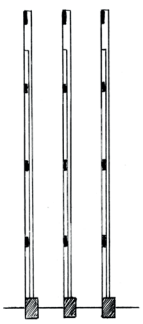


Figure 18. Jäla, nave (1124–1142 d). Reconstruction of the lattice trusses. The timbers are of remarkable thin dimensions and the spacing tight with a cc of 0,4 m. The struts were all nailed. Drawing by the author.

Figure 19. Göteve, chancel (1136–1143 d). Bridled ridge joint (gone apart). Note the carpenter marks in shape of notches which is very rare among Swedish 12th century roofs. Photo by the author.

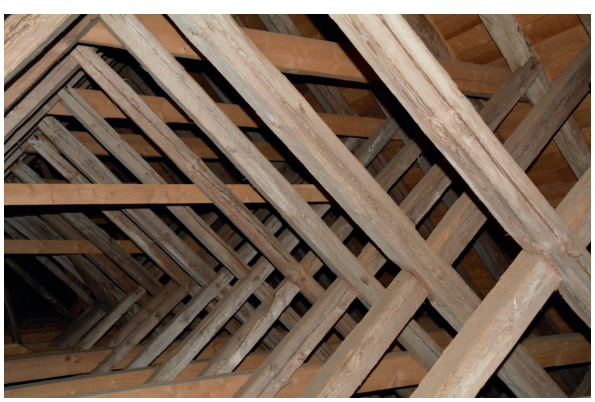


Figure 20. Ornunga, nave roof (post 1247 d). Photo by the author.

Figure 21. Gökhem, nave (1140/41 d). The meeting rafter has been reduced by axe to get it flush with the strut. Photo by the author.

impression of a truss used in all heartlands of medieval Sweden, but concentrated to Västergötland. Other truss types exist, as the ones with collar beam, though these are in 12th century Västergötland only found in four chancel roofs, whereas it was common in neighbouring Småland.[34]

The High Medieval trusses of Sweden in general lack carpenters' marks as well as any trace of template trusses, while the internal bracing is normally not positioned in exactly the same positions from frame to frame. The dimensions of the timbers also vary. Even though each truss is of the same type they were all made independently, but probably laid out on a tracing of the outer triangle. Traces of the processes survive, such as scribing by the joints and axe-cuts on the tiebeams upper face by the joints that stem from the adjustment of the strut lap. The carpenters put much effort into getting tight joints, flush on the upper face, sometimes adjusting the meeting surfaces of the timbers with the axe (Fig. 21). Even if the trusses could have been raised completely assembled, it is more likely that the tiebeams got placed first, providing a good platform for the following erection of the rafters and the final insertion of struts.

Hybrid roofs – early double-framing

An alternate solution to the single-framed roofs existed during the 12th and early 13th century, with features related to the post-and-purlin roofs traceable in excavated Iron Age houses, where the wall was not supposed to support the roof, and timber framed Early Modern farm buildings in the Nordic countries.[35] Thirteen Swedish church roof structures can be classified as hybrids between single-framed tiebeam roofs and roofs carried by a ridge purlin, mainly belonging to the second half of the 12th century and situated in Scania, Småland, Södermanland, Västergötland and Östergötland.[36] This is a double-framing long before the Gothic "Stuhl" came into use in medieval Sweden around 1400.[37] The main structural element is the ridge purlin whose ends rest on either a king post, a normal truss or masonry, in some examples with support in the middle, shaping two bays. The rafters have tenons inserted into the purlin, in the bottom fixed to the side of a tiebeam, while the struts have tenon in one end and lap joint in the other (Fig. 22–24).

The roofs of Eriksberg (nave and chancel 1152–1153 d), Edåsa (nave 1177–1179 d) and Valtorp (nave 1200–1204 d) give insights into the "chaîne opératoire".[38] After mounting the tiebeams, in Edåsa and Valtorp, a centered steering beam was put ontop, together with the wall plates and an infill of masonry securing the beams from racking. The gable crests in all churches are now of stone, but doweled trenches

34 Suntak (probably 1130s d) and Marka (1155/56 d), Söne (1197–1199 d), Vilske-Kleva (undated). Thelin 2006; Gullbrandsson 2014 & 2017.

35 Ágústsson 1975; Näsman 1983; Sjömar 1988, p. 154f; Henriksson 1996; Halfar 1999; Rosberg 2009 & 2013; Kaliff & Mathes 2017; Godal et al 2018.

36 Melin 2015 & 2017; Taawo 2018; Gullbrandsson, Hallgren & Hansson 2021.

37 Bridgettine convent church of Vadstena 1410s (d), Menander & Hallgren 2017.

38 Gullbrandsson & Hallgren 2021.

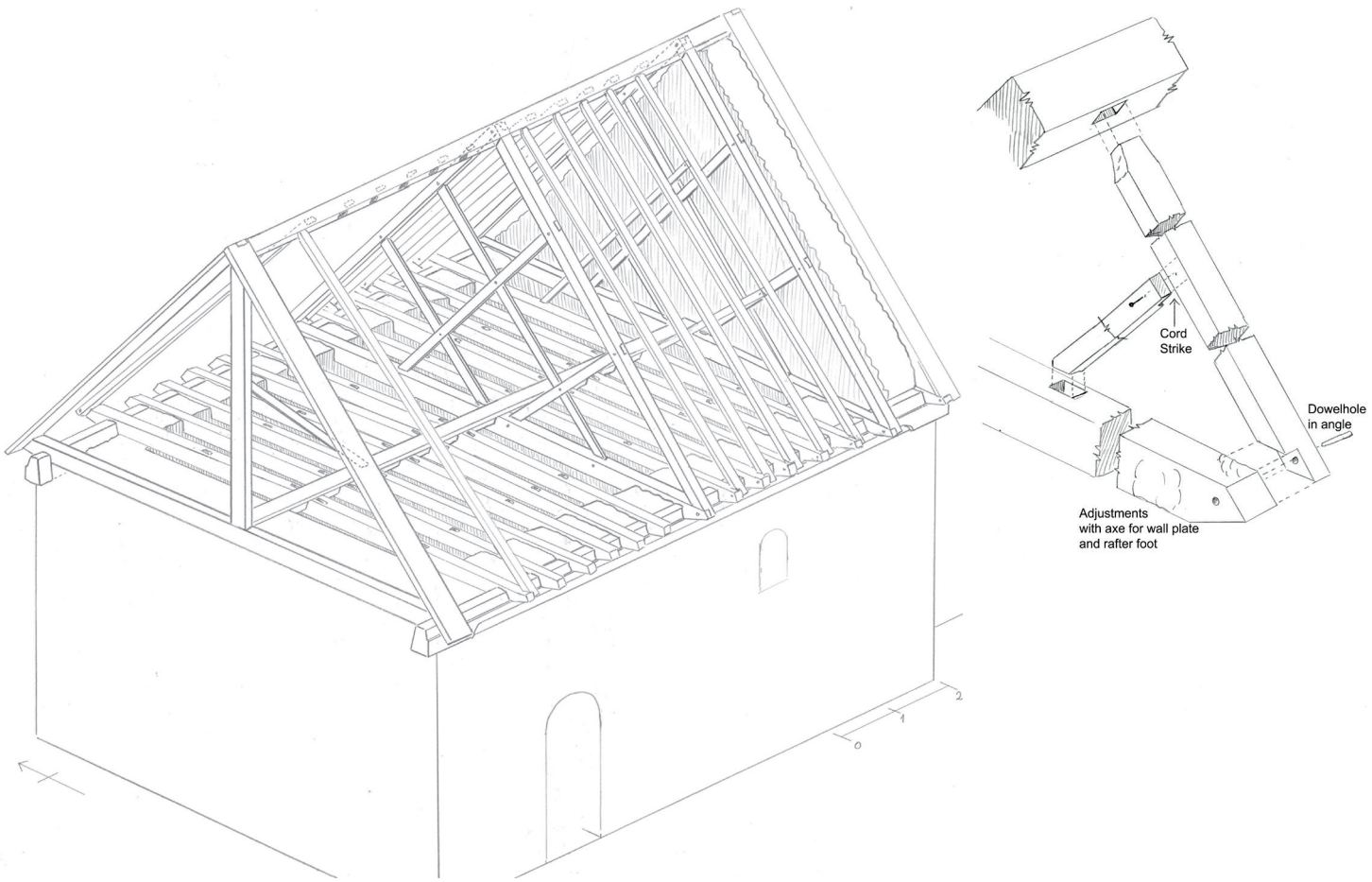


Figure 22. Isometric reconstruction of the nave roof of Valtorp (1200–1204 d) halfway through the building process. The tiebeams mounted, steering-beam laid, king post and two primary trusses erected, ridge purlin mounted, rafters inserted into the purlin and fixed to the tiebeams in the east half, insertion of struts has just started. Drawings by the author.

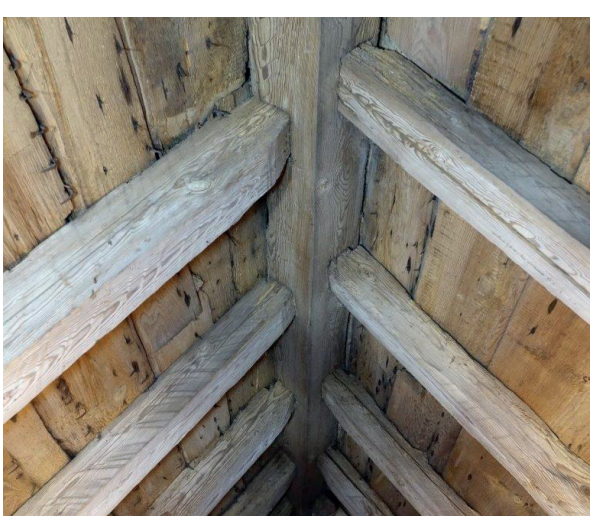


Figure 23. Valtorp, nave. Ridge purlin with rafters put into mortises. Photo by Mattias Hallgren.

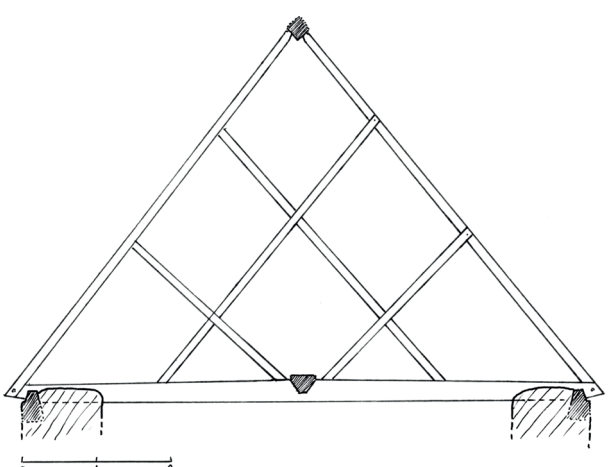


Figure 24. Valtorp, nave. Section of truss. Drawing by the author.

Figure 25. Valtorp, nave. West end of the steering-beam with recess for a brace to an original king post. Photo by the author.

Figure 27. Edåsa, nave (1177–1179 d). The rafters have no trench for the struts, which are simply nailed onto along the impression of a snapped line. Photo by the author.

in tiebeams respectively steering beam indicate braces for now gone king posts (Fig. 25). In the chancel of Eriksberg a brace is still in situ (Fig. 26), the present king post in the nave dates from 1723 (i). In the middle part of the roofs in Edåsa and Valtorp there is a proper truss with upper face and halved lap joints (in Valtorp also by the former east gable). These "primary" trusses and the king posts provided the support for the ridge purlin, pulled up as the next step. In Edåsa and Valtorp the mortises are not in line with each other, making the northern and southern rafters meet with different sides of the tiebeam without halving. After inserting the rafters in the purlin, the sides of the tiebeam end were adjusted by axe to make the rafter foot fit, then secured with a dowel. The four crossing struts stand in shallow mortises on the tiebeams, which are

Figure 26. Eriksberg, chancel. The author shows how the remains of a king post brace in the crest took support on one of the tiebeams. Photo by Mattias Hallgren.

Figure 28. Eriksberg chancel. Rafter with trace of snapping for making the strut mortises. Photo by the author.

placed off centre in correspondence with the rafters, thus joined from different sides. The position of the joint with the rafters has been marked by snapping. To facilitate the fixing of the struts, the rafters have no trench either, the lap joint of the strut is simply nailed onto (Fig. 27). In Eriksberg the procedure was somewhat different. The rafters had already on the ground been snapped with cord for the strut mortises (Fig. 28), the struts were finally lap jointed into the tiebeam.

Gothic carpentry solutions

The advent of Gothic architecture in northern France during the 12th century led to several carpentry innovations, such as the timber saving use of primary and secondary trusses, appropriate for spanning vaults, as well as a more advanced distribution of loads through double-framing.[39] These influences reached medieval Scandinavia very unevenly. Roofs adapted for vaults were built in enlarged churches on the prosperous island of Gotland in the first half of the 13th century, whereas Västergötland has few examples before the mid-14th century and in fact not many more in the Late Middle Ages, contrasting to the situation in the provinces around Lake Mälaren and along the Baltic. Most commonly, adjustments were made by cutting some tiebeams.

The oldest preserved roof of Västergötland without tiebeam in each truss, is found above the vaulted chancel of Forshem (1269 d). The new chancel was influenced by the rebuilt one of the Cistercian monastery church in Varnhem.[40] The secondary trusses in Forshem have sole and ashlar pieces and a collar beam. All joinery is lap jointed with the timbers flush on the upper face, one truss has drilled shallow holes indicating its use as a template (Fig. 29 & 30). The impression is the same in the steep roof (57°) of the late 13th or early 14th century chancel of Knätte, the trusses though having tiebeams and a flat ceiling (Fig. 31). The nave has the old-fashioned lattice trusses but otherwise the same techniques. Similar to Knätte is the hall church roof of Månstad (1340 d) where all the trusses originally had a tiebeam (Fig. 32). This is

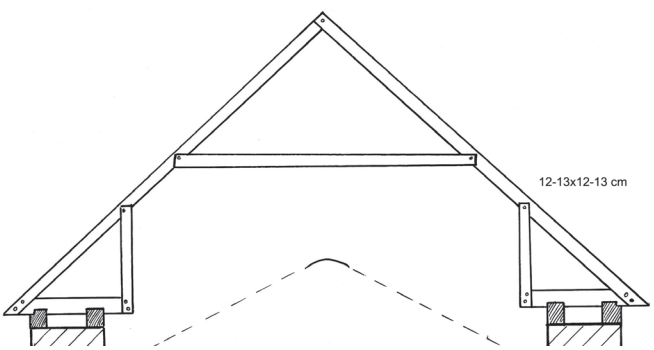


Figure 29. Forshem, chancel (1269 d). Section of secondary truss. Drawing by the author.

Figure 30. Forshem, chancel. Boxed whole timbers of equal size with flush upper side. Photo by the author.

39 Épaud 2007.
40 Dahlberg 1998, p. 106.

Figure 31a&b. Knätte church, exterior and view of chancel roof structure. Photos by the author.

Figure 32. Månstad hall church (1340 d). Roof structure with collar beams and wind braces. Photo by the author.

Figure 33. Månstad hall church. Rafter foot with doweled tenon and mortise. All trusses numbered from the center with carpenters' marks. Photo by the author.

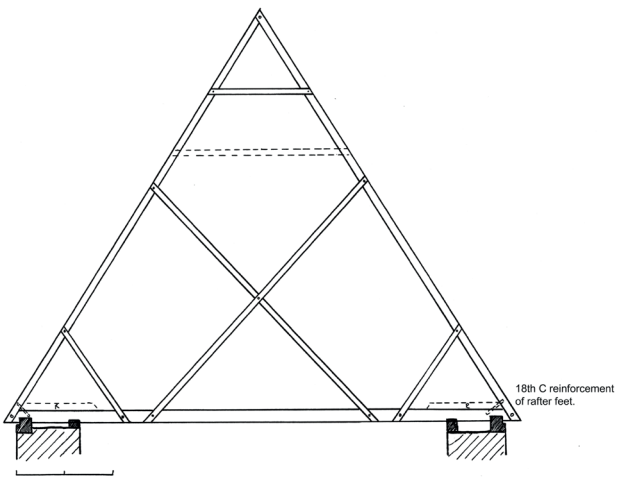


Figure 34. Ransberg, nave. Section of trusses (c. 1360 d). Drawing by the author.

Figure 35. Ransberg, chancel. The trusses are built for the vault but lack inner wall plates. The joints between ashlar and sole pieces are placed according to the rounded shape of the vault. Photo by Mattias Hallgren.

Figure 36. Mölltorp hall church (c. 1379 d). Template truss marked "I" with dovetail joint for scissorbeam, broadaxed surfaces. Photo by the author.

the first dated example in Västergötland of a rafter foot with doweled tenon and mortise, a solution stronger than the simple lap joint (Fig. 33). The doweled open mortise, though, was known in Västergötland since it had been applied as ridge joint in the 12th century and for rafter feet of 13th century tower roofs, but strangely not used for the rafter feet of trusses.[41] Unlike Forshem and Knätte, Månstad has consequent carpenters' marks numbering the tiebeams from the middle truss (X) towards the west (drilled holes) and east (lines). Numbering is also found in the undated roof structure of the prolonged nave in Forsby (notches). A new feature to appear in Månstad are windbraces in order to resist wind pressure.

The steep roof (58°) of the hall church of Ransberg was rebuilt in 1356–1361 (d) after a fire (Fig. 34 & 35). The chancel roof with sole and ashlar pieces and collar beams was made to fit the brick rib vault that survived the fire (probably one of the earliest in the province), but lack inner wall plates and gives the impression of having been built with tiebeams as part of the process. This suggests an uneasiness by the carpenters in handling the presence of the vault, unlike Forshem almost a century earlier where the carpenters knew well how to accommodate it. Curiously, the nave roof with tiebeam in each truss retains original inner wall plates. The trusses for chancel and nave are thin and rank with regard to the steep pitch, the internal bracing was not sufficient since reinforcements were made later on. Evidently, the carpenters could not handle the demands of the new architectural ideals properly. Meanwhile they had adopted the continental

[41] The rafter foot with doweled tenon and mortise was applied in Vallby, Södermanland already by 1134 (d), Taawo 2018. The Swedish tower roofs show similarities in construction to continental tower roofs as in the cathedral of Lisieux, Normandy, and Kloster Schwarzach, Rhine Valley. Tower roof construction could have been a special carpentry field.

way of building on templates, which shows itself in drillholes by the joints of several trusses. Each template was never used more than twice, indicating the production of several trusses simultaneously. Perhaps this explains the absence of carpenters' marks (except for a row of notches in one truss, as in Knätte). The carpenters retained the old-fashioned straight lap joints with dowel, even for the rafter feet. In the neighbouring hall church of Mölltorp the carpenters built a fully up-to-date roof less than 20 years later (1378/79 d), even if all trusses are identical with a tiebeam (Fig. 36). It has double wall plates, a template truss, tenoned and doweled rafter feet, collar and scissor beams fixed to the rafters with dovetail joints, all joints marked with Roman numerals.

Overlapping features

In 12th century Västergötland three interrelated systems in building tiebeam roofs on churches co-existed. Several features are not linked to the choice of system however and raise questions on decision-making and overarching traditions. In the following, the timbers, their dimensions, treatment and spacing as well as the junction between roof and masonry and the use of longitudinal timbers will be examined.

A common feature in 12th century roof structures of medieval Sweden is the often-stated fact that they were originally part of the church interior, due to for example ornate features and arrangements for liturgical bells. How visible the upper parts of the constructions actually were, was dependent on the spacing of the trusses, the position of windows, the time of day and year (Fig. 37). Some churches have small openings in the western gable crest, whereas many lack this, thus making the roof structure obscure. Perhaps this explains the fact that many masonry crests are unplastered, although often with the mortar struck out over the stones, in some rare examples with ashlar imitation (Kinne-Vedum, Vättlösa) or as in Forshem and Skälvum having the same unplastered ashlar masonry as the rest of the interior originally had.

Figure 37. Model of a Romanesque church room with tightly spaced tiebeams (Västergötland's Museum), modelled on Marum. The daylight gives only a diffuse view of the lattice of crossing struts. Note the small bell above the side altar. Photo by the author.

Timbers and dimensions

Dendrochronological samplings in medieval roofs of Västergötland indicate the use of local timber resources.[42] One question is how each roof got its timber, if it came from one forest or different, of shifting species, if felled simultaneously or not. This could indicate if timbers were provided by one landowner or whether all households of the parish had to provide, the latter being the norm in the Early Modern period.[43] In the case of Ransberg the timbers were felled over five years, not reflected by different building phases but rather indicating that all landowners in the parish were providing timber up until the actual construction began. Timbers prior to the 14th century ought to

42 Seim et al. 2015.
43 Almevik & Melin 2017. Also stated in the Norwegian 13th century Frostating Law, Stige 2016, p. 148.

Figure 38. Forsby, chancel. Tight lap joint on tiebeam. Photo by Mattias Hallgren.

Figure 39. The seasoned timbers did not fully suffice for the last truss in Suntak, thus the rafter had to be scarfed. Photo by Mattias Hallgren.

have been more or less dry when assembled[44], since the carpenters have adjusted to deformations of the timbers in shaping the very tight joints (Fig. 38) and sometimes secured to large heart-wood cracks with dowels. The timbers accordingly had to be provided in due time before the carpentry work started, when the size of the church was traced and the needed amount of timbers and their dimensions could be estimated. It the nave roofs of Gökhem, Marka and Suntak the timbers clearly did not fully suffice for the last truss, where the final timber had to be lengthened with a scarfed piece, testifying to a certain amount of delivered and seasoned timbers at hand (Fig. 39). From the 14th century onwards the carpenters began to use green wood, as in Ransberg c. 1360 where mainly rather young and fast grown spruce could be acquired.

The most common species is pine, sometimes spruce. Oak was used for exposed parts as wall plates and ridge pieces, due to finds also for shingles. Trusses made completely of oak are rare, but found around Kinnekulle and the area known as Edsveden, famed for its oak forests according to the 'Old Law of Västergötland'. The 12 m long wall plates of oak in Gökhem testifies to the good availability of straight-grown thick oaks. In some roofs, as in Jäla, a mix of pine and oak indicate different providers of timber. Often the timbers have grown slowly, but there are also examples of rapid-grown pines and spruces, mainly from the 14th century onwards, indicating lack of good timber after the intense church building of previous centuries.

The tiebeams are normally whole timbers given their purpose of holding the rafters together as well as to manage the weight of the roof. The latter determined the height of the beam (from ca 20 to well over 30 cm), which in some churches increase towards the middle of the span, making it more resistant to deformation by the loads transferred by the struts. The internal width of the naves in the first stone churches, though, is modest with c. 5–6 m, Forshem, Götene and Hagebyhöga being the exceptions with over 7 m, the larger widths belonging to churches from c. 1200 onwards.

In comparison to the tiebeams, the rafters of the 12th century are slender, the struts even more so, with Forshem as the most elaborate example. This meant that timbers of different size had to be sought

44 Sjömar 1988, p. 253.

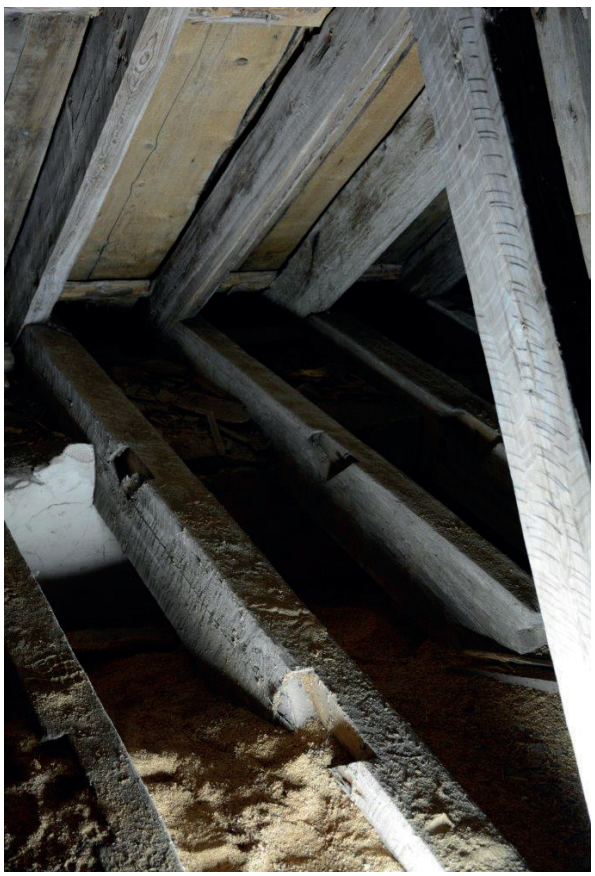


Figure 40. Jäla, nave. Tightly spaced tiebeams embedded in the masonry. The timbers are of a high and thin dimension with the marrow in the middle, here the hewing technique "sprätthuggning" is clearly visible. Photo by the author.

Figure 41. Gökhem, nave. The strut timbers have been heavily reduced to save out the decorate junctions. Photo by the author.

or the timbers cleaved. The carpenters of the 12th century were experienced in cleaving up to as much as eight pieces out of a single log, as in Västerplana, sometimes even sixteen.[45] Perhaps the advanced knowledge of cleaving among Scandinavian carpenters can be explained by the tradition of high quality boatbuilding. The rafters and struts are to a varying degree taller than broad. The timbers in Jäla (1124–1142 d) are exceptionally thin and high, almost plankshaped (Fig. 40). Most pine timbers have the heartwood in the middle and the major part of the timber thus hewn away, while the oak timbers are cleaved from very old and straight trees with slow growth. The timbers of these roofs give an impression of a wish to reduce loads onto the tiebeam, whose strength was vital. In Gökhem, the original height of the strut timbers has been used to shape decorative circles, points and crosses in a way unknown from any other European roof of the time, showing the large amount of wood hewn away to get the final product (Fig. 41).

From c. 1200 the use of whole timbers was preferred as well as larger, more equal dimensions with square section, still there was no need to economize. This can be seen in the 13th and 14th century roofs of Ljungsarp, Ekeskog, Forshem (chancel), Knätte, Månstad and Mölltorp.

45 Such cleaving has been tested in craft experiments, Eriksson & Torgén 2016; Almevik & Melin 2017; Melin 2017.

Figure 42. ”Sprätthuggning” on tiebeam in Kestad nave, 1130s (d). Photo by the author.

Figure 43. Jäla, nave. Tiebeam where the sides have finally been flattened with broadaxe, but retaining the ”sprätthuggning” along the edges. Photo by the author.

Treatment and spacing

A common feature of High Medieval timbers in Sweden is the technique of hewing along the fibres with a knife-ground axe in several stripes, shifting directions. This technique, known as “sprätthuggning”, is a characteristic for boxed timber in Scandinavia, applied until the mid-14th century (Fig. 42).[46] The product is sharpedged without waney, but seldom rectilinear. Many roofs from the first half of the 12th century show yet further treatments, a diversity which later disappears in favour of plain “sprätthuggning”. In Jäla, the sides of several timbers were at last flattened with broadaxe (Fig. 43), without regard to the position in the construction. Probably one of the carpenters did this with the timbers that still had a ridge on the middle after the box-hewing, in order to get a surface flat enough and more rectilinear, which is a pronounced feature of this roof. Since several beams were not treated this way, it is clear that the shape was more important than the choice of axe and technique.

Since the tiebeams were a prominent feature of the interior, their treatment is of special interest. The final hewing with a broadaxe across the fibres on the visible sides of the tiebeam is noted in several roofs from the 12th century, especially before c. 1160 and already in the oldest fragments from c. 1120 (d) in Kungslena. In the nave roof of Gökhem, most tiebeams have this treatment. The struts have been finished with a plane on the upper face, the other sides retain the “sprätthuggning”, also noted in Forsby. The use of the plane marks the importance of the upper face as the front of the truss, in Gökhem reflected in the fact that all face westwards apart from the first two trusses, west of the southern portal.

The broadaxe apparently belonged in the tool boxes of at least some highly skilled carpenters of the 12th century and was also applied during the Viking Age to flatten boards for ships together with the plane.[47] The carpenters at work in Herrestad around 1110 hewed only with the broadaxe, an indication that they were not from the region, whereas the slightly later trusses in nearby Kaga are “sprätthuggna”. The sole hewing with broadaxe did not become common

46 Sjömar 1988; Berg 1989; Storsletten 2002; Carlsson & Nilsson 2006; Melin 2008; Linscott 2017.
47 Juel 1985, p. 38fff.

Figure 44. Ransberg, nave. Late diagonal "sprätthuggning", c. 1360 (d). Photo by the author.

until the second half of the 14th century, in roofs such as Mölltorp. There, the wall plates are "sprätthuggna", the product of different carpenters than those who made the trusses, being the youngest dated example of the technique in Västergötland. The technique disappeared before the end of the century, indicating a rupture in the carpentry traditions of Scandinavia.[48] The late "sprätthuggning" from the second half of the 13th and first half of the 14th century has a different character in being more diagonal across the fibres and not in even stripes, as can be seen in Forshem (1269 d) and Månstad (1340 d) (Fig. 44). In the roof structure of Ransberg we encounter all the different hewing techniques, likely the result of different carpenters with various techniques and axes, which mirrors a craft in transformation.

Figure 45. The bottom of a tiebeam in Våmb, worked with plane and given decorative mouldings along all edges. Photo by the author.

Narrow, rather rectilinear tiebeams are found throughout the 12th century but co-exist with roofs where their section is square or even trapezoid. The sides of the tiebeams in Forshem are slightly rounded, retaining their "belly" and thus all heartwood, still finished with the broadaxe, showing a different ideal than Jäla. As a final touch, the most attractive tiebeams from the first half of the century are worked with plane, some given decorative mouldings along one or several of the edges (Fig. 45). In Gökhem this appears only along the lower edge on the upper face of two tiebeams positioned by a former window in the south. In Od (c. 1140 d) it is on the west side of all tiebeams, while in Västerplana on both sides along the bottom edge, on the reused tiebeams of Våmb along every side as well as on a reused beam from the chancel of Fivlered with traces of enhancing black paint. Such moulding was applied throughout the original nave roof of Hagebyhöga. It appears on the ridge capping of Garde, portals of the early 14th century timber churches of Hammarö and Södra Råda, Värmland, and in several medieval stave churches and vernacular timber buildings in Norway as well as on Viking ship boards, marking it as a Scandinavian feature.[49]

A question addressed by Courtenay & Alcock and Linscott is the tight spacing of trusses in Romanesque churches of medieval Sweden. They found no

48 Sjömar 1995; Storsletten 2002.

49 For example Urnes stave church (c. 1131 d). Berg 1989, p. 74f.; Juel 1985, p. 67.; Storsletten 2002, p. 40f, 317f.

correspondence between the number of trusses, their spacing and the size of the church.[50] The number of trusses over naves varies from 10 to 23 (Hagebyhöga), commonly 13. The inner length of the nave roofs with 10 trusses is c. 7 m (Göteve, Västerplana), for roofs with 18–20 trusses c. 9–11 m (Jäla, Kärråkra, Ljungsarp), hardly motivating the almost double amount of trusses. Among the tightest-spaced roofs with 0.4–0.5 m are Jäla, Kärråkra (1210–1211 d) and Ljungsarp (1205–1207 d). Most High Medieval roof trusses in Västergötland are spaced around 0.5–0.65 m, normally differing a few inches throughout the roof. The spacing corresponds to the most common ell of the Nordic countries, 0.52–0.64 cm, as well as the shorter version of 0.47 cm (1 ½ feet), the same foot used in the Rhineland.[51] A few early roof structures have a somewhat larger spacing of 0.7–0.8 m (Västerplana, Skälvum, chancels of Eriksberg and Forsby). Some structures before 1140 even have a spacing of two ells, 0.8–1 m or more, as in Götene and the nave of Forshem, in Östergötland Hagebyhöga, Herrestad and Kaga. In Götene and Kaga the spacing differs between chancel and nave roof, although built by the same carpenters. According to the reused steering beam of Herrestad, the stave church roof had the same spacing as the present roof. The wall plate of Hemse stave church shows a spacing of slightly more than 1 m. Otherwise this larger spacing reappears in Västergötland first with the chancel roof of Forshem and the hall church roof of Månstad.

The intersection of masonry and roof

Wall plates, how they are joined with the tiebeam and to which extent these timbers are integrated in the masonry show various solutions in Västergötland. The trusses of the 12th and early 13th century all stand on single wall plates placed along the exterior of the wall. Double wall plates appear with the chancel roof in Forshem.

Most 12th century roofs have wall plates with a flat or square base and a high cog. The flat ones, in the shape of an upside-down T (Fig. 46), was mainly

Figure 46. Gökhem, nave. Flat wall plate with high cog, originally put on a flat plastered surface. Note the small notch for an eaves board. The gable crest was made after the erection of the trusses. Photo by the author.

used during the first half of the century. The cog has recesses for the tiebeam, but it differs whether the tiebeam has a hook to take up thrust or not. On tiebeams without a hook the sides are reduced to fit into the trench of the cog. Already the tiebeams from the 1060s in Norra Mellby, Scania, have hooks for cogged wallplates. In Västerplana, the same carpenters applied hooked tiebeams in the nave and ones without in the chancel, maybe due to the lesser span.

Most wall plates have a small notch for the eaves boards, nailed to the upwards angled bottoms of the protruding tiebeams so typical for High Medieval Swedish church roofs. The higher wall plates, as well as the eaves boards, were clearly visible elements in the exterior and could have carved decorations in relief or inscribed lines. The exterior ornamentation of the early stone churches was seemingly limited to the carpentry in a mix of Romanesque and Viking Age styles, often claimed as inherited from the stave churches.[52]

Whereas the high wall plates are integrated in the masonry, the flat ones are placed on top. The flat wall plate has the quality of providing a big surface for friction with the masonry, limiting the need for embedding.[53] The top of the masonry is smoothed

50 Courtenay & Alcock 2015, Linscott 2017.
51 Kulturhistoriskt lexikon för nordisk medeltid, "alen".
52 Lundberg 1940; Karlsson 1976; Sjömar 1995; Ullén 1995, p. 49; Gullbrandsson 2015.
53 Thelin 2006, p. 61.

Figure 47. Hagebyhöga nave (1119–1120 d). View from beneath of the tiebeams with ornate steering-plate. The bottom of the tiebeams have nails and imprints from a later ceiling, predating the Late Medieval vaults. Photo by the author.

with plaster, as in Gökhem and Västerplana.[54] One has relied on the stone walls as a stiff foundation and that the trusses carry themselves. In Gökhem, the plaster was still fresh when the tiebeams were put in, leaving an imprint. The final work of the masons and the raising of the roof by the carpenters were intertwined. This is obvious in the chancel of Forsby where the tiebeams were embedded in masonry and the gable crest raised to final height first after erecting the trusses. Together with the chancel of Kungslena it is one of few examples of wall plates and tiebeams completely embedded in masonry in Västergötland. On the other side of Vättern it is seen in Hagebyhöga and Kaga, where an angled top reaches up to the rafters and is completely plastered. The same is the case in Herrestad and Garde, which both lack wall plates, making the masonry more important. The most common solution in the churches of Västergötland was to embed the tiebeams up to their top towards the interior and plaster the surface in between. The embedded tiebeams shaped a steady junction between walls and roof, but was obviously the matter of choice for carpenters and masons, maybe related to visual impression.

Longitudinal timbers

Several High Medieval church attics in Sweden have preserved, or traces of, longitudinal steering-beams, also named "spacer-" or "locking-beams", riding atop tiebeams, collar beams or ridge, proposed as a Scandinavian speciality (Fig. 47).[55] The feature is documented in 42 churches from Scania in the south to Lake Mälaren in the north, from Halland and Västergötland in the west to Gotland in the east.

54 Hallgren & Gullbrandsson 2018.
55 Courtenay & Alcock 2015; Smith 2004.

They appear as beams or T-shaped plates. The parts between the trusses often have a decorative arch and bulb, a shape encountered in many parts of Europe under different epochs.[56] On the tiebeams the timbers appear single in the centreline, or double, even triple as in the nave of Hagebyhöga. In Småland we also find them on collar beams, in Kumla (1200–1238 d), Östergötland, even riding the intersection of two crossing struts. A ridge-positioned steering-beam cover the rafter joints and resembles a ridge purlin, but without its function, a matter of some confusion in earlier research.[57] The steering-timbers is a more prominent feature in Småland and Östergötland than in Västergötland.

Steering-beams represent a longitudinal support system vaguely resembling the double framing that arrived with Gothic structures. These timbers were in use already in stave churches with trussed roofs as seen in Herrestad. The function resembles a reversed wall plate, securing the trusses in between from racking.[58] In the building process this was surely of use if the tiebeams functioned as a working platform, the plate also serving as a path. In Västerplana the plate also had the function of securing the struts from withdrawing from the tiebeam mortises. Supporting the theory of plates as a method of securing the trusses in between during the building process are the centred recesses on collar beams in Ransberg.

Medieval church roofs of western Sweden in a European context[59]

The blockhewn, sharpedged timbers with smooth surfaces and often a narrow section is a feature in common with the earliest dated church roofs of Germany and Northern France. The differences lies mainly in the hewing techniques. In the continental roofs the broad-axe was the preferred tool to cut across the fibres.[60] Another difference is that in France and Germany green wood was used and preferably one log per timber, while cleaving or sawing seem to become more common first with a need to economize.[61] In Western Sweden, severe shortages of wood are recorded first in the Early Modern period.

Several features of early tiebeam roofs in Northwestern Europe were applied in Västergötland and surroundings, others were unknown or rejected. The flat wall plates with cog and tiebeams with hook are found in German 12th century roofs, the same wall plates are known from Northern France and Belgium from early 11th century and into the 12th century.[62] Completely embedded wall plates and tiebeams appear in some early church roofs in Northwestern Europe, some lack wall plates.[63] The very protruding tiebeam end with angled eave is known from 12th century German roofs. During the 11th century, the dovetail was already applied in parts of France and Belgium, but did not become known in Västergötland until the 14th century, the notched lap joint even later. The rafter foot with doweled tenon and mortise was adopted for trusses quite late. A unique feature of the Swedish corpus is the tight spacing of the trusses. A spacing of the double, 0.8–1.15 m, was the norm in other parts of Scandinavia as well as on the continent.[64]

56 Lundberg 1971.

57 Lundberg 1971; Smith 2004.

58 Smith 2004, Courtenay & Alcock 2015.

59 Binding 1991; Fischer-Kohnert 1999; Bontemps 2002; Hoffsummer (ed.) 2002; Lohrum 2004; Épaud 2007; Hoffsummer (ed.) 2011; Schöfbeck 2014; Courtenay & Alcock 2015. Visits to churches in Baden-Württemberg, Sachsen-Anhalt and Normandy.

60 An example of hewing along the fibres is found in Kloster Schwarzach, the Rhine Valley (late 13th century).

61 Épaud 2007, Schöfbeck 2014, p. 286–294.

62 Early ones in Saint-Dénis, Liège and Saint-Germain-des-Prés, Paris. Épaud 2007, p. 146ff.

63 For example Sankt Lubentius (1166/67 d), Limburg-Dietkirchen, and Sankt Ägidius, Mittelheim, Binding 1991.

64 Épaud 2007, p. 177f. Own measurements in some churches in Baden-Württemberg, Franken and Altmark. Information from Melin on Scania. Storsletten 2002; Madsen 2007.

Figure 48. Sankt Martin, Sindelfingen, nave roof, trusses with canted struts in straight lap joints (1132 d). Photo by the author.

Bracing with canted struts, early on also with a collar beam, fixed with straight lap joints into an upper face is found among early church roofs in the German states of Sachsen-Anhalt (Altmark), Hessen and Baden-Württemberg. The nave roof of Sankt Martin, Sindelfingen (1132 d) is a good example, which might have been visible with regard to the treatment of tiebeams and gable crests (Fig. 48). The many roofs from late 12th and early 13th century in Altmark are versions of trusses with canted struts and often collar beams, built from perfectly boxed and flattened timbers set flush in the upper face and placed on flat wall plates on top of the masonry (Fig. 49). There are variations for example in the application of unfixed tenon and mortise or lap joints.[65] As among the lattice trusses of Västergötland there are small differences in choices concerning joinery and the intersection of wall and roof in a limited region and time. The nave roof of Brechen-Niederbrechen in Hessen (1160 d) is similar to Swedish examples in the sole use of straight lap joints, canted struts put into housed trenches, a narrow tiebeam and masonry rising up to the rafters. In the same state the nave roof of Martinskirche, Dautphe (1088 d), is the oldest

Figure 49. Groß Möhringen, chancel (1171 d), Altmark. Trusses with struts and collar beams, lap jointed. Photo by the author.

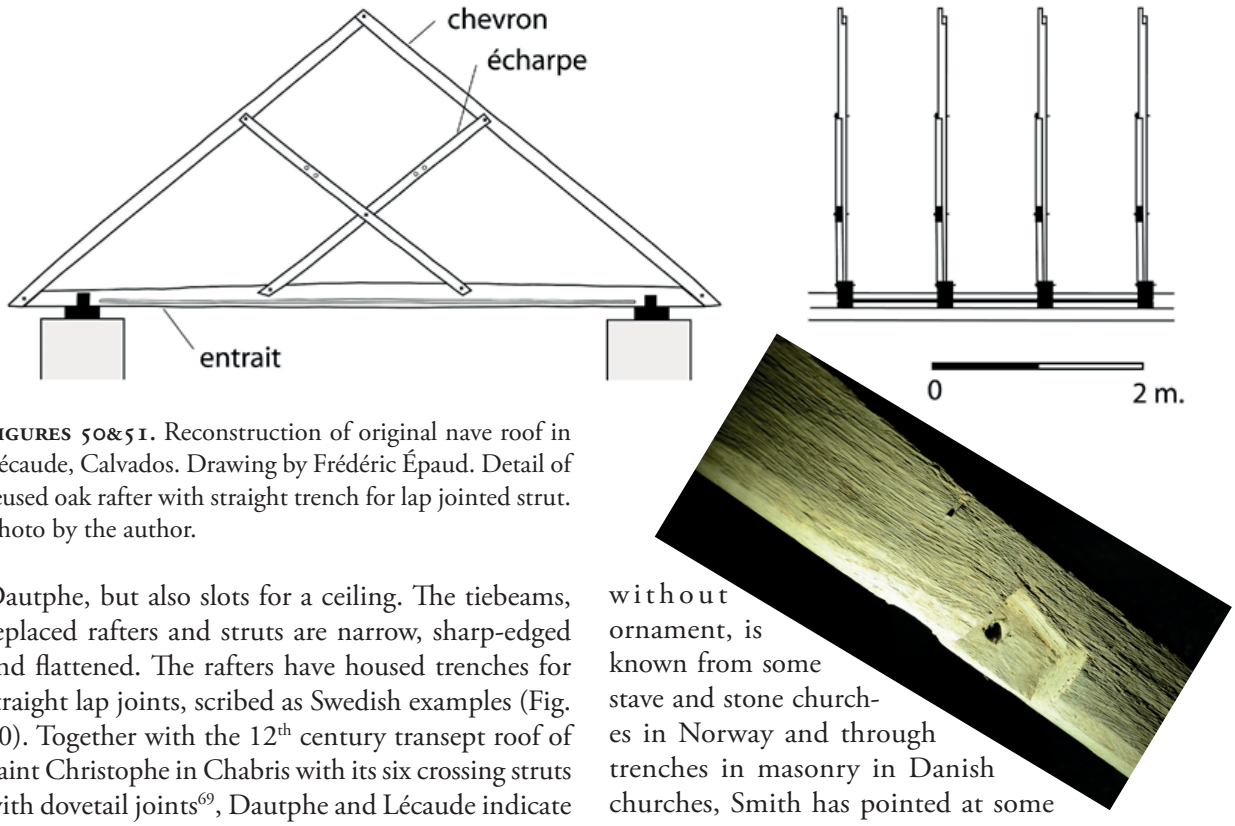
yet-dated roof preserved in Germany.[66] With two crossing struts, rafter feet with lap joint and bridled ridge joint, it resembles the chancel roof of Göteve. Reused tiebeams (1179 d) in the nave of Augsburger Dom also testify to crossing struts and two canted outer ones, all lap jointed.[67] A recently discovered roof structure in the Romanesque church of Lécaude, Calvados, Normandy, has reused timbers from the original trusses, dated between 1044 and 1074.[68] The tiebeams have trenches for two crossing struts as in

65 Excursion with Arbeitskreis Dachwerke 2019 to Berge (1221 d), Groß Möhringen (1171 d), Groß Schwechten (c. 1160 d), Hämerten (1191 d), Insel (1162–1182 d), Schinne (1207 d), Staffelde (1192 d). These roofs have several somewhat younger counterparts in medieval Denmark. Madsen 2007; Gullbrandsson (ed.) 2020.

66 Lohrum 2014.

67 Jahrbuch der bayrischen Denkmalpflege, Band 64/65 2010/2011, p. 20ff.

68 I would like to express my gratitude to Yves Lescroart and Frédéric Épaud for accompanying me to this recently



Figures 50&51. Reconstruction of original nave roof in Lécaude, Calvados. Drawing by Frédéric Épaud. Detail of reused oak rafter with straight trench for lap jointed strut. Photo by the author.

Dautphe, but also slots for a ceiling. The tiebeams, replaced rafters and struts are narrow, sharp-edged and flattened. The rafters have housed trenches for straight lap joints, scribed as Swedish examples (Fig. 50). Together with the 12th century transept roof of Saint Christophe in Chabris with its six crossing struts with dovetail joints[69], Dautphe and Lécaude indicate that the characteristic lattice trusses of Västergötland could well have origins in Northwestern Germany or Northern France.

Few 12th century church roofs structures in Britain are known. The undated tiebeam roof of the Norman ashlar church of Saint John the Baptist in Adel, Yorkshire, is from present knowledge unique with its Scandinavian features.[70] Its trusses with ashlar pieces and collar beam resemble many Swedish, Danish and North German examples and has the same tight spacing as in medieval Sweden (0.64 m). The loose fragment of a T-shaped steering-plate boast the same ornate profile as many Swedish examples, giving testimony to an originally visible roof. The steering-beam, although without ornament, is known from some stave and stone churches in Norway and through trenches in masonry in Danish churches, Smith has pointed at some "locking beams" in Britain and Germany.[71]

The solution of struts kept in place by pressure has a counterpart in Sankt Martin, Neckartailfingen, Baden-Württemberg (1111 d). There the rafter foot is a tenon and mortise without dowel and the lap joints for the struts depend solely on pressure. In Normandy there are traces of roofs from the late 11th and early 12th century where the struts stood in shallow mortises on the tiebeams, but had lap joint with the rafter.[72] For the flat rafters with notched foot the nave roof of Stiftskirche Niederzell (1144/45 d) on Reichenau is an interesting but rare example from Southwestern Germany. It has quite flat rafters with a bridled ridge and a foot notched to the wall

discovered and investigated roof, not yet published.

69 Bontemps 2002; Hoffsummer (ed.) 2011.

70 Chantrell 1887; Smith 2004; Courtenay & Alcock 2015:143. Other tiebeam roofs are Odda's chapel, Deerhurst (c. 1056 d), spacing 0.67 m, nave roof of Ely cathedral (1105–1140 d). St. Mary in Kempley, Gloucestershire, is the oldest intact structure (1128–1132 d), unclear whether it had tiebeams. Courtenay & Alcock 2015, p. 143.

71 Storsletten 2002; Madsen et al 2020; Smith 2004; Godal et al 2018.

72 Épaud 2007:144f. Épaud interprets this joint as younger than the lap joints, prototypes to the gothic ones which are deeper and doweled. The case is reversed in the Swedish material.

plate, the coupled rafters assembled and mounted independent of the tiebeam. Rafters notched to the wall plate is a feature of Norwegian stave churches and traditional barns in "grindbygg".[73] The use of king posts and ridge purlin in combination with rafters and tiebeams is not known in any church outside of Scandinavia, though depicted in "La légende de Saint-Dénis" from the 14th century.[74] The use of purlins in combination with rafters and tiebeams could not have been an unknown phenomena in stone churches of continental Europe. The remains of transept roofs in Münster Mittelzell on Reichenau (1235–1237 d) had multiple purlins combined with rafters and tiebeams. This gives the impression of solutions borrowed from timberframed buildings.[75]

No carpenters' marks or use of template trusses have been encountered in any of the roofs from the first half of 12th century which the author visited in Southwestern Germany. In Neckartailfingen the struts even shift position as in Swedish trusses, showing that they were also made individually. The use of carpenters' marks seems to have become common in northern France already during the 11th century.[76] In Germany the use of carpenters' marks seemingly came into use during the second half of the 12th century as seen in the corpus of Altmark. Template trusses and carpenters' marks reflect changes in the operational processes that became a rule.[77]

From diversity to normativity

Which were the motifs behind the use of a certain system or feature, the adoption, adaption or rejection of new solutions? "Technological choices" have increasingly been discussed by archaeologists and ethnologists. Anthropologist Pierre Lemonnier has stressed the importance of recognizing the options open to the crafts persons and which role their sociocultural context played. A favourable "technical milieu" is a prerequisite for innovation and adoption of new techniques. A technique can have both "primary" and "secondary features", of which the latter can be both functional and "stylistic".[78] The primary features could be connected to what Richard Harris describes as carpentry "languages", different ways of solving a problem, shaping a tradition, which also could mean the rejection of other known solutions.[79] Craft researchers Jon Bojer Godal and Harald Bentz Høgseth have used the term "craft dialects" to define the differing solutions connected to geographical areas, their climate, material resources and building traditions, which accords with Sjömar's view on the High Medieval Swedish roofs.[80] Shifting levels of skill can be read from craft products and a thorough study of a large corpus make it possible to identify a norm or "standard of time" as demonstrated in archaeologist Maikel H. G. Kuijper's thesis on bronze working.[81] The observation and interpretation of traces of craft techniques is a necessary part of these "readings".

73 Lohrum 2004. The rafter foot is also found in Sankt Michael, Büsingen, Lohrum 2016. Urnes (c. 1131 d) is the oldest dated example of the type. Storsletten 2002, p. 317, 362.

74 Binding 1978. Ryde chancel is one of few Danish traces of a ridge purlin. Danmarks kirker. The feature can be traced in two stave churches. Storsletten 2002.

75 Lohrum 2004. In Normandy I noted the use of purlins combined with rafters attached to a wall plate and independent tiebeams on the small timber framed church of Saint-Martin-de-Mesnil-Oury. Some profane medieval timber buildings in Norway have rafters resting on purlins, Godal et al 2018, p. 325.

76 Épaud 2007.

77 Fischer-Kohnert 1999, Épaud 2007, Schöfbeck 2014. The Gothic roof for the vaulted chancel of Kloster Schwarzach (1298/99 d) is built on templates, but lack carpenter marks and inner wall plates, thus reminiscent of Ransberg, and show that there were exceptions from the rules.

78 Lemonnier 1986 & 1993 (ed.).

79 Harris 1989.

80 Godal 2006; Høgseth 2007.

81 Kuijpers 2018.

Shaping a normative language

The widespread European language of tiebeam trusses with lap joints into an upper face is at hand in the first traceable roof of a stave church in Scania of the late 11th century and in the first stone churches of western Östergötland in the 1110s. The oldest preserved trusses in Västergötland, though, were not assembled as normal frames, since the internal supports are only kept in place by pressure. The flat rafters and their notched feet show a know-how different from that of European frame builders. These roof structures, although few, represent a system in itself, rooted in highly developed domestic carpentry traditions, as imitations of what carpenters, patrons or master builders could have seen in existing stone churches during journeys. They knew how it should look but did not have the knowledge of the assembly process, instead relaying on their own methods, creating in a sense a "creole language".[82]

A repertoire of solutions for a trussed roof on a church was getting known among Scandinavian carpenters at least in the decades around 1100, to a large extent features already at hand in churches of Normandy and Western Germany (for example Dautphe and Lécaude). But the combination of features (such as the junction between wall and roof structure, positioning of struts and their joinery etc.), sometimes with domestic traits, might have been an expression of the carpenters' leeway. An explanation to the diversity of the trussed church roofs from the first half of the 12th century in Västergötland and western Östergötland could be the supposed private initiatives behind many of the first stone churches, reflecting diverse networks and ambitions, also differing know-how and openness among the contracted carpenters.

In Västergötland, the first trusses assembled as upper face frames coincide with the introduction of ashlar masonry during the 1130s, marking the presence of experienced stonemasons and a fertile "technical milieu". During the following three decades hundreds of stone churches were built. This led to a huge demand for skilled people and among them several groups of specialized church carpenters with a broad field of action ought to have evolved, long before the presence of guilds. In contrast to the assumed case in Herrestad, these were mainly regional crafts men, visible in the Scandinavian hewing techniques and an inclination for decorum. In short time the framed truss with lap joints into a flush upper face was adopted. Inside this overall language the trusses of the 12th century, especially before its middle, show various dialects or secondary features, which can help distinguish among groups of carpenters.

Around 1200, Västergötland saw a new big wave of stone church building. By this time the diocese had strengthened its control over the church buildings through the more or less accomplished formation of parishes with tithe. The tightly spaced lattice trusses had by then become normative, a carpentry language that was to hold on for more than a century, applied on small timber churches as well as on high status churches built with ashlars by professional stonemasons. Whereas the early trusses show a delicate carpentry with slender dimensions and sometimes decorate traits, the later are heavier, implying standardization and the application by more local carpenters, enlisted by the parishioners themselves. It is likely that already during the 12th century, the most experienced carpenters could not satisfy demand. Decisions on provision of timber were simplified if there was a common norm, especially if all households had to supply timbers. Still each truss was individually made, reflected in shifting positions of the struts and somewhat differing dimensions, expressions of a "workmanship of risk" and not "certainty" which belong to the use of templates.[83] To quote Godal on Norwegian barn building, "every project is a variation on a well-known theme".[84]

Merging of old and new – shaping of hybrids

Beside the standard, a hybrid system survived for at least half a century. Inside the church, these roof structures looked as the norm with tightly spaced lattice trusses. But they represent a different way of thought, applying the well-known processes of building a post-

82 Compare Roede 2001 on the introduction of early modern timber framing in Oslo in terms of "creole".
83 Pye 1968.
84 Godal 2006.

and-purlin roof to the tiebeam roof. The Norse church inauguration sermon "Stavkyrkjepreken", from c. 1200, describes a stave church with purlins carried by small posts on tiebeams, which rest on posts, the church thus divided into bays, whose rafters were fixed to the purlins. The "long timbers" (wall plates and purlins) are interpreted as symbols of "ruling men put to care for and strengthen Christianity, as abbots over the monks or chieftains over the people". But none of the preserved stave churches has such a structure.[85] The description of a stave church in the 'Old Law of Västergötland', written down during the first half of the 13th century, mentions "posts" standing and "ridge" lying. But by 1200 most churches in Västergötland were either built of stone or timbered, both ways with trusses. It has been suggested that the text of 'The Law' only concerns churches built by the parishioners, who were independent peasants.[86] Still, we find the surviving hybrid roofs in stone churches, of which at least Eriksberg shows signs of a mighty patron in its high class murals. The later roofs of Edåsa and Valtorp give a rougher impression with regard to hewing, finish and joinery and could indicate two local groups of carpenters applying a building process they knew well to the new purpose of covering a stone church. The primary trusses, though, show that the carpenters knew how to make a proper framed truss, but regarded their own way as more rational with ready-made parts mounted one by one. These roofs represent a meeting between domestic know-how and the visual aspect of the normative Romanesque church interior with tiebeam trusses. The distribution of hybrid roofs in medieval Sweden indicates that this system was once more common and even existed as an option for specialized church carpenters since in three cases the carpenters at work used the hybrid for the smaller chancel and normal trusses for the nave.[87]

The tight tiebeam roof and its motives

The tight spacing of trusses in Swedish High Medieval roof structures in combination with the assembly of sufficiently dry timbers begs the question who decided on the appearance of the roof in the interior and the motives. The light covering of shingles did not motivate the tight spacing, nor the use of a certain ell of measurement. Was it an expression of wealth and abundance in material? For the nave roof of Gökhem nearly one hundred pines were needed, in Jäla even more. The oldest preserved roof structures in Väster- and Östergötland show the European "standard" in spacing, whereas the tight spacing appears in Västergötland during the 1130s, not so extreme though in other parts of Sweden. Maybe the greater spacing showed a more direct influence from continentally experienced master builders. A spacing less than 0.6 m seems to be a feature limited to Västergötland, which might be interpreted as the builders using the shorter ell. The number of trusses and their internal bracing was a decision which had to be made before the felling, in an early phase of the church building. The decision makers must have known that from each specific log, so many rafters or struts could be split forth. Was this common knowledge? It is possible that a master carpenter was engaged from the start. The primary features (spacing, pitch, bracing, dimensions) were decided by the leaders of the building project, whereas the secondary features were open to the carpenters or negotiated with the customer during the process. Several traces show how the work of masons and carpenters were intertwined, the carpenters were not a group that came "and did their thing" when the masons had left.

The number of trusses affected the visual impression of the church interior as well as the visibility of the roof structure. The tight spacing became a visual ideal in the 12th century churches of Västergötland and the tiebeams blocked much of the view of the rest of the roof structure. The tiebeams ought to have had a

85 Ágústsson 1975, Storsletten 2002, p. 390.

86 Claesson 1989; Wiktorsson 2022.

87 Drev, Småland, has a single framed nave roof (1170s d) and a hybrid chancel roof (recently documented by Hallgren, Melin & Thelin), the same is the case in Bringetofta, Småland (undated), and Furingstad, Östergötland (1160s d). In Bredestad, Småland, only the apse roof is a hybrid (undated). This indicate that the carpenters had knowledge of both systems and choose them when appropriate, in these cases on the smaller roofs.

meaning beyond the static. The means were at hand with good timber resources, skilled carpenters and wealthy landowners willing to demonstrate contacts and status in a time of profound political change. The tight procession of trusses was maybe not so much function as manifestation. As a feature of the international Romanesque stone church, the tiebeams could have been symbols of adherence to European culture. The openness in the older bay-divided post-and-purlin roofs of hall buildings and early stave churches was no longer wanted, still not completely rejected. The tiebeams created a limit and made the roof structure a zone in itself, though connected to the interior, a link to be broken first with the introduction of ceilings, after which the spacing again increased. The ornate ridge-steering beam could be meant as an imitation of the symbolically important ridge purlin of open roofs.

The slow adoption of Gothic carpentry

The strengthening of the church and liturgical reforms during the 13th century coincided with the introduction of new architectural ideals such as the hall church and the insertion of ceilings and later vaults, changing the interiors. Sjömar has suggested that this reflected a will to break with the interiors connected to the phase of clerical consolidation and more domestic ideals.[88] Now the church was no longer dependant on worldly patrons. This coincides with the first adoptions of Gothic solutions. With the first ceilings of boards nailed to the tiebeams during the course of the 13th century (traces noted in most roofs) there was no need for diversified slender dimensions and nice surfaces, even waney appear. The trusses were reduced to function.

Whereas the roof carpentry evolved during the 12th and 13th centuries in Western Europe, the Romanesque way of truss building remained quite unaffected in Västergötland. This was dependent on several facts: there was no need for more churches by the mid-13th century and the seats of power had started to shift towards the provinces around Lake Mälaren. Investment in churches thus declined, limiting the need for specialized carpenters. The agrarian crisis and pestilence of the 14th century was rather the deathblow to the tradition than the reason behind its stagnation. Most churches retained their Romanesque appearance until the vaultings and refurbishments of the late 15th century, which in comparison to other parts of Sweden were limited. This made the need for the innovations of Gothic carpentry small. The use of templates, primary and secondary trusses, the broadaxe as preferred tool, the double framing, the lap joints with dove tail or notch as well as the tenoned and doweled rafter foot were features that needed a long time to become adopted among the carpenters in Västergötland.

Some roofs give the impression of a jump from one technique to another, others show varying degrees of adaption. Some solutions seem to have been unknown whereas others probably were rejected as unnecessary. In the wake and aftermath of the Black Death, the roofs of Månstad and Ransberg are good expressions of this period of transition, Romanesque in overall language with a varying adaption of Gothic carpentry features. It is no coincidence that the first roof structure in Västergötland apt for a vault was erected on a chancel inspired by Cistercian architecture. The roof of Mölltorp hundred years later also had a Cistercian connection through a nearby monastic grange. Such contexts must have been triggers for the introduction and adoption of new solutions.

Conclusion

Twelfth century Västergötland was a good technical milieu with rich material and economical resources as well as advanced knowledge in carpentry when the first stone churches were built. The earliest tiebeam roofs are testimonies of highly skilled carpenters working with established sets of tools and techniques, which mirrors an independence with regard to continental models, rather freely imitated than copied, following a line of assembly of their own. But in short time the building of European tiebeam trusses, assembled with an upper face, got adopted and reached a normative status with the ever increasing rate of church building during the 12th century. This coincided with a strengthened clerical organisation and the fixing of territorial parishes with tithe duty. The homogeneous

88 Sjömar 1995.

character of these structures imply the formation of carpenter crews specialized in church building as well as the existence of a norm for the appearance of the church interior with the tiebeam trusses as important visual element, rooted in an international context. The higher diversity in features of the roofs prior to the mid-12th century could have an explanation in private initiatives behind the first generation of stone churches, thus giving an image of diversified networks and ambitions. The use of seasoned timbers which had to be provided for and the intertwined work of carpenters and masons implies that important decisions on the execution of the roof structure had to be made at an early stage and ought to have involved the patrons of the project as well as master builder and probably also master carpenter. Still, the executing carpenters had some leeway. Hybrids between truss and purlin roofs show that some groups of carpenters preferred sticking to old domestic systems rooted in post-and-purlin constructions, but still they had knowledge of the techniques of the normative truss. Related hybrid features in some continental roofs enhance the Swedish examples as interesting references, which could help in the search for more remnants of this kind.

The High Medieval church roofs of Västergötland fit into an international tradition of Romanesque tiebeam roofs, but show at the same time their own characteristics through assembly of dry timbers, over-dimensioned spacing – which could be regarded as a manifestation of the commissioner – and normative lattice bracing as well as hewing technique and use of steering timbers.

The decline in church projects after the mid-13th century, followed by periods of crisis led to a deterioration of the technical milieu and a slow adoption of the new solutions derived from the Gothic carpentry of the continent. The 12th century must have been seen as a Golden Age of carpentry, at least by the carpenters themselves with regard to the huge amount of prestigious works. That must have created a sense of pride and fortified a tradition among the carpenters, which could be a reason behind the conservatism of decades with decreasing building intensity, where possibilities to adopt new techniques were few or at least seldom motivated.

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Chapter 5
Discussion

The aims of this thesis are: *to structure and analyse the medieval church roofs of Västergötland and Northern Småland with regard to typology; to distinguish key features in the craft of High Medieval church roofs in Västergötland (c. 1100–1350); to position the High Medieval church roofs of Västergötland in a European context.*

The results I will here condense in a summarizing discussion on *what*, *where* and *when* on one hand and *how* and *why* on the other. The discussion will start on how I have structured my empirical material and specify my conclusions thereof. Thereafter I will discuss and put forth conclusions on my interpretations of patterns and variations, *key features*. This relate to the hypothesis of a coherent regional tradition in High Medieval building of roofs on churches. Comparisons are made with Scandinavian and continental material. This leads to a proposed narrative on the building of church roofs in High Medieval Västergötland and possible motives behind the patterns. Finally I will make an excursus into which use this research could have for conservation practices and suggest themes for further research.

5.1 Structuring my material

The structuring of survey results has been central to all articles. What we search for and our pre-knowledge will influence how we treat material. The object of study may in return make us revise our assumptions, especially after repeated visits. What could be grasped during a half day visit during the surveys was just scratching the surface of a wealth of information. Even during the case studies, the roofs kept some of their secrets, maybe to be revealed in a future cleaning and restoration.

5.1.1 Terminology

The articles show my progress in the use of terminology. Terminology is difficult enough inside one language with its diverse dialects, not to speak of different languages. The terminologies of English, French, German and Scandinavian research are not always easily compatible, related to differences in building traditions and research traditions.[1] Names have also changed throughout the historiography. What things originally were called is difficult to trace, but some terms appear in Scandinavian High Medieval Law texts, sermons and Sagas. I have tried to settle for existing terms that grasp both system and appearance of a construction, sometimes I have preferred old terms such as *double-framing* to grasp all roofs with both cross and longitudinal framing.

5.1.2 Typology

Typology is directly linked to terminology. Roof structures can roughly be divided into *trussed rafter roofs* or *purlin roofs*, or a mix of both, into *single-framed* or *double-framed*, into *tiebeam roofs* and *open roofs*.[2] Trusses can be categorized according to their internal bracing, or according to the nature of joinery. One could also choose to focus on the relation between truss and roofing[3] or on spacing, pitch, timber properties, surface treatment *et cetera*. When making an Excel file over the roofs the variables made several orders of structuring possible. As pointed out by Swedish philosopher Bengt Molander, a systematic typology can in itself be regarded as a proper theory (Molander 2022:392).

1 Attempts have been made to bridge this tower of Babylon, recently the multilingual dictionary "Glossary of Prehistoric and Historic Timber Buildings" (Zimmermann & Volmer eds. 2012). From a German horizon "Vorindustrieller Holzbau in Südwestdeutschland. Terminologie und Systematik" (2012) should be mentioned.

2 A good discussion on terminology from a Southwest German horizon is found in Lohrum 2004.

3 For example concerning Norwegian roofs one distinction is how the outer boards are directed and attached (Godal et al. 2018).

Figure 33. Nave roof of Marka church, Västergötland, 1155/56 (d). Individually built lattice trusses.

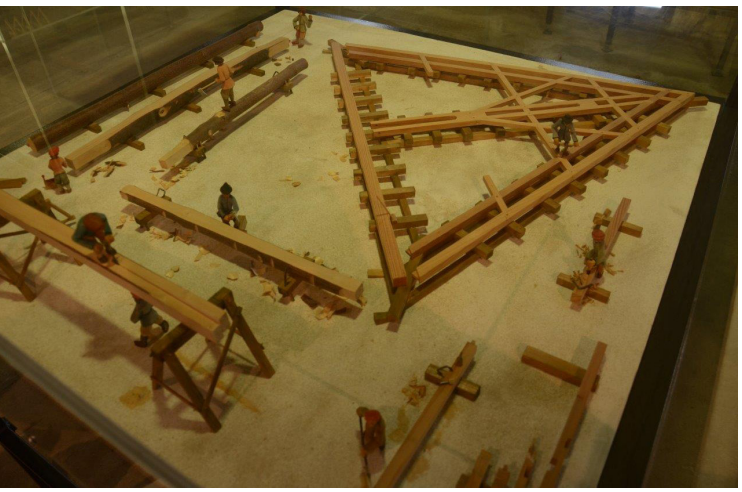


Figure 34. Building of an upper face roof truss on template. All timbers are joined on the upward side. Model in Bauhofstadel, Bad Windsheim.

Earlier researchers have often put stylistic labels from art history (*Romanesque*, *Gothic*, *Renaissance*, *Baroque*) on different types of trusses judging them by their shape. The use of stylistic names has in Scandinavian research on roof structures been questioned (Madsen 2013; Linscott 2017). Earlier research has much focused on sections and shapes. Through my articles I have stepwise distanced myself from a typology of sections as well as the use of stylistic labels. Instead I have increasingly used craft techniques for assessing the material.

We can state that there are sets of techniques and features in roof carpentry that are frequent in churches from the High Medieval period that are referred to as *Romanesque* (c. 1100–1250), some go on, some disappear. Another set of techniques spread with *Gothic* architecture in order to solve new demands, as shown by among others Épaud. These also go on. Many 16th century (and later) roof structures in Sweden are *Romanesque* or *Gothic* since they apply all the techniques connected to medieval carpentry. The increasing empirical material of Europe shows that reality has blurred border zones with mixtures of old and new solutions. The first dated *Gothic* roof structure in Normandy (1144 d), that is without tiebeam and built on template, is placed on the nave of the contemporary, exquisitely Norman Romanesque church of Sainte-Marie-aux-Anglais, not motivated by any presence of stone vaults (Épaud 2007). We have seen 12th century church roof trusses in Sweden borrowing features from purlin roofs and post-and-plank building. Not only the development of stone architecture influenced how roof structures were made on masonry churches. Researchers as Schöfbeck have argued that material resources contributed as much as architectural demands to the evolution of different roof structures. My research has strengthened an image where the evolutionary path of roof structures was rather winding than straight and governed by several factors.

In discussing High Medieval roof structures I have sought to group them according to their systems of building, if trusses are assembled as upper-face-frames or not, if they are individually built or made on template, if linked by longitudinal timbers or not. This distinction grew forth with the case studies. It gave an entry to the spread and implication of carpentry novelties in the framework of church building as well as the endurance of possibly domestic techniques and features.

It has not been my intent to create a whole new typology, rather to elaborate the typologies created for the Swedish material by Sjömar and Linscott as well as the European typologies by Hoffsummer and Courtenay & Alcock. Although Hoffsummer in his very thorough typology over French and Belgian roofs included the longitudinal section of the structures as a matter of order (not only for double-framed roofs), grouping is focused upon the elements of the cross section. For several High Medieval Swedish roof structures such an approach does not grasp their complexity, actually a roof truss with lattice struts could in some cases have more in common with a roof truss with canted struts than the other ones with lattice. I have in my research gone from the two dimensional section to a view in perspective, noting the importance of differences in joinery. Tiebeam trusses could as well – or maybe better – be grouped according to whether they were assembled with an upper face or not. This notion underline the diversity of 12th century roof structures stated by Linscott. An apparent example is a group of tiebeam roofs where the rafter tops are inserted into a ridge purlin, thus being both trussed

rafter roof and a purlin roof. Consequently, I have chosen to enlarge or deepen the existing typology with tiebeam trusses assembled without upper face and a related hybrid of trussed tiebeam and purlin roof. These categories take no regard of whether the internal bracing is canted struts or lattice, what matters is the joinery that gives testimony to another way of assembly than the normative upper face tiebeam truss of European kind, which is regarded as a category in its own. Another way of structuring that I have used is whether the trusses are individually built or built on template.

It can be concluded that it is risky to build typologies on second and third hand information, especially if this is just a section drawing. The existence of three different, though interrelated, systems for building roof structures on churches in 12th century Götaland could hardly have been noticed with less than visiting and scrutinizing what was actually at hand in the attics. Being there, measuring, seeing, feeling, meant a growing knowledge through on-site-practice, learning from the historic constructions. Some observations of features needed repeated visits to understand. Some features revealed themselves more or less by accident due to the light falling in a certain angle.[4] Some features became visible through decay or in the process of restoration such as the imprint of a tiebeam in fresh plaster on the masonry top in Gökhem, stating the intertwined nature of the work by masons and carpenters. The strange dimensions and joinery of Götene and Västerplana got clearer when recognizing the same features in Hagebyhöga chancel, indicating a different line of assembly and thought compared to the normal upper face tiebeam trusses in neighbouring churches. My research has thus been a hermeneutical and abductive process of knowledge production.

5.1.3 Conclusions on typology, distribution and dating

• The oldest dated church trusses in Västergötland are from the 1120s, these are *tiebeam trusses with canted struts* but they are *not assembled with an upper face*.

Figure 35. Impression of a tiebeam with marrow cracks, placed in fresh mortar during the building of the nave in Gökhem around 1140. Photo: Mattias Hallgren.

No later evidence of this technique has hitherto been found in the province.

• The oldest dated *tiebeam trusses assembled with upper face* in Västergötland are found in churches from the 1130s (in Östergötland in the 1110s in Herrestad, in Scania already in late 11th century), these have already in this decade different internal bracings: *canted struts* (Forshem), *ashlar struts and collar beam* (Skälvum), *lattice struts* (Forsby).

• From the 1140s and up until the mid-13thcentury *tiebeam trusses with lattice struts* dominate the material from Västergötland. It is documented in 43 of in total c. 60 cases, thus c. 75% of the preserved or traceable High Medieval roofs. These 43 cases represent a bit less than 10% of all medieval churches that once existed in the province. It is probable that the present distribution of the lattice truss reflects how common it was in the Middle Ages. The type was copied as late as in the 15th and even 18th centuries. It is at hand in other parts of medieval Götaland but to a lesser degree.

• *Collar beam trusses* are few in Västergötland, mainly found on chancels, the oldest are dated to the

[4] Such a feature were the thinly scribed centrelines on some tiebeams in Gökhem, a feature that we somewhat later discovered on some tiebeams on revisiting Götene and Kumlaby. Since this feature has not yet been consciously searched for in other roofs, it was thus not discussed in the third article.

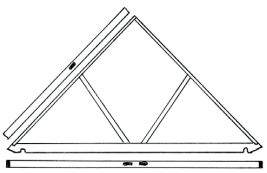
EUROPEAN COMMON-TIEBEAM-ROOFS
11th & 12th C. France & Germany

TRUSSES ASSEMBLED WITHOUT UPPER FACE

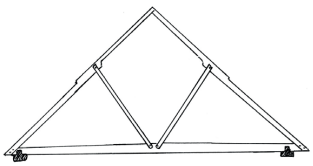
TRUSSES ASSEMBLED WITH UPPER FACE
(lap joints)

1100

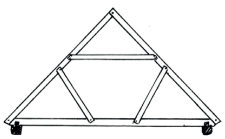
Domestic building traditions



Truss with canted struts assembled with tenon and mortise, notched rafter foot.
Götene 1125(d)
Västerplana 1120s(d)



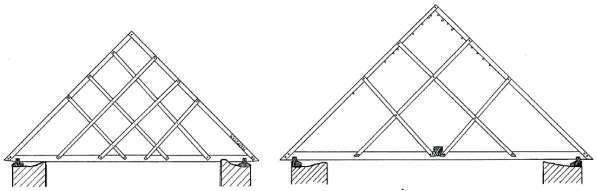
Truss with canted struts
Forshem 1135-40(d)
Herrestad, Ögl 1107-17(d)



Truss with collarbeam and struts
Skälvum 1134/35(d),
Marka (chancel)
1155/56(d)

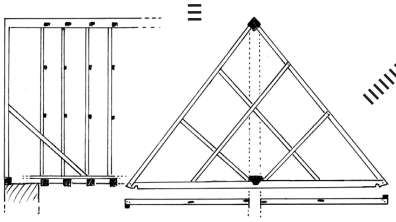
1150

Domestic post-and-plank buildings with purlins on posts

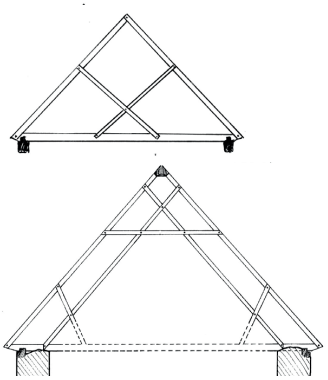


Normative lattice truss
Jäla 1124-42(d), Forsby 1134(d), Göteve 1136-43(d), Gökhem 1140/41(d), Marum 1140s(d), Od 1140/50s(d), Skalunda 1140s(d), Marka (nave) 1155/56(d), Kinne-Vedum 1186-88(d), Mjäldrunga early 13th C(d), Kärråkra 1210/11(d), Ekeskog 1247/48(d), Ornunga 1250/60s(d).

1200



Hybrid of trussed tiebeam roof and roof with ridge purlin on posts
Eriksberg 1152-53(d)
Edåsa c. 1177-79(d)
Valtorp c. 1200-04(d)



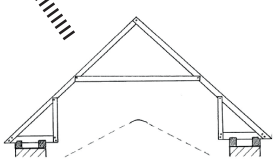
East-Norwegian truss
Ljungsarp 1205-07(d)

EUROPEAN GOTHIC CARPENTRY
12th & 13th C. France & Germany

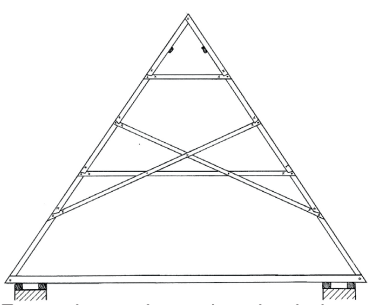
1250

1300

1350



Primary (tiebeam) and secondary trusses (sole and ashlar pieces) adapted for vaults (template built)
Forshem (chancel) 1269(d)
Ransberg 1356-60(d)



Truss with scissorbeams (template built with carpenter's marks)
Mölltorp 1378/79(d)

1150s (Marka). They are more common in Northern Småland, only Kumlaby has been dated there, to around 1150. Some structures have collar beam trusses with additional bracings of small struts or queen posts. The diversity of truss types in Northern Småland do not testify to a ruling *standard* as Västergötland.

• An anomaly in Västergötland are the *East Norwegian trusses* in Ljungsarp from early 13th century.

• From the mid-12th century up until c. 1200 a small amount of churches in Västergötland have *hybrid roof structures* that *combine tiebeam trusses and a ridge purlin*. Such have also been documented in Småland, Södermanland, Östergötland and as fragments in Scania, most of those yet dated belong to the same time span as the ones in Västergötland.

• *Trusses adapted for vaults* (with primary and secondary trusses) are in Västergötland first found during the second half of the 13th century (Forshem chancel), but few are known. Most vaults are Late Medieval and usually some of the old tiebeams were cut to accomodate them. The province has few church roofs from the Late Middle Ages, most notably by Lake Vättern, which are built with tiebeams on template, with collar beams and in one case scissor beams. In Northern Småland there are a few examples of Late Medieval roof structures adapted for vaults, among them one example of *double framing* with *Stuhl* which might be early modern.

5.2 Patterns and variations

In the following I will discuss features of High Medieval roof structures from churches in Västergötland and their relation to each other, as well as to material from other regions and countries. The surveys and case studies provide a foundation for a discssion of techniques and traditions in time and space, the aim of my third article. Close reading of roof structures in cooperation with craft researchers have identified *key features*, often not linked to just one system. Key features in this respect are: *selection and scantling of timber, dimensioning and spacing, manner of surface treatment, joinery/assembly, the use of longitudinal framing elements*.

5.2.1 Tradition and diversity

A hypothesis put forth in my first two articles was that there are traces of a coherent carpentry tradition in churches around Lake Vättern. In the third article I suggest that a tradition in roof carpentry took shape during the 12th century and continued through the 13th century, sometimes longer, withstanding many of the innovations that spread with Gothic architecture. It is also asked how this tradition took shape.

There are key features in the material from Västergötland that indicate an overarching carpentry tradition or *language*, which is also present in neighbouring Scandinavian regions. But there is a wide array of variation or *dialects* inside this tradition, for example in the use of different assembly systems. These variations are in Västergötland most common up until the mid-12th century and disappear more or less after c. 1200. All are tiebeam roofs on more or less pronounced Romanesque masonry structures in the central parts of the province. It is notable that the same team of carpenters could alternate between solutions in one church project as shown in for example Götene and Västerplana. In Northern Småland the variation is also notable, but this is not discussed here due to few dendrochronological dates.

Key features in church roof structures of Västergötland c. 1120–1150/1200:

• Multiple techniques in the finish of timbers, most notably on the tiebeams with additional broadaxe hewing to attain flat and smooth surfaces, sometimes also worked with plane and moulded.

• Timbers hewn to a narrow section (diversity of tiebeam shapes), rafters and struts are often cleaved, normally little or no sapwood.

• Flat wall plates with cog.

• Examples of trusses assembled without upper face.

• Different variants of inner bracing (canted struts, lattice, collar beam).

• Examples of tenon and mortise without dowel, an early alternative to the lap joint.

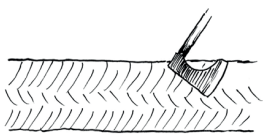
5.2.2 Tradition and normativity

Tiebeam trusses braced with a lattice of struts turned into a normative way of building church roofs in Västergötland around the mid-12th century. This type

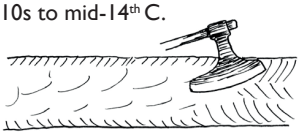
Table 4. Typological scheme over High Medieval roof structures in churches of Västergötland. Drawings by the author

KEY FEATURES IN MEDIEVAL CHURCH ROOFS OF VÄSTERGÖTLAND

TOOLMARKS ON SURFACES

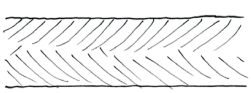


”Sprätthuggning”
1110s to mid-14th C.



”Sprätthuggning” and flattening with broadaxe 1120s-1150s

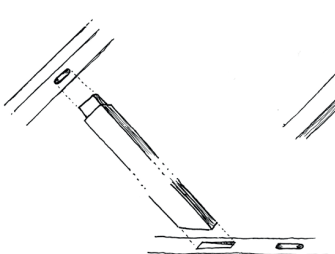
Surface worked with plane, occasional mouldings, 1120s-1140s



Diagonal ”sprätthuggning”
mid-13th C-mid-14th C

Sole use of broadaxe
mid-14th C onward

Inner bracing



Tenon and mortise. 12th C.

SCANTLING

Tiebeams

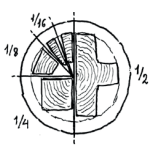
Jäla 1124-42(d)
(25x10-15 cm)

Forshem 1135-40(d)
(25x15/18 cm)

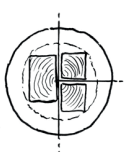
Mularp 12th C
(27x17/14 cm)

Kinne-Vedum 1180s(d)
(18x17 cm)

Late Medieval and Post Medieval often with vaney.

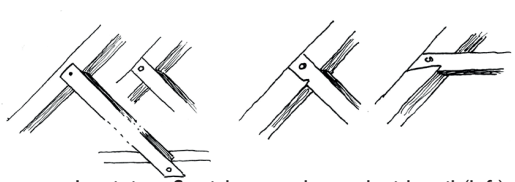


Cleaved old and straight oaks (wall plates, rafters and struts). No sapwood. 1st half of 12th C.

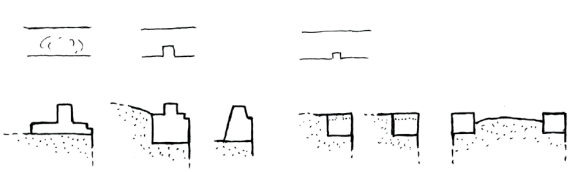


Cleaved old and straight fir (rafters and struts). No sapwood. 12th C.

Boxed whole timbers of younger fir (pine and spruce) throughout the roof. 13th and 14th C. With time often sapwood.



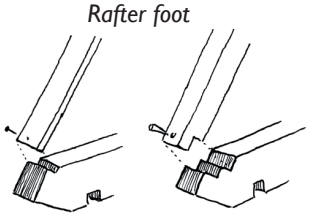
Lap joints. Straight ones: housed with nail (left) 12th C, crossing with dowel 12th-mid-14th C. With notch 15th and 16th C. With dovetail late 14th C onward.



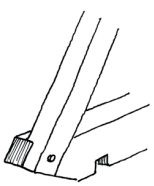
Examples of wallplates. From the left: 12th C (flat and high with cog), c. 1200, rectangular 13th C, double 14th C onward.

ASSEMBLIES

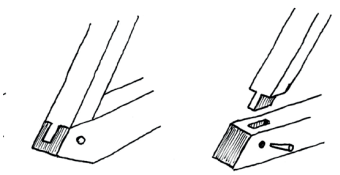
Rafter foot



Rafter notched to tiebeam. 1120s.

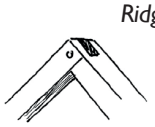


Lap joint. 1130s until mid-14th C.



Open tenon and mortise (left), 13th C (tower roofs) and onwards. Tenon and mortise, mid-14th C onward.

Ridge



Bridled. Mainly 12th C.

Half in half lap joint. 1130s onward.

Ridge purlin.
1150s-c. 1200.

RG-22

was with some variations in techniques known and applied in most of what in the High Middle Ages were the heartlands of the Swedish kingdom: Väster- and Östergötland, Småland, Närke, Södermanland, Västmanland and Uppland. Also in Danish Scania the truss type existed. The impression of being a *standard of the time* is with regard to the corpus strongest in Västergötland, other provinces show larger variation or low degree of preservation. How ideas were transferred is hard to tell, probably much dependent on networks of builders and patrons as well as the resources at hand. Maybe an increasingly consolidated church played a part, giving directions from the diocese centre. An expression for the quite large leeway inside this tradition are the hybrids with ridge purlin, which have a distribution similar to the normal upper face trusses with lattice struts. Here a solution from vernacular timber building in post and plank technique has merged with the row of tiebeam trusses to a *creole* construction or hybrid, obviously a part of the repertoire for at least some groups of carpenters working in churches. The hybrids in Västergötland and other provinces ought to be further examined to understand variations in this system and why it was chosen.

Key features in the "standard" church roof structure in Västergötland c. 1140–1250:

- Trusses with lattice struts, assembled with straight doweled lap joints in an upper face, in the early ones fixed with wrought iron nails.
- In the 13th century a tendency towards more standardized dimensions and use of full timbers throughout the structure.
- Timbers square hewn in *sprätthuggning* technique without subsequent treatments.
- Trusses spaced with c. one ell.

5.2.3 The High Medieval roofs of Västergötland in European comparison

The normative timber roof of 12th and 13th century churches in Västergötland was firmly rooted in a European context where churches and other monumental buildings since long had roofs with tiebeam trusses assembled as upper face frames. What then in the High Medieval roofs I have studied is actually domestic or Scandinavian?

The earliest preserved remains of trusses in Västergötland show a blend of European carpentry and what ought to be domestic techniques. The carpenters at work in building the churches of Götene and Västerplana by Kinnekulle in the 1120s and the chancel of Hagebyhöga across Vättern more or less at the same time, applied flat rafters from domestic timber building tradition to a tiebeam truss, neglecting its assembly as a frame with an upper-face. The carpenters applied the joint between rafter and wall plate in vernacular building to a tiebeam crossing the room. This is my interpretation in the light of features in Norwegian stave churches[5] and vernacular timber buildings from the High Middle Ages[6] and Early Modern Period[7] as well as observations in churches on Reichenau in Lake Constance[8] (which indicate timber building tradition fusion also in this part of Europe). The somewhat earlier trusses at Herrestad, Östergötland, (1110s d) and Norra Mellby, Scania, (1060s d) show that proper *European* tiebeam trusses assembled with upper face were being built at the same time in Sweden and even earlier in Denmark. Thus, in the early stone churches in Götaland there was a variation in carpentry tradition, with on one hand close adherence to continental practice and on the other hand groups of carpenters that adapted parts of the continental practice, or rather imitated using their own traditional knowledge and skills.

Early 12th century roofs in Baden-Württemberg, the remains of a 11th century roof in Lécaude, Normandy, and a pair of 11th century roofs in Westphalia have a

5 Many stave church roofs are in effect double-framed with root knees, small purlins and wind braces supporting the few trusses whose rafter feet just stand in notches on the wall plates, for example Hegge (c. 1216 d), Høre (c. 1179 d) and Urnes (1130s d).

6 For example Raulstadloftet (1230 d), Norsk folkemuseum.

7 For example barns in post-and-plank construction, see Henriksson 1996.

8 Foremost Stiftskirche Niederzell (1144/45 d).

Table 5. Schematic presentation of key features in medieval church roofs of Västergötland. Drawings by the author.

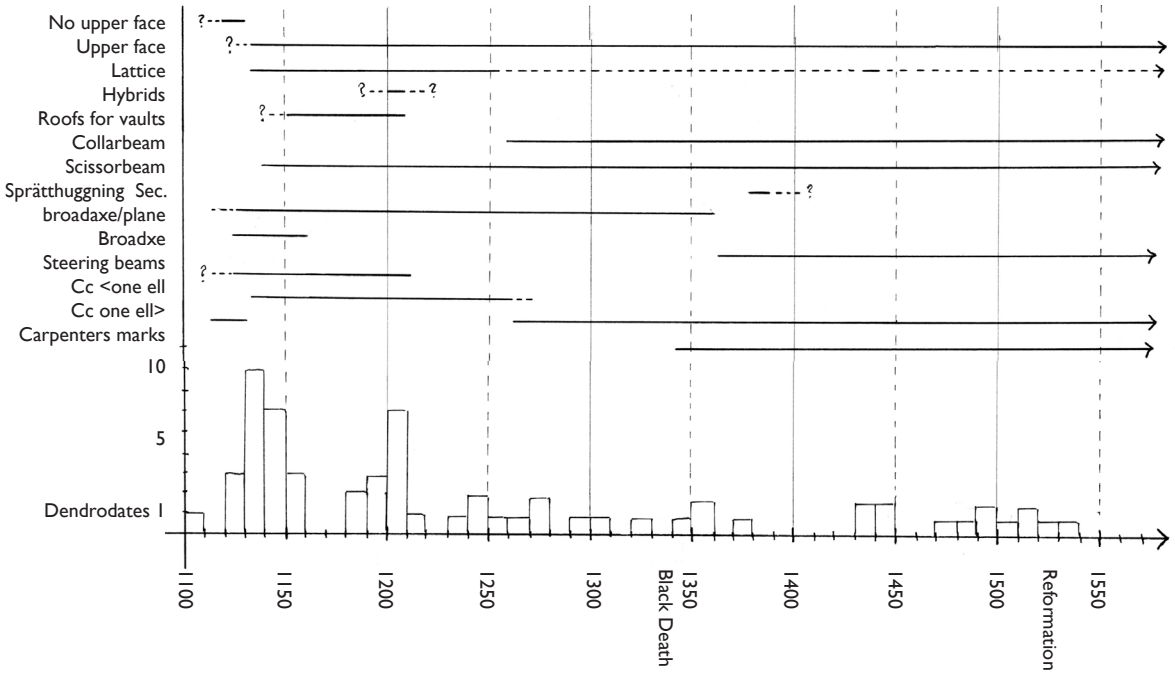


Table 6. Time scale over techniques and key features of medieval church roofs in Västergötland combined with quantifications of dendrochronologically dated structures in churches (including belfries).

lot in common with what developed into a standard solution in Västergötland during the 12th century. They have powerful well-crafted tiebeams (but with slots for ceiling boards) with thickened mid-part, slender rafters and struts, even crossing struts, put into housed lap joints with nail or dowel, often square cut and hewn very flat, lacking templates or carpenters' marks. Individual built trusses indicate a high degree of *workmanship of risk*, thus a high level of skill. In putting roofs on the first generation of stone churches in Västergötland there were plenty of possible role models on the continent, in the successors of the Carolingian empire. Here is a field for further research.

In contrast to the continental examples is the work invested in surface finish and even decoration on Scandinavian church roofs of the 12th century. This relate to the lack of ceilings. Several Swedish examples show upper faces or tiebeams worked with plane, sometimes moulded, sculpted steering beams and in the exterior ornamented wall plates and eaves boards. Norwegian stave churches and vernacular buildings from the High Middle Ages are extreme in the sense that all visible surfaces in the roof structures, including the roof boards are finished with plane, often also moulded.[9]

The observations drawn from the large empirical material of Västergötland allow for conclusions on which key features that are in common with European tiebeam roofs and which ones appear domestic or Scandinavian.

Key features in common:

- Tiebeam trusses built with straight lap joints in a flat upper face with all timbers flush.
- Protruding and upwards angled tiebeam eaves.
- Single outer wall plates with cog, embedded in masonry or not.
- Strive for sharpedged timbers with flat surfaces. The broad axe has been used in several roofs before late 12th century in Sweden together with "sprätthuggning".

9 This is clearly to be seen in Urnes stave church from the 1130s. The only places retaining "sprätthuggning" are the lower parts of the rafters, hidden by the root knees, and backsides of the strainer beams. In Raulstadloftet all round timbers have been worked with plane.

• A few roofs from the 11th and early 12th century in Germany and Normandy have as the Swedish ones individually built trusses and lack carpenters marks, whereas most 12th century roofs in Europe are template built and numbered. In my material this appears first in the 14th century. This gives the Swedish roofs a *relict* character.
• No other longitudinal support than the outer boards.

Key features unique for the High Medieval roofs in Götaland:
• Tight spacing of trusses (in the rest of Scandinavia found in the rafter spacing of 13th century Norwegian lofts and Urnes stave church).
• The use of plane(s) and sometimes mouldings as well as ornate wall plates and eaves boards. The roof structure is an integrated part of the interior and can be seen as an expression of ambitions and aesthetics, maybe also with symbolic meaning.
• Access to old, straight grown firs and oaks throughout most of the 12th century, allowing the use of mainly heartwood as well as multiple cleaving.
• Assembly of sufficiently dry timbers.
• Longitudinal steering beams and plates.
• Scandinavian hewing technique, *sprätthuggning*.
• Hybridization of trussed tiebeam roofs and post-carried purlin roofs.

5.2.4 A narrative of church roof building in medieval Västergötland

According to the results of surveys and case studies, as presented in the articles, a narrative will here be proposed with possible motives. The roof structures of High Medieval Västergötland represent *no pure domestic tradition with regard to layout and assembly*, they are *part of an established continental tradition of spanning churches and monumental buildings without intermediary support structures*. Meanwhile they show *Scandinavian hewing techniques* and occasionally *refined treatments with plane and décors as moulding or arches*, which seem to have been a common Scandinavian thing to do related to the visibility of these roof structures.[10] *Västergötland was a fertile technical milieu* due to wealthy and internationally oriented gentry, skilled and appreciated carpenters, good access to sand- and limestone as well as old natural fir and oak forests. Some hundreds of stone churches were built throughout the 12th century, especially around its mid, indicating the existence of carpenter crews mainly working in churches and resulting in a *standard* roof solution. The quality in the treatment of timber and joinery as well as individually made trusses speak of a high degree of skill and *workmanship of risk*. Still, the tiebeam roof truss assembled with an upper face was not introduced as a ready concept all over the line in 12th century church building in Västergötland. There was *initially experimentation or rather imitation*. A *hybrid version between the tiebeam roof and post and purlin roof* was also developed and was an alternative during at least half a century, a *creole* between domestic and borrowed systems. What I regard as imitations and hybrids with features from wood building traditions show how a developed domestic carpentry stepwise adhered to novelties. We can imagine the commissioned master builder of the 1120s in Götene or Västerplana drawing on the ground the outline of a tiebeam truss for the patron and the employed carpenters, the latter solving the given task according to their own knowledge with the timbers that were selected and felled in the patron's forest.[11] The presence of hybrids in quite high status churches testify that their use was not a question of ignorance (the primary trusses prove that these carpenters knew how to build normal trusses assembled with upper face), rather the pluralist repertoire among carpenters.

There is a diversity in the stone churches built in central Västergötland in the period c. 1120–1140, expressed in different tiebeam roof versions but also in the stone architecture. The varieties in dimensions, surface treatments and intersections with masonry are largest up until the mid century. It is often hard to distinguish that similar roofs could have been made from one and the same team of carpenters. As for the stone architecture (Dahlberg 1998:191) there was a variety of options open to the patrons and builders,

10 Compare Raulstadloftet, Norsk Folkemuseum, and Norwegian stave churches.
11 In Høre stave church (c. 1179 d) a runic inscription mentions how a local gentry family provided timber for the building of the church.

depending on resources, knowledge and networks. One should keep in mind that Sweden as a kingdom at this time still was not centralized, and the power of king and church dependent on local gentry and power structures. It is thus remarkable how fast and wide the upper face tiebeam truss with lattice struts got adopted and spread in Västergötland. It ought to have been part of an interior ideal with a tight row of well-crafted tiebeams and a semi-open roof structure. The large corpus indicate that this developed into a standard from around 1140. If this is connected to a consolidated and more independent church is yet to be proved, but seems plausible as the diocese of Skara got more centralized in the course of the 12th century. A parish structure was formalized and the power of local gentry in ecclesiastic matters diminished.[12] The normative lattice trusses appear in exclusive decorated ashlar churches as well as in rather plain ones built from crude fieldstone or even timber.

Intriguing is the very tight truss spacing that emerged towards the mid-12th century, making the roof structures heavily over-dimensioned and subsequently the lattice bracing hardly perceptible from below. This created an interior experience that differed from old hall buildings with post-carried purlin structures.[13] The tightly spaced tiebeam roof must have been important for both carpenters and clients, a manifestation that demanded almost the double investment of material and labour, maybe as important as a sculpted portico or murals. The assembly of seasoned timbers imply that the size, structure and appearance of the roof structure was decided at an early stage of the church building, probably in a negotiation between client/s, master builder and carpenters.

Towards the end of the century the roof structures tend to become more standardized with less variation and less preoccupation with slenderness and nice surface treatments. Young fulltimbers are increasingly used. The practice of subsequent tiebeam flattening with broadaxe disappeared towards the end of the 12th century. Finally this culminates with the introduction of ceilings from the late 13th century and onwards when the roof structures became reduced to just function.

With the late 13th and the 14th century we see the first influences from carpentry systems and techniques that spread with Gothic architecture and interior vaulting. This did not get directly and widely adapted, rather the opposite, showing a much slower rate than the adoption of the tiebeam roof. Much indicate a weakened technical milieu in Västergötland towards the end of the 13th and more so in the crises struck 14th century. Only in some high-ranking contexts did fully developed roofs for vaulted interiors with template built trusses get erected. Building commissions were in comparison to earlier centuries or other provinces few, and new solutions got adapted or adopted in slow pace and not always really understood or properly applied. A replacement of the *Romanesque* techniques and systems with new European solutions had to await the Late Middle Ages, and even afterwards tiebeam trusses of the lattice type were built up until the 18th century, but without the skill of the 12th century carpenters. Such things testify to the stagnation of a carpentry tradition that had its prime days in the 12th and early 13th century.

5.3 Research and conservation practice

The research presented in this thesis grew forth from conservation practices. Surveys, documentations, assessments and restorations provided the empirical material and developed in interplay with earlier and current research the objectives. How can my research affect practice in return? We do not document something doomed (as in exploitation archaeology) but something we want to preserve in a sustainable way, even something to draw inspiration from in present and future building and restoration. The question of how the investigations of medieval church roofs could apply in practical buildings conservation is not addressed in the articles, but in different forms in the

12 Compare Nyqvist 2021 and her discussion on how old and new elites in Västergötland expressed themselves in funerary monuments of different character, reflecting the emergence of a social stratus in service of or loyal to a strenghtened church and king.

13 On interpretations of Iron Age hall buildings see for example Ágústsson 1975; Halls, houses and huts. Buildings at Ribe Viking Centre 2014.

Summary of results on High Medieval Church Roofs

• The High Medieval roofs of Västergötland and Northern Småland belong to a common European tradition of trussed rafter roofs with tiebeams.

• Some early roofs can be seen as *imitations* of tiebeam trusses but *assembled without upper face*, probably reflecting domestic building techniques.

• The tiebeam truss with lap joints in an upper face was early adopted in churches. In Västergötland a normative version with tightly spaced lattice trusses developed during the 12th century, highly influencing the appearance of the interior. The large leeway for variation diminished after the mid-century, maybe due to a more consolidated church, strengthened at the expense of the old local gentry. The large amount of commissions and the recurring patterns in the material indicate that Västergötland during the High Middle Ages had crews of carpenters specialized in working with church building.

• Västergötland was a fertile ground for adopting novelties. There was an overarching and highly developed domestic tradition connected to the use of timber, expressed in the art of cleaving, the hewing in *sprätthuggning*, a strive for perfection with sharp edges and flat surfaces (but not so much right angles), also a sense for decoration, especially connected to the base of the structure (tiebeams, occasional steering beams, wall plates and eaves).

• The High Medieval carpenters working in the churches had knowledge of several solutions, for example reflected in hybrids between trussed tiebeam roofs and purlin roofs.

• With time the roof trusses of Västergötland got more standardized, departing from the original slenderness and nice surface treatments, ending up with the introduction of ceilings during the 13th and 14tthcenturies and a new interior ideal reducing the trusses to mere function.

• The adoption of truss building on template from fresh timber, mainly working with broad axe, as well as new types of joinery was in Västergötland slow and selective, probably due to a decrease in building commissions from the late 13th century onwards.

diocese projects (Gullbrandsson & Hallgren 2020; Hallgren & Gullbrandsson 2021). As an excursus I found it motivated to address this aspect in the light of my partaking in the restoration of the roof structures in Gökhem 2017–2021 (Gullbrandsson & Hallgren 2017; Gullbrandsson 2020, 2021).

5.3.1 Creating awareness for something hidden

Reseachers as Almevik, Eriksdotter, Linscott and Sjömar have underlined that how and what we document is of great relevance for future preservation and restoration. Surveys motivated by the needs of heritage care are still important and trigger development of new research questions and methods as they did in the beginning of the 20th century, providing vital input into each discipline.

Documentation reflects what we hold valuable, thus depending on our background and experience. It makes a large difference if the investigator approach the object with a *knowing*, *unknowing* or *dead* gaze

Figure 36. A piece of rotten wood or a valuable document? The sole surviving piece of medieval ceiling from the nave of Gökhem with two fitting nails.

(Meløe 1979). A person with an *unknowing* gaze knows there is something to learn, the one with a *dead* gaze does not. Getting acquainted with medieval carpentry meant for me going from an *unknowing* to a *knowing* regard. My cooperation with craft researchers and skilled craftspeople put light on values rarely acknowledged in the conservation of historic timber structures. What then is valuable? Is it the appearance, the visitor's experience in entering a medieval space? Is it foremost the authentic historic substance, each timber in itself as an historical document of the construction? Each tool mark from a carpenter on the surface? The imprint of a dirty and sweaty hand from unknown times? The piece of plaster with an imprint of a disappeared timber? Is it the authenticity in the construction actually working as it originally was meant to? All represent different values. The medieval church attics ought to be regarded as archaeological sites where even small remains can have bearing on the interpretation and in the end on evaluation and measures. Such as the sole surviving piece of ceiling boards with fitting decorate nails found in a birds nest in Gökhem and the dirt stripes on the tiebeam bottoms testifying to the vanished ones. Due to lack of knowledge, many measures (installations, repairs, insulation) have been taken without properly considering the church attics and their constructions as something of historical value, rather just function and hardly under antiquarian control. How can we reach a more *knowing* or at least *unknowing* gaze among the actors involved?

Knowing that there is something of value was the primary goal of the diocese surveys. The dissemination and implementation of this knowledge was directed both to laymen and experts, not the least the local caretakers, and the results must be easily understood. As a part of the case studies, each roof structure got an illustrated *pro memoria* directed to the caretakers of the parish, the diocese conservator and the Regional County Administrative Board, highlighting values and problems related to maintenance and preservation. Information was communicated through reports, lectures, a radio programme, a short film and a traveling exhibition.[14] Often the information on the church attics recieved keen interest and created a sense of pride among caretakers and parishioners. But in most cases the attics remain a heritage that is only accessible to the few. Ways of making secluded attics accessible to audience through physical and digital models could be a field to study further.

5.3.2 Thoughts on restoration

Regarding historic roof structures, proper assessments have to be made prior to project planning. This has not always been the case since the values were unknown, or the understanding of the historic building systems and techniques was lacking. The surveys and subsequent restoration projects of the medieval roof structures in the churches of Gökhem and Ransberg, as well as preparations for Marka church, have shown the need for proper knowledge and a holistic view of the buildings (Gullbrandsson & Hallgren 2017; Gullbrandsson 2022). The interplay between detail and entity and knowledge of several related roofs have been important for the decisions made. The mentioned projects have emphasized the use of cross-disciplinary investigations prior to any restoration plan or calculation, which

14 https://vastergotlandsmuseum.se/utstallningar/dolda-rum-kyrkvindarnas-hemlighet/; https://sverigesradio.se/avsnitt/1257778; https://www.youtube.com/watch?v=iRLZ5pHns_o

Figure 37. The traveling exhibition "Hidden rooms" (Västergötland's museum) on tour in Åsle church, Västergötland, in 2016.

led to a higher degree of preservation of historical substance and a more realistic calculation of costs.

The starting point in Gökhem, Marka and Ransberg churches was an *archaeological cleaning* or rather excavation (Melin & Ranta 2020; Gullbrandsson & Hallgren 2020). The aim was to uncover all wooden constructions hidden by debris and birds nests to get a detailed grip of condition of the constructions as well as collecting finds and observations of value for understanding the building's chronology, maintenance and uses (sometimes these could be put in relation to historical sources). A more complete assessment of damage and problems could be made, shaping the foundations for planning the restoration. Restoration timber with the right qualities could be sought and felled in due time before restoration.

The restoration in Gökhem church was not just an execution of plan, but also a process of knowledge production in co-operation between buildings conservator and carpenters. The executing craftspeople have been acknowledged as fellow documentors, which has several gains since they are on site the whole time and close to the object. Many features only get visible in the process of restoration. In Gökhem each truss and its relation to masonry could be documented, enhancing the understanding of production, qualities, skills and the relation between the work of the original masons and carpenters. But such a cooperation demands craftspeople trained in reading and documenting historic traces. The approach in Gökhem can be compared with the concept *processual restoration* used at the Norwegian open-air museum Maihaugen (Renmælmo 2004; Gammersvik 2007). The quality of a restoration depends on one hand on the demands from the parish as commissioners, the Regional County Administrative Board as permit giver, and the diocese conservator handling funding. On the other hand the outcome is dependent on the

Figure 38. Uncovering the easternmost nave trusses of Gökhem from a huge birdsnest in 2017. In the bottom it even contained human bones from the churchyard.

Figure 39. Same trusses after the archaeological cleaning, making a proper damage assessment possible.

Figure 40. Cleaning in medieval church attics often reveal several finds from the history of uses and maintenance, here the author is examining old oak shingles found in the nave of Marka 2017. Photo: Mattias Hallgren.

level of skill and interest among the workmen, the buildings conservator and project manager.

There is no standard recipe for restoring a historic church roof, but there are guidelines for maintenance (Sandin 2015; Gullbrandsson & Hallgren 2020) and the international ICOMOS' Mexico charter (1999) that states rules for treating historic timber structures.[15] Some structures are both well preserved and impressive, sometimes quite accessible. Others can be hard to reach for a visitor in a safe way, they can be heavily reshaped through the centuries, but still preserve important parts of the original structure which provide clues to the interpretation of similar structures in other churches, or maybe be the only surviving feature. Assessments must be individual with regard to condition and values.

Gökhem nave roof (1140/41 d) is a preserved entity with ambience and high authenticity while another roof may reflect several successive changes, but retains high document values. This necessitates different approaches. In Gökhem the goal was to maintain appearance and authenticity. In a roof as the one in Jäla church (1124–1142 d) (Fig. 42), it would be a question of attaining functionality with maximum preservation of historic substance. One could distinguish between respecting original function, assuring that the structure works according to the original system, "by itself", or an approach permitting modern reversible additions in order to preserve maximum of original building substance. Often we will find ourselves somewhere in between, a matter of degrees.

In Gökhem it was actually a mix. Static evaluation of the nave roof helped us find a level of restored function that was "good enough", much facilitated by the tight spacing, where only every second truss had to be fully functional, minimizing the intervention (Thelin 2019). When modern solutions were used (wooden fillings of hollow tiebeams[16], reversible iron draw bars, hidden irons securing the ridge joints), it was in order to save maximum historical substance. Even historically inspired solutions from the Early Modern period were used, such as the 18th century doubling and iron bracing of sole pieces (copied from Ransberg) used in the younger western part of the nave roof.

The by fungi most damaged tiebeams got scarfed halfways in traditional technique in order to preserve the authentic appearance of the structure and its function. Aiming at maintaining the same qualities of timber and hewing techniques this was also a way of learning more about the original techniques, raising awareness and giving experience in evaluating other roofs with the same features. This also applied to the replacement of the southern wall plate, cut on site by the church and thus providing audiovisual qualities for visitors.

Tiebeams cut for the vaults in the late 15th century got secured from diverging through discrete modern iron ties, an honest addition, which was also used in securing the Late Medieval roof of the northern chapel. This was highly altered and hard to get at, thus the works focused on attaining functionality and keeping original material, but not appearance. New additions were allowed to look new (sawn timbers and easily removable screws), but these are reversible.

5.5.3 Challenges in church conservation

Working with heritage care and churches it is my impression that more ought to be done on an early stage and involve the right competences. Often the buildings conservator is first consulted in the permit process. In the worst case the buildings conservator is contacted only when the measures are about to be taken, having few possibilities of changing the direction. And does the conservator have the right experiences or at least willingness to learn for the actual case?

Since the 2000s each church has a maintenance plan. But these ought to be made more holistic and incorporate assessments made by experts in relevant fields, of which roof carpentry is one of the most commonly neglected. "Hidden" constructions in the church milieus are often treated randomly or overlooked, missing severe damages that could result in collapse, loss of historical values and unforeseen costs. Either too little is made or too much. A more holistic

15 Compare the restoration of the tithe barn in Ingatorp, see Almevik & Melin 2016.

16 A method pioneered by Richard Harris. I saw this applied recently in Sankt Gangolf, Bamberg.

Figure 41. "Chirurgical" repairs as well as traditional scarfings on damaged tiebeams in Gökhem 2019. The ambition was to retain maximum of original substance and appearance.

assessment of values and condition in cross-disciplinary cooperation could prevent this and lead to more informed measures, which depending on object and scale could have a *processual* character. It is the County Administrative Board and the Diocese that in theory have the possibilities of regular controls, but in practice this is seldom the case due to lack of resources.

A challenge is the survival and passing on of the practical as well as theoretical craft knowledge gained through projects as Södra Råda and restorations. But also proper materials and qualities have to be ensured. The medieval roof structures are built with timbers that today are hard to find and unwanted by the industry. In order to restore structures from especially the High Middle Ages we need firs and oaks of large diameter, slow grown, straight and long. The Church of Sweden itself could play an important role as one of the largest forest owners in Sweden.

5.4 Conclusion and suggestions for further research

The revised typology, the search for patterns in craft and a possible *standard of the time* (and place) as well as contextual interpretations put forth in the third article have taken inspiration from a set of different but interconnected approaches focusing on building systems, craft techniques, skills and traditions. As I see it the activity to build was guided by a set of rules, a normative language or dialect corresponding to the concept of tradition. Inside this the level of skill allowed for freedom, leeway or improvisation, in interplay with material qualities and society. Identification of technological choices, their circumstances and alternatives is central to understand the characters and variations inside the High Medieval church roofs of Västergötland.

Figure 42. The nave roof of Jäla church, Västergötland, (1124–1142 d) with lattice trusses, remodeled in 1787 with new inner bracing but reusing many of the old struts. The testimonies of the original substance is more valuable than the present appearance.

My research has shown the knowledge that can be gained from medieval church attics. They provide an entry into the history of a building and its techniques otherwise only possible through knocking down plaster or making excavations. The roofs are sources to understand crafts, ideals, landscape and resources in the Middle Ages. Such understanding can foster a more conscious conservation practice.

The surveys and case studies have had an inner dynamic due to their abductive and hermeneutical character. Cooperating with craft researchers and dendrochronologists, being on site scrutinizing the constructions, revisiting them and interacting with them has been a process of learning for more than ten years. It has deepened my sense for the complexity of the sites and their structures, what they can tell and that even a small detail as a single joint or strike of cord could be of vital interest, sometimes altering earlier assumptions. The first-hand observation is crucial as well as having seen lot of structures with your own eyes and documented them, even for a short time, is central for a qualitative approach to this timber heritage. I guess that these years have made me a better buildings conservator and maybe turned me into a buildings archaeologist for real, letting me join my present profession with my beginnings in archaeology. It has been a long journey, but still much is left to discover or uncover. More in-depth-field studies and European exchange could shed new light on crucial questions as the introduction of the common tiebeam roof in Swedish churches in the late 11th and early 12th centuries as well as the adoption versus rejection of new techniques during the 13th and 14th centuries.

Chapter 6
Sammanfattning

Sedan åren kring 2010 har det skett en kraftig kunskapsuppbyggnad kring Sveriges äldsta stående byggnadsarv i trä, medeltidskyrkornas taklag. Mycket har handlat om vad som finns bevarat, var och från vilken tid. Dessa frågor har stått i fokus för ett flertal stiftsvisa inventeringsprojekt som fördubblat såväl antalet kända konstruktioner som antalet dendrokronologiska dateringar. Inventeringarna och deras samspel med hantverksforskning och rekonstruktionen av Södra Råda gamla kyrka har gett nya perspektiv på det kyrkliga kulturarvet.

Som ansvarig för inventeringsprojekten i södra Linköpings stift, Skara stift och Göteborgs stift 2010–2021 kunde jag personligen dokumentera långt över hundra taklag. I nära samverkan med timmermän, hantverksforskare och dendrokronologer genomfördes också fördjupade fallstudier i enskilda kyrkor. Min medverkan i restaureringen av 1140-talstaket i Gökhems kyrka gav ytterligare näring. Inom ramen för ett licentiatprojekt i kulturvård kunde jag från 2019 bearbeta materialet från dessa projekt vidare. Denna licentiatuppsats består av tre vetenskapligt granskade artiklar som speglar hur min forskning om medeltida kyrkortaklag gått framåt. Angreppssättet är byggnadsarkeologens och -antikvariens. En övergripande ambition är att lyfta fram taklagen som källmaterial och visa på nyttan av tvärvetenskapliga samarbeten både för forskning och kulturmiljövård.

Målsättningarna för uppsatsen är att strukturera, analysera och tolka det empiriska materialet från inventeringarna av medeltida kyrkotaklag i Västergötland och Norra Småland. Baserat på undersökning av system och tekniker i taklagen diskuteras typologi och tradition. I den avslutande artikeln snävar jag in på materialet från äldre medeltid (ca 1100–1350) i Västergötland. Det omfångsrika materialet med ett sextiotal påvisbara konstruktioner, varav 48 är daterade, tillåter en diskussion om mönster och variationer i hur taklagen byggts. Detta leder vidare till hypoteser om varför det ser ut som det gör. Utbyte med forskare från andra länder inklusive exkursioner och litteraturstudium har möjliggjort en jämförelse mellan mina studerade taklag och de som finns bevarade från 1000-, 1100- och 1200-tal i Nordväst- och Centraleuropa.

Den reviderade typologin och kartläggningen av mönster i bygget av kyrktak har inspirerats av olika läsningar fokuserade på att förstå byggnadssystem, hantverkstekniker och -traditioner. Som jag ser det styrdes byggande av regler eller normer, byggnadstradition, man kan jämföra med språk eller dialekter. Inom dessa ramar fanns varierande grad av frihet och utrymme för improvisation i samspel med materialets och samhällets förutsättningar. Att fundera över vilka val som var öppna för byggarna och varför är en del i tolkningen av mönster och variation i taklagen.

De huvudsakliga slutsatserna av min forskning är som följer. Kyrkotaklagen från äldre medeltid i Västergötland och Norra Småland hör hemma i en allmäneuropeisk tradition av konstruktioner med likartat utformade takstolar med bindbjälke. Exempel från Normandie och Västra Tyskland från 1000- och 1100-tal visar hur dessa redan då byggdes med knutning av timren gjord från en sida (den sida som låg uppåt när takstolen knutades samman) på vilken lades extra omsorg att få alla delar att liva. Vi känner igen de raka husade bladknutarna och frånvaron av timmermansmärkning. Detta byggnadssätt kan beläggas i Skåne redan på 1060-talet och i Östergötland på 1110-talet. De äldsta bevarade taklagen i Västergötland, från 1120-talet, är motsvarande i form, men har inte byggts med en knutsida, de tillämpar inte heller bladknuten, istället tapp och tapphål utan dymling liksom en takfotsknut i form av ett tvärgående hak på bindbjälken. Processen har här sett annorlunda ut och jag föreslår att det rör sig om imitationer av bindbjälkstakstolar, byggda av lokala timmermän med lösningar från äldre inhemsk byggnadstradition. Takstolarna från 1130-talet och framåt är dock som regel byggda med bladknutarna samlade på en sida.

I den högkonjunktur av kyrkobyggande som rådde fram till och med mitten av 1100-talet finns en

Figure 43. The author in the nave roof of Ljungsarp (c. 1207 d). Note the ridge-steering-beam. Photo: Mattias Hallgren.

påtaglig variation i dimensionering, försträvning och ytbearbetning. Ofta har den skandinaviska sprätthuggningen kompletterats med slätbilning och även i fen del fall bearbetning med skave, även dekorer skapade med profilhyvel förekommer på bindbjälkar. Högben och stödben har slanka dimensioner, ofta framkluvna ur stora rakväxta gamla furor och ekar. Mot seklets mitt kom en takstolstyp med två till sex korsande stödben att bli dominerande, den kom att bestå som en slags norm ända fram till mitten av 1200-talet, men kom att kopieras även i senmedeltid och tidigmodern tid. Variationen i taklagens byggande ebbade ut efter 1100-talets mitt och en förenkling inträdde avseende dimensionering och ytbearbetning. Jag föreslår att det kan hänga samman med att de i det tidiga kyrkobyggandet så betydelsefulla lokala makteliterna gradvis ersattes av en stärkt kyrka och sockengemenskaper.

Som tidigare forskning framhävt var taklagen en del av kyrkorummet, men den täta uppställningen av takstolarna gjorde taklaget snarast halvöppet. Den täta följden av takstolar med bindbjälkar var ett karaktärsskapande element i kyrkorummen som särskilde dessa från andra byggnader. Ofta tycks sammanknutningen av takstolarna ha skett med timmer som hunnit torka något. Ibland har timret knappt räckt för sista takstolen. Detta innebär att beslut om taklagets utformning måste ha fattats redan i början av kyrkobygget för att hinna få fram rätt mängd timmer av rätt kvaliteter. Introduktionen av innertak från och med 1200-talet reducerade takstolarna till funktion.

Västergötland lyfts fram som en gynnsam miljö för anammande av nyheter i byggnadsteknik under 1100-talet. Mängden uppdrag i kyrkor tyder på att det fanns flera grupper av skickliga timmermän som var specaliserade på taklag för kyrkor. Av bevarade taklag att döma så hade en del av dem kunskap om olika konstruktionslösningar som kunde användas. Ett exempel på detta är de taklag som kombinerar bindbjälkstakstolar med en nockås som vilat på stolpar i gavlarna och vittnar om samspel med lösningar tagna från inhemska byggnadstraditioner.

Under loppet av 1200-talet kom världslig och kyrklig makt i kungariket Sverige allt mer att förskjutas mot Mälardalen. 1300-talets klimatförändring och pestepidemi bidrog ytterligare till att det kyrkliga byggandet i Västergötland avstannade. Den mycket ringa nybyggnationen och de före senmedeltiden mycket få valvslagningarna medförde en stagnation i timmerhantverket, nyheter anammades nu långsamt och selektivt. Landskapet uppvisar få fullt utvecklade taklag enligt de regler som kom med det kontinentala gotiska byggandet, det vill säga bygge på mall med färskt timmer och bredbila, nya knuttyper, saxsparrar, timmermansmärkning och introduktion av knäbock för att möjliggöra uppskjutande valv. Länge höll timmermännen fast vid bindbjälkar och raka bladknutar.

1100- och 1200-talets takstolar i Götaland har mycket gemensamt med sina europeiska motsvarigheter från 1000- och 1100-tal (även om få är bevarade). De särskiljande dragen är bearbetningsteknikerna med sprätthuggning och det i början rikliga bruket av skave samt dekorativa element, vilket även påträffas i material från tiden i andra delar av Skandinavien, främst Norge. Särskiljande är även den täta positioneringen av takstolarna med cirka en alns avstånd, vilket är mest utpräglat i Västergötland. Detta innebar dubbel materialåtgång och arbetsinsats och speglar en kontext där varken materiella eller ekonomiska resurser var något problem. Till skillnad från i exempelvis Frankrike och Tyskland tycks man därtill inte har byggt samman takstolarna av färskt timmer.

Jag har i min forskning försökt visa på den kunskap som kan avlockas medeltida kyrkotaklag. Inventeringsprojekten har varit en lärandeprocess som gradvis ökat förståelsen för det som dokumenteras. Att lära av konstruktionerna med öppna sinnen, återbesöka och omvärdera har varit centralt för hur min forskning bedrivits liksom därmed den egna observationen och interaktionen med det fysiska materialet. Kyrkvindarna är ett titthål in i historien. De erbjuder möjligheter att läsa av och tolka försvunna hantverkstraditioner och arkitektoniska ideal likväl som kyrkobyggnadernas brukande och underhåll. Analyser av taklagens trä kan också ge ingångar till att förstå tillgång till timmer och därigenom även hur landskapet kan ha sett ut. Att vara medveten om och genom tvärvetenskapligt samarbete kunna dra nytta av olika läsarter kan ha en positiv effekt inte bara på forskning utan även på den praktiska kulturmiljövården.

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