Det Kongelige Norske
Videnskabers Selskab

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SKRIFTER 2010 • nr. 1

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KONGELIGE
NORSKE
VIDENSKABERS
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Editor

Kristian Overskaug, The Royal Norwegian Society of Sciences and Letters,
Postuttak, NO-7491 Trondheim
e-mail: post@dknvs.no
URL: http://www.dknvs.no

Tapir Academic Press, 7005 Trondheim

Communications regarding accepted manuscripts, orders of reprints,
subscriptions etc. should be sent to the Publisher.

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ISBN 978-82-519-2750-5
ISSN 0368-6310

Trykk og innbinding: AIT Oslo AS

Tapir Akademisk Forlag
7005 TRONDHEIM
Tlf.: 73 59 32 10
E-post: post@tapirforlag.no
www.tapirforlag.no

Forlagsredaktør: terje.togersen@tapirforlag.no

Transactions of
The Royal Norwegian Society
of Sciences and Letters
(Trans. R. Norw. Soc. Sci. Lett.
2010(1)1-177)

The Mint in the Nidaros Archbishop's Palace.
Coin production under Archbishop Gaute Ivarsson (1475–1510)

by

Otto Lohne[1], Jon Anders Risvaag[2], Pål Ulseth[1] and Jardar Lohne

ABSTRACT

Archaeological excavations in the Nidaros Archbishop's Palace in 1991–1995 revealed the remains of three medieval mints, alongside with remains reflecting the whole production process of coins. An authentic mint workshop is today exposed *in situ* in the museum constructed over the excavation site, and the richness of the finds makes this mint unique in its kind. The project *Erkebiskopenes utmynting på 1500-tallet* has undertaken to deepen our

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understanding of the production processes and the importance of the coinage under the office of Archbishop Gaute Ivarsson.

The multidisciplinary analyses presented in this paper permit us to conclude the following:

1) The finds document coining activity in specified houses and enable us to follow the total production chain involved in coin production, from assaying of silver-containing materials through casting, hammering, surface treatments and selection of dies for the final imprinting stroke.

2) The high number of small bone-ash cupels indicates that silver for the coins was coming from silver-containing objects and not from ore.

3) The hammering and intermittent annealing procedures are labour intensive processes. By restricting the workforce to solely one mint master and one assistant, the king made it easy to limit the amount of coins coming from the archbishop's mint and to control the activity.

4) A number of 282 Norwegian hvids are known from the period when Archbishop Gaute Ivarsson was in office. Studies of die-links, weight and silver-content lead to the conclusion that 192 of these coins were produced in the workshop in the Archbishop's Palace, from which 51 obverse and 29 reverse dies have been identified.

5) By establishing die links it is possible to make assumptions of the number of dies used. By estimating the number of coins that could be produced per die, suggestions on the total number of coins produced during the office of Archbishop Gaute Ivarsson end up at 600,000 hvids. This number is also in reasonable agreement with estimates made from a technical point of view when looking into the laborious processing steps from casting bullion with the correct fineness to the finished hvid.

6) Tithe and land-rent was the main income to the archbishopric. The value of the produced coins is estimated to 28 % of the tithe or 42 % of the land-rent. The profit of the coin production, however, may be about 200 mark annually equivalent to 4 % of the tithe or 7 % of the land-rent.

7) The low margins indicate that the production of hvids was motivated more by its political and symbolic significance for the archbishop than by profit.

CONTENTS

PREFACE

Sometimes tragic events entail positive effects. A fire in 1983 ravaged the eastern and southern building structures in the Nidaros Archbishop's Palace, but led to extensive archaeological excavations in the years 1991–95. Thereby, the remains of three consecutive mints were revealed, of which the oldest is today exposed *in situ* in the museum constructed on the excavation site. This mint complex, dating from the office of Archbishop Gaute Ivarsson (1475–1510), is unique in its kind, as not only the remains of the mint itself but also objects connected to the whole range of coin production were excavated and are on show.

AD 2010 marks the quincentenary for the passing away of Archbishop Gaute Ivarsson, a preponderant figure in Norwegian history. Not only did he hold office as supreme leader of the Norwegian Council of the Realm. In a time marked by conflict – as well within the Church as between the union king of the three Nordic countries and the Councils of the Realm of Sweden and Norway – Gaute Ivarsson managed to reinforce the authority of the Nidaros archbishopric. One of the significant indicators of this authority was his regaining the right to produce coins after it had been halted in Norway for more than a century. By a major project of restructuring the Archbishop's Palace in Trondheim, he established a mint complex in the palace precinct, thus integrating the mint in the activity there, protected by the curtain wall. In this paper, an interdisciplinary study of the coin production brings to light the numerical importance and the level of sophistication involved in the production of coins during the office of Gaute Ivarsson.

The curiosity instigating this project was aroused by the coming millenary jubilee of Trondheim in 1997. Otto Lohne and Pål Ulseth (then at the Foundation of Industrial and Technical Research at NTH (SINTEF), now at Institute of Materials Science and Engineering, Norwegian University of

Science and Technology (NTNU)) were initially striking a copy of the first coin of Norway, bringing in the skills of master engraver Øistein Ronæss. However, as the leader of the archaeological excavations, I was happy to be able to reorient the project towards the archbishops' coins. Otto Lohne and Pål Ulseth, with their metallurgical background, analysed microstructures of metal samples in order to re-enact the process of medieval coinage performed in the Archbishop's Palace. At a later stage, Jon Anders Risvaag (NTNU Vitenskapsmuseet) joined the project, being able to shed light on the numismatic aspects of the coinage. Based on a donation from The Royal Norwegian Society of Science and Letters (Det Kongelige Norske Vitenskabers Selskab – DKNVS), it was possible to bring the project to a higher level than otherwise feasible. As a result, this current work is presenting remarkable results from the research on the activity in the medieval mint, which adds even more to the importance of the unique archaeological finds.

Interdisciplinary research and presentation may be a challenge, not the least concerning communication between various specialists, and between them and their audience. Jardar Lohne has been a key person in assuring the progress of the work, uniting the various subjects into one coherent paper and giving the manuscript a precise language without too many technical formulations uncommon for many interested readers.

The late engraver Øistein Ronæss was an important part of the team. His keen interest and inspiring assistance by making dies for copying the production of silver coins from the Archbishop's Palace has made the medieval way of producing hvids known for many visitors at the St Olav Festival in Trondheim.

This paper summarises the work in the project *Erkebiskopenes utmynting på 1500-tallet*, launched in 2003. In 2010, we also celebrate the 250th anniversary of DKNVS. The generous support of this society and NTNU provided the occasion to present in an adequate manner a cultural heritage site that up to this

day has not been sufficiently elucidated. In addition a future paper is planned, undertaking the investigation of finds belonging to the time of the succeeding archbishops, Erik Valkendorf and Olav Engelbrektsson. I would take the opportunity in this foreword to congratulate the authors, the respective institutions and the rest of us with the illuminating results presented in this publication.

Sæbjørg Walaker Nordeide
Director of the archaeological excavations in the Archbishop's Palace
Now: Centre for Medieval Studies
University of Bergen

LIST OF FIGURES AND TABLES

1 INTRODUCTION

The heart of nowadays Trondheim is dominated by the ecclesiastical complex materializing the importance of the former Archdiocese of Nidaros. Nidarosdomen, the world's northernmost Gothic cathedral, and the former Archbishop's Palace, one of the oldest secular buildings in the Nordic countries and unique to its kind in northern Europe (Nordeide, 2000:11), form together a remarkable ensemble.

Figure 1.1. The Nidaros Cathedral and the Archbishop's Palace by the river Nid in its present day appearance viewed from west. The new building structures erected over the excavation area are in the east and to the south. Photograph by Ole P. Rørvik, Aune Forlag AS

In the decades preceding the Reformation in AD 1537, a more symbolic marker of ecclesiastical authority was exercised within the confines of the palace, in accordance to the privilege of coin production. Nowadays, unique in its kind, the original remains of a late medieval mint workshop are exposed *in situ* in the palace museum constructed on the site[i]. In this publication, we examine both the consecutive steps of coinage as it was conducted in the palace and present an overall analysis of its importance, from a metallurgical and numismatic perspective.

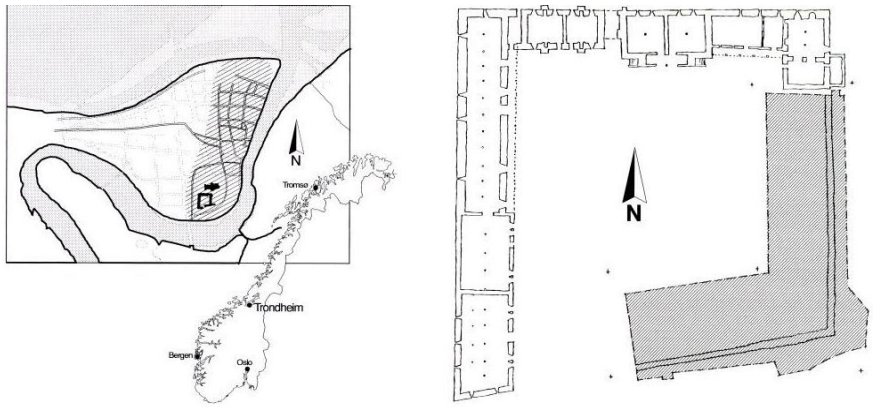
1.1 THE ARCHBISHOPS' MINTS

Following a 1983 fire that ravaged the buildings forming the southern and eastern wings of the Archbishop's Palace precinct, extensive excavations were performed from 1991 to 1995. The excavation area of ca 2200 m^2 revealed a continuous line of occupation dating from the late Viking Age up to the date of the fire. The buildings ravaged by the fire were constructed as army barracks in the 18th and 19th centuries; up to four meter of cultural layers contained a huge number of artefacts of an assortment of types.

The eastern and southern wings of the palace interior – the excavation area – were dominated by various workshops; smithy, armourers workshop, shoemakers workshop, and a house without certain attribution of usage, but which according to Nordeide (2003:174–5) – based on the ample supply of water in this house – might have been used as a tannery or other clothes related activities.[ii]

Among the finds were a sequence of buildings and a large number of objects associated with coin production. As we shall see in figure 1.3, three successive mints were all located in the northernmost area of the east wing. Based on the rich assortment of other workshops and the finds in the immediate surroundings

of the mints, it seems probable that the mints in addition to coinage were used also for other refined metalwork.



a) b)

Figure 1.2. Location of the mint in the Archbishop's Palace, Trondheim. a) Map of Norway and Trondheim showing the location of the Archbishop's Palace, the hatched area indicating the extent of the medieval town at the river Nid (from Nordeide, 2003:14). b) Sketch of the location of the 1991–1995 excavations in the Archbishop's Palace (hatched area)

1.2 THE THREE LAST ARCHBISHOPS OF NIDAROS

The Archdiocese of Nidaros was founded in the period 1151–54 (Nordeide, 2003:42), asserting Nidaros (nowadays Trondheim) as the clerical capital of the old Norse kingdom, with the bishoprics of Hamar, Oslo, Bergen, Stavanger, Kirkwall in the Orkneys[iii], Kirkjubø in the Færoes, Skålholt and Holar in Iceland, Gardar in Greenland and Peel in the Isle of Man placed under its

ecclesiastical jurisdiction, thus making the church province at the zenith of its territorial expansion stretch from the Kola peninsula and Greenland in the north, to the Isle of Man and the River Gøta to the south.

The choice of Nidaros as archdiocese is due to the Olav cult, which had made the town an important pilgrimage destination in northern Europe. And while the royal court moved south to Bergen and later on to Oslo during the 13th- and 14th centuries, the Church remained firmly situated in Nidaros. Both as a major economic player and as the superior spiritual supervisor, the archbishop was a potent authority in local as well as national affairs.

The importance of the Church in medieval Nidaros is reflected in the position of the Archbishop's Palace. The site occupies the highest topographical point on the Nidarnes peninsula, adjacent to the cathedral, with a wide outlook, relatively easy to defend and – though today this is invisible due to land rise – offering a better natural harbour for permanent use than locations further down the river (Nordeide, 2003:75–77).

The archbishop equally exercised considerable secular authority on a national level, an authority significantly augmented from 1449, when he was delegated the responsibility of tax collecting and supervision of the local courts from the king (Nordeide, 2003:19). This prominence also came to be reflected on a constitutional level. In 1397, Norway joined the Kalmar Union along with Sweden and Denmark. According to the agreements establishing the union, the king was supposed to rule under the supervision of national councils from each of its member-countries. During the 15th century, it came to be institutionalised that the Norwegian Council of the Realm was led by the archbishop. These councils had their greatest influence at the moment of the election of kings, especially from 1448, when Norway was officially recognised as an electoral kingdom (Benedictow, 1977:24).

One notable result of this influence, as we shall see in chapter 2.3, is found in the so-called *Halmstadrecess* (1483), the protocol conditioning King Hans' election as king of Norway. Among several concessions, Hans had to reconfirm the privilege of the Archbishop of Nidaros to strike coins, a privilege that previously had been accorded by King Håkon Håkonsson in 1222 but later was withdrawn.

Although coins were struck by the Archbishops of Nidaros in the period between 1222 and 1281 (Risvaag, 2006:239), the excavations in the Archbishop's Palace (1991–1995) found no indication of a mint within the precinct prior to the late 15th century (Saunders, 2001:27)[iv]. The excavations brought to light three successive mints, and confirmed coinage in these building complexes dating from ca 1500 to 1537. Coin production is thus confirmed under the offices of Gaute Ivarsson (1475–1510), Erik Axelsson Valkendorf (1510–1522) and Olav Engelbrektsson (1523–1537).

1.3 GAUTE IVARSSON

The instigator of the coinage in the Archbishop's Palace, Gaute Ivarsson, was probably born in the 1440s (neither the exact year of birth, family background nor birthplace is known[v]) and died in May 1510. During 35 years, from 1475 to his death, he held the office of Archbishop of Nidaros, a position which also was earning him the role as head of the Norwegian Council of the Realm. Besides being an ecclesiastical potentate, Gaute Ivarsson also was a secular lensherre (feudal overlord), with five of the old fylkes (regions) of Trøndelag in fief.

Gaute Ivarsson received his education at the University of Rostock from 1462, wherefrom he sorted as magister in 1466. He is bespoken of as kannik (canon) in Nidaros in 1472, and was perceived as a natural successor at the death of Archbishop Olav Trondsson in 1474 in Rome. Hamre (1955:498) argues that Gaute Ivarsson most probably was following Olav Trondsson at this occasion; at

any right, as this latter died at the Curia, the pope was entitled to designate his follower, and on the 15th of June 1475, Gaute Ivarsson was appointed by papal provision.

As head of the Council of the Realm, Gaute Ivarsson's main priority seems to have been safeguarding the Norwegian nobility's interests within the union with Denmark, with particular focus on ecclesiastical privileges. This included interfering with violations from the Crown of any clause featured in the treaty of the union, as well as with those from the agreement governing the king's conditions of rule. The preponderant role of Gaute Ivarsson on the highest political level became particularly apparent at the occasion of the *Halmstadrecess* where he appeared as leader of the nine men strong Norwegian commission.

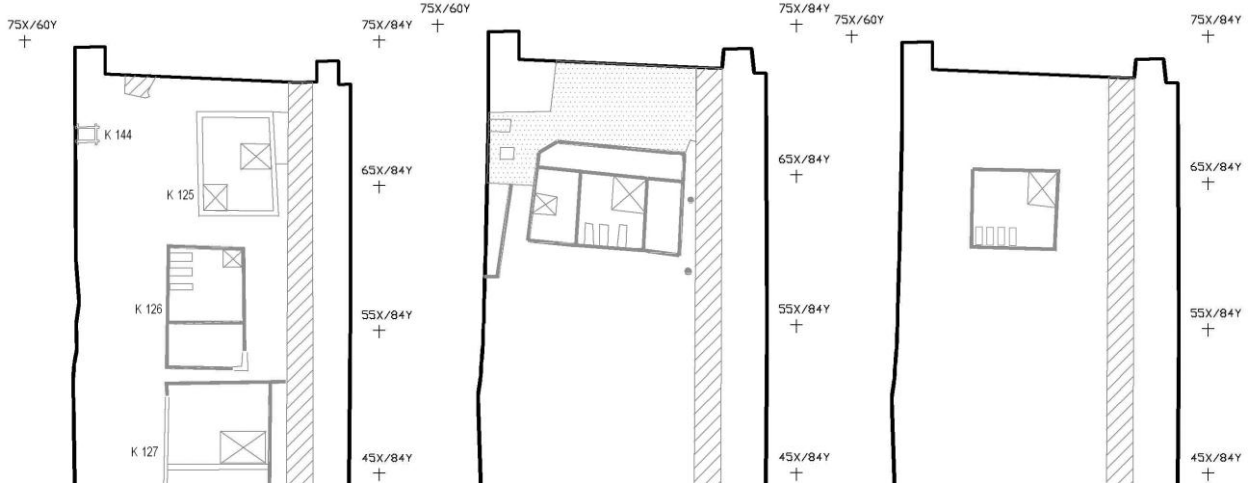
The latest year's historical and archaeological research have underlined the importance of Gaute Ivarsson. This is contrary to earlier scholarly opinions, for the most part emphasizing the importance of the earlier Archbishop Aslak Bolt (1428–1450) and the later Olav Engelbrektsson (1523–1537). The first of these owes his celebrity mainly to the registries of property, cadastres, he established, thereby establishing firmly the wealth of the archbishopric, and providing an inestimable asset for future historians. Gaute Ivarsson also wrote cadastres, however, these were not as extensive. The preponderant position Olav Engelbrektsson occupies in Norwegian history is mostly due to the role he was to play in the Reformation of Norway. On his side, Gaute Ivarsson's firm insistence on the rights of the Church and Norway inevitably brought him into conflict with Duke Christian (the later King Christian 2), who governed Norway as viceroy in 1508–1513. However, even considering his refusal to crown Duke Christian as king of Norway whilst the father of this latter was still alive (Hamre, 1955:506), this conflict was obviously not as consequential as the Reformation, and has therefore not left so profound traces.

This received impression of Gaute Ivarsson does not, however, necessarily correspond to the role he played in his lifetime, and later times discoveries have tended to call attention to Gaute Ivarsson as one of the outstanding archbishops of Nidaros. Nordeide (2003:210) remarks how the excavations following the 1983 fire revealed that some of the most important structural changes in the Archbishop's Palace can be dated to the office of Gaute, and not to Aslak Bolt, as previously assumed. During the late 15th century, the palace precinct underwent substantial restructuring, with the removal of the eastern and southern wings as part of a reduction of the courtyard. This might be understood as a change imposed by novel strategic demands, mainly caused by the newly introduced firearms, and to the wish to situate building structures with major economic and military significance inside the walls. The mint might be seen as a part of this strategic development of the palace. As we shall see in what follows, the reestablishment of issuing privileges and the actual coinage within the confines of the Archbishop's Palace contribute strongly to this readjusted and enhanced picture of his marked leadership.

1.4 THREE SUCCESSIVE MINTS 1500–1537

The excavations recognised three successive mint complexes in the northern part of the eastern wing, all close to the adjacent stone wall framing the palace. Their structure, with workbenches, tiled floors and hearths clearly indicate the purpose of the buildings as late-medieval moneyers' workshops, corresponding to illustrations of coinage in contemporary treatises. The interpretation of the buildings as mints is furthermore corroborated by the archaeological evidence, with important finds of debris from coin production such as cupels, crucibles, hammered rods, blanks and coins.

The finds were mainly found in the excavation defined period 6 phase1–3, i.e. covering the years AD 1500–1532, and period 7 phase 1, 1532–1537, indicating the coinage at this site to have started approximately at AD 1500.



First mint complex
1500–1520s

Second mint complex
1520s–1532

Third mint complex
1532–1537

Figure 1.3. Sketches of the successive mint complexes which were discovered during the excavations, presented in a common reference system. Workbenches and hearths are clearly identified. The second workshop appears to be the most advanced, counting two fireplaces and a variety of storerooms. In this structure, we can also see the workbenches oriented southwards, thereby assuring the workers more light than in the first structure. The third workshop, on the other hand, appears significantly less sophisticated, consisting of only one room; it had, however, traces of four workbenches.

The eastern and southern parts of the palace interior were dominated by workshops of diverse character. The mints were situated in the north-eastern corner of the precinct (as seen on figure 1.2b and figure 1.3).

According to dendrochronological dating, the first mint complex was established ca AD 1500 (Olsson, 2000). This complex consisted of three closely spaced timber buildings (K125, K126, K127) arranged in a row running parallel to the eastern precinct wall, and an associated water cistern (K144).

Building K126, a rectangular, two-roomed structure of laft technique ca 8.5 m long and ca 5.5 m wide, is interpreted as the first mint workshop, figure 1.4 (Saunders, 2001:8). The main northern room contained a chequer-board patterned floor composed of glazed tiles, with a small north-east corner hearth and the bases of three wooden work benches set in a row along the western wall. The southern room was subdivided into two areas: a small section of glazed tiled floor, interpreted as an entrance area, and a plank floored charcoal store.

During the excavations, five blanks and two coins (Gaute Ivarsson's hvids) were found in the direct vicinity of the first mint complex, either inside the workshop or dumped outside between the workshop and the eastern wall. It is likely that the processes of hammering, annealing, cutting, blanching and striking of coins took place here. This first mint workshop was torn down and covered with clay, possibly in the early 1520s (Olsson, 2000:206).

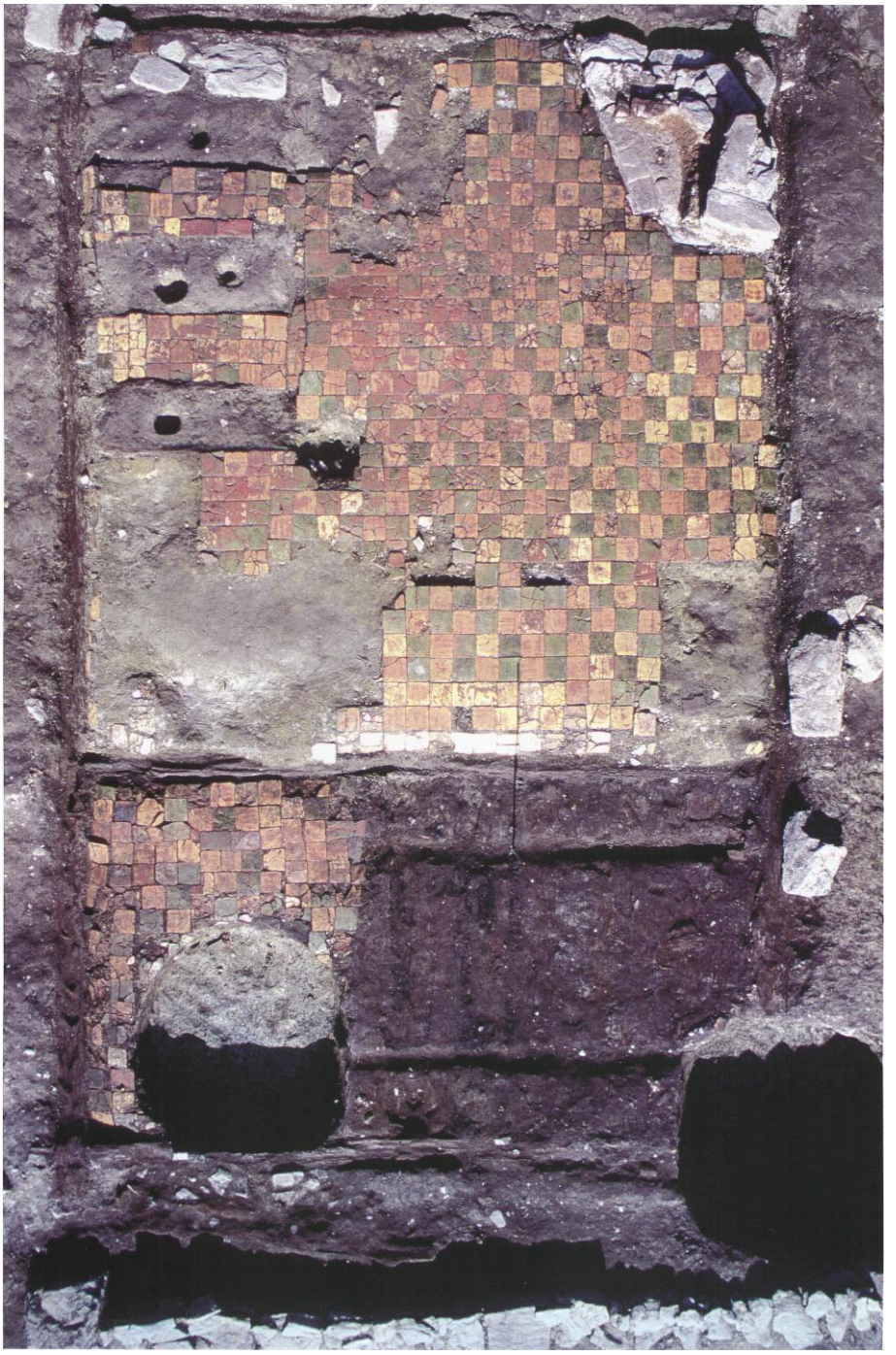
The remains of other building structures unearthed were less well defined. Building K125, north of the mint workshop, was a poorly preserved rectangular structure, ca 7 m long and ca 5 m wide, with traces of timber walls and flooring, and two large stone foundations for possible hearths or furnaces. It is difficult to detect signs of internal partitioning, but it is possible that K125 was a two room structure. To the west of building K125, and possibly associated with it, was a plank-lined water cistern K144 (Saunders, 2001:8).

Shards of crucibles were found in the dump between K125 / K126 and the eastern wall. The distribution of the bone-ash cupels showed a clear concentration around K125. These finds indicate that K125 was used for heating crucibles and cupels. It is therefore probable that the large stone foundations have supported hearths used in metalworking processes like assaying and melting / casting of silver bullions. This assumption is reinforced by the fact that the small corner hearth in K126 does not appear big enough to have generated the heat necessary to melt silver or copper alloys.

Building K127 lay immediately to the south of the first mint workshop. It was a larger and more consolidated structure, ca 14 m long and ca 7 m wide. The role of this building is less clear. Its spatial location infers a close relationship with the mint, but there were no finds which suggest that it served as an actual workshop. It may be that it had a more administrative function in the mint, e.g. storage of equipment, silver and finished coins.

The archaeological finds from the mint complexes are unique from this period in Europe, both with regard to the condition of the workshop today on display, and to the large assembly of crucibles and debris connected to coin production found in its immediate surroundings.

Figure 1.4. (Next page) The first mint workshop, building K 126. The excavations unearthed the original tiled floors of the first mint, dendrochronologically dated AD 1500, thus dating this mint to the office of Gaute Ivarsson. We can clearly see the traces of three workbenches with their tree stump holes, probably used as a base for various tools, especially dies and anvils. The benches were lowered into the soil for stability. We can also see, in the upper right corner, the remains of a hearth. Note also the heavy wear of the tiled floor between the hearth and the workbenches, indicating frequent traffic. Size:5.5x8.5 m. Photograph by Edwin Baker, Riksantikvaren.



The modest size of the complex indicates that coin production was organised on a relatively small scale, compared to the large factory mints of late medieval Europe[vi]. It is worth noticing that the workshop seems not only to have been used as a mint. Other metal debris, such as bronze clippings, copper and lead pieces, as well as traces of gold on some of the crucibles, indicate that it also was used as an atelier for a silver- or goldsmith.

At a later stage[vii], during a complete reorganisation of the eastern range of the palace, a new mint complex was constructed. This second complex was oriented towards the northern range of the palace, rather than with the eastern precinct wall (Saunders, 2001:31). The exact dating of the second mint complex is uncertain (Olsson, 2000:206). The three-room building was ca. 9.5 m long and 6.5 m wide, and the size might suggest that there was place for more than the two workmen that the royal privilege accorded. Both its reorientation towards the buildings in its vicinity and the modification of the mint itself indicates developments in the organisation of coin production.

Both this second mint and the adjacent weapon manufacture workshop burnt to the ground, in all probability whilst the troops of King Frederik I ravaged and burnt the palace in 1532.

After this episode, a third mint was constructed. This mint complex was significantly smaller, only 5.5 m x 5.5 m, and was built over the second structure. Being constructed as a single-celled building, it appears to stand alone as an independent structure (Saunders, 2001:35). Despite the simplicity of the structure, its production capacity seems to have increased, as this mint was equipped with four rather than the previous three workbenches.

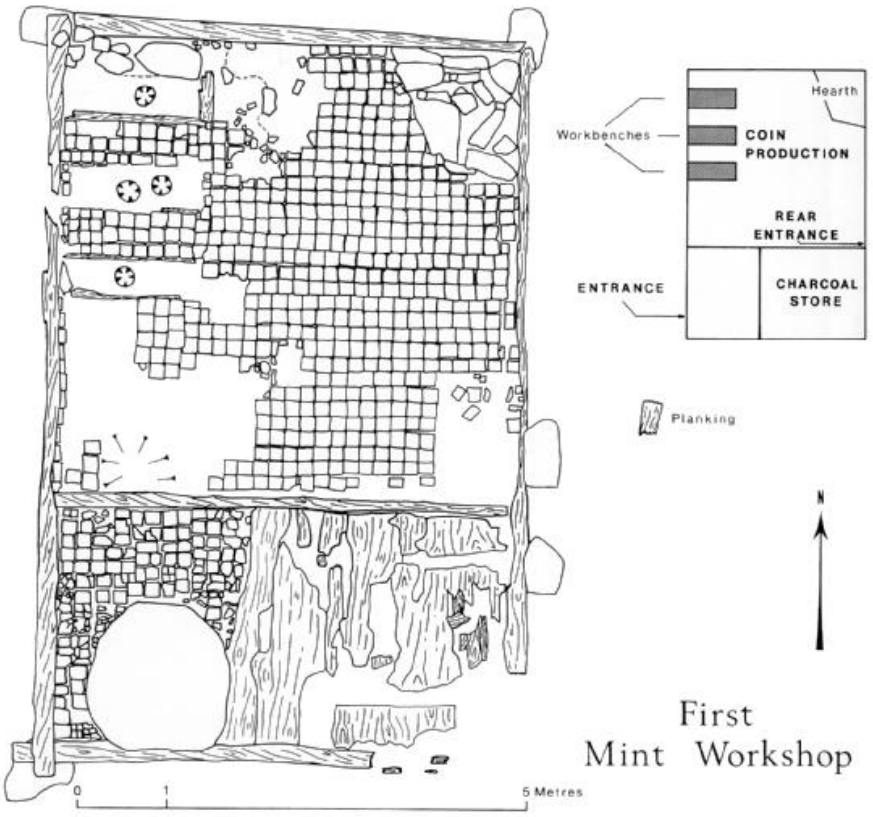


Figure 1.5. The first mint workshop, building K 126 – sketch. The sketch highlights certain structural observable facts, such as the tree stump holes used for fastening the tools, the laft structure of the building, and the differentiated flooring. The mint itself had a tiled floor, permitting easy recovery of lost small objects, which would have been irretraceable on flooring consisting of wood or stamped soil. The room to the lower right, however, had wooden flooring. Drawing by Richard Cutler, Riksantikvaren.

With the Reformation of the Church imposed by Christian III in 1536, and the flight from Nidaros of the Archbishop Olav Engelbrektsson April 1st 1537 (Rian, 1997:21), an end was put to the Catholic Church in Norway and the Archbishopric of Nidaros; and subsequently to coin issuing privileges. When the late Danish numismatist Julius Wilcke published his great survey on monetary conditions under the Danish kings 1481–1588, he found the coinages of Gaute Ivarsson and Erik Valkendorf at the time of King Hans too irrelevant to give any description. Simply dismissing them as not having any greater economic significance as means of payment, he referred those with special interest in the matter to other publications (Wilcke, 1950:146). Concerning the economic significance of Gaute Ivarsson's coinage Wilcke most certainly was right. However, as we will argue in this paper**,** taking into consideration the political and symbolic implications of the archbishops' coinage Wilcke was probably far off mark.

PART I

A NUMISMATIC PERSPECTIVE

2 THE COINAGE UNDER GAUTE IVARSSON

2.1 INTRODUCTION

The purpose of the following chapters is to assess the importance of the coinage performed in the Archbishop's Palace during the office of Archbishop Gaute Ivarsson, from a numismatic perspective.

The literature concerning Norwegian coinage during the late Middle Ages in general – and the archbishops' coinage during the reign of King Hans in special – is in reality meagre, to a large extent quite out of date, and rarely based on modern, scientific analysis (Schive, 1865; Schou, 1926; Holst, 1936; Ernst, 1940; Skaare, 1995). Up to this day, such discussions have been based primarily on analyses of the iconographic representations as well as on inscriptions or absence of inscriptions found on coins.

In order to propose a more up to date, coherent and thorough analysis, a wide array of elements needs to be taken into consideration. The first step will be an interpretation of the pictorial representations – an iconographic analysis – through which we will be able to identify the different types of coins existing, and, by examining their inscriptions – the legends – and their dies, come to a premier idea of their provenance. Secondly, in order to assert with more certainty both in which mint the coins were produced and the possible amount of coins produced in the mint in the Archbishop's Palace, we turn to the more technical approach. The key element of this technical analysis is the die link study performed on coins known as hvids (from German "Witten"). From this study, we will be able to attribute production site of the coins, as well as a rough estimation of the total number of coins produced and their relative chronology. This analysis will be reinforced and its range extended by a consideration of weight, diameter, die axis positioning and silver content, all elements

enlightening different aspects of the production technique and local practice at the mint.

In order to understand the political and economic context into which the issuing of coins under Gaute Ivarsson took place, we will first describe the state of the ecclesiastical coinage in Norway in the centuries preceding Gaute Ivarsson's coin production in the Archbishop's Palace. Secondly, we place the coin production in the Archbishop's Palace in its more immediate historical- and political context, before finally engaging the coins themselves.

2.2 COINAGE IN NORWAY IN THE 11TH TO 16TH CENTURIES

King Olav Tryggvason inaugurated a sporadic and limited Norwegian coinage during the years immediately prior to AD 1000. The production of coins on a larger scale, however, was not instigated until fifty years later. Numismatic and archaeological evidence suggest that from the time of King Harald Hardråde (the Hard Ruler) (1047–66), the Norwegian Crown kept strict control over the issuing of coins within its realm. Introducing a system of forced exchange of foreign and older currency, *renovatio monetae*, King Harald and his successor Olav Kyrre (the Peaceful) (1067–93) managed to establish and maintain a national currency over a period of nearly fifty years (Skaare, 1976:22–23; Gullbekk, 1997; Gullbekk, 2009b:42–47). At the same time, the kings secured the right to issuing coins as belonging to the Crown exclusively. The subsequent emissions then took the classical form as described by Volz (1971:160) as *Münzhoheit*, in which the king possesses all rights concerning design, weight, fineness, denomination, size of the emissions and area of distribution. As was the case in medieval Denmark, the rights to issue coins were to be regarded as the king's private property – *bona regalia* (Grinder Hansen, 2000:70–71; Risvaag, 2006:201–203). Even though several of the succeeding kings in the 12th and 13th centuries were unable to uphold the issuing of coins, there is little or no evidence of rivalling emissions. It has been suggested that the archbishops

achieved or assumed the rights to issue coins in the second half of the 12th century (Schive, 1865:XXVI; Holst, 1936:101–108; Johnsen, 1945:247; Blom, 1967:132–143; Simensen, 1992; Simensen, 1994:57–59; Simensen, 2003); however, these suggestions are based either on arbitrary interpretations of the iconography of anonymous coins[viii] from the period or even overlooking the evidence of coins themselves (Risvaag 2001:131–141; Risvaag 2006:232–270).

The first written evidence[ix] of the archbishops of Nidaros' right to issue coins is a letter of confirmation and protection (a *rettarbot*) of 1222, issued by King Håkon Håkonsson (1217–63)[x]. Its wording indicates that this was a new privilege (Blom, 1967:132–143), conceded to the residing Archbishop Guttorm and his successors as long as they remained friends of the Kingdom, accorded workforce, one moneyer ("*sylfr slatto man"*) and one assistant ("*Þionosto man"*), and not the right to determine weight, silver content, imprint, and area of circulation (*jus monetae* or *jus monetam percutiendi)* (Cf. Volz, 1971:158).

August 1st 1273, King Magnus Lagabøte (the Law-Mender) (1263–80) and Archbishop Jon Raude (1268–82) signed an agreement (*compositio*) in Bergen. One of the privileges being confirmed at this incident is the archbishops' right to issue coins.[xi] The text refers to the King's letter ("*littera sua"*) on the right to issuing coins, which may be a reference to the rettarbot of 1222, but is more likely to refer to a missing letter of privilege and confirmation issued by the reigning King Magnus (Risvaag, 2001:141). The agreement was rejected by Pope Gregor X (1271–76), but was replaced by a new settlement in 1277, named the *Settargjerd*. As in the 1273 agreement, a short statement on the right to issuing coins, the so-called *Stedjebrev*, was included.[xii]

As a consequence of a bitter strife between Archbishop Jon Raude and some of the most influential members of the Regent Government of the minor King Eirik Magnusson (1280–99), the *Stedjebrev*, and thus the issuing privilege, was

retracted by the Regent Government in 1281. After this incident, the archbishopric did not formally regain this privilege before 1458.

Although it is reasonable to assume – considering their preponderant position along with the economic interest linked to coin production – that the archbishops actually did issue coins throughout the whole period of the privilege (i.e. from 1222–1281), only one type of coins can be positively identified as of an ecclesiastical type. The type, a bracteate bearing a head with a mitre, is attributed to Jon Raude (Skaare, 1965; Skaare, 1995 II: No. 328). This absence of other clearly identifiable ecclesiastical coins is likely to be explained by the king's overall authority concerning the coinage. Practices identified in Denmark and England, probable sources of influence on the Norwegian system, lead us to assume that coins were issued by the archbishops according to the king's instructions which would have been impossible to distinguish from the kings own coins (Risvaag, 2001:134; Risvaag, 2006:269; Hauberg, 1900; Galster, 1936; Blunt, 1960; Blunt, 1961; Bendixen, 1976; Galster, 1978; Posselt, 1985; Jensen, 1993). As we shall see in the discussion concerning the coinage of Archbishop Gaute Ivarsson, there is reason to believe that this pattern was to be altered during the late years of his office and his followers.

By the late 1380s, Norwegian coin production gradually came to a halt, due in part to the economic downturn that had begun already in the decades preceding the Black Death (1349–50), in part to the lack of royal presence within the kingdom following Magnus Eriksson's role as king over both Norway and Sweden. The political course of events during the late Middle Ages is complex, with varying alliances and allegiances between the Nordic countries. None the less, neither the lack of coins in Norway, nor the desire to perform coinage within the kingdom ceased. Consequently, the Norwegian Council of the Realm

Figure 2.1. Bracteate attributed to Archbishop Jon Raude (1268–82) from Ranem church, Overhalla, Nord-Trøndelag (T24718–430)[xiii]*. A 1/4 penning*[xiv] *of the bracteate type is a thin flan with imprint only on one of the sides, weighing between 0.06–0.3 gram and was the most commonly used coin in Norway in the 12th and 13th centuries. The diameter of this coin is 15 mm. Photograph by Kari Dahl, NTNU Vitenskapsmuseet.*

on several occasions during the 15th century appealed, unsuccessfully, to the king, residing either in Sweden or in Denmark, to restore the Norwegian coinage (Risvaag, 2006:274–5). No trace of an initiative to the restoration of the Norwegian coinage can actually be found from the side of the Crown. The king's mints, in particular in Malmö, were producing large quantities of coins

from the early 1440s, and even though the availability of coins in Norway was scarce, in the eyes of the Crown it must have appeared satisfactory. Coin production in Norway thus was abandoned for more than a century.

There is no evidence of coin production in Norway after the late 14th century, until King Christian I on January 21st 1458, in an effort to have his oldest living son Hans accepted as his successor and thus reinforce the claim to Norway as a kingdom-elect, reconfirmed the *Settargjerd* of 1277[xv], and in consequence reinstated the archbishops' right to issuing coins. However, the lack of written or archaeological evidence, as well as of identifiable coins, suggest that coins still were not produced in Norway until the reign of King Hans (Risvaag, 2001:148; Risvaag, 2006:275–6; Risvaag, 2009). It is difficult to perceive the reason for this apparent lack of new ecclesiastical coinage in Norway. No evidence suggests the king actively taking actions to prevent such a coinage; actually, King Christian seems rather to have been lacking interest in Norwegian affairs in every way, including monetary issues (Albrechtsen, 2000). On the other hand, there cannot be detected any effort undertaken by the archbishops Henrik Kalteisen (1452–58) or Olav Trondsson (1458–74) to initiate coin production either.

2.3 ECCLESIASTICAL COINAGE 1483–1510

Following the death of Christian I on May 21st 1481, Hans was elected King of Denmark in May 1482. Negotiations with the Councils of the Realm of both Sweden and Norway were soon after initiated by the Danish Council in order to ensure the election of Hans to king in the two countries. In Norway, these attempts had been anticipated, and a proper response prepared. Soon after Christian's death, in August 1481, Archbishop Gaute Ivarsson summoned the clerically dominated Norwegian Council to Bergen. There, the Council decided on refusing participation in any election until their demands of having all Norwegian fiefs and castles placed under the authority of the Council were met.

Furthermore, the Council demanded the replacement of the Danish captain of Båhus Castle by a Norwegian. Securing the support of the Swedish Council at a meeting in Oslo in January – February 1482, the two councils signed a federation agreement February 1st 1482[xvi]. In a first attachment to the agreement, the Norwegian council laments the fact that the king, in spite of all promises, had not yet restored the Norwegian coinage[xvii]. A second attached letter to the Swedish Council of the Realm requests them to send one or two good moneyers to Norway[xviii]. No response from the Swedish Council of the Realm has been preserved.

The conditions were thus elucidated and the Norwegian position reinforced by the cooperation with the Swedes. After negotiations and the replacement of the Danish captain of Båhus by the Norwegian Jon Smør, the Norwegian Council of the Realm accepted Hans as their king. Of particular interest in this context is the fact that, in the protocol conditioning King Hans' election as king, the *Halmstadrecess*, of February 1st 1483, the archbishops' rights to issue coins were explicitly stated in an official document for the first time since the *Settargjerd* in 1277.

The § 14 of the *Halmstadrecess* states that coins equal to Danish coins were to be issued in Trondheim according to the privileges of the Church, as well as in Bergen and Oslo[xix]. Thereby the old privilege of 1222 was reiterated, since the statement "coins equal to Danish coins" ("*jaffngod mynt wid Danske penge"*) is in strict accordance with the statement "coins of the fineness and weight We or other Kings decide to circulate in Nidaros" ("*slykt sylfer at skyrleika oc stinleika sem var vili verdr till. eda annara kononga at gange i Nidarose"*) in the original privilege. The consequence for the Norwegian coinage of the statement "coins equal to Danish coins" was the formal shift of weight systems from the Anglo Saxon/Norse to the mark of Lübeck, which the Danish coinage formally had been following since the turn of the 14th century. The system of Lübeck was

based on the mark of Cologne, with a content of 233.85 gram fine silver. Nominally Danish and Lübeck coinage were considered equal; in reality the Lübeck coins generally were of a higher standard compared to the Danish (Skaare, 1995:86).

2.4 COINAGE IN NORWAY DURING THE OFFICE OF GAUTE IVARSSON

The fact that the *Halmstadrecess* reinstates the right to issuing coins in Trondheim, Bergen and Oslo, does not automatically imply that coin production was resumed in all three designated cities, nor that the actual production was started immediately or that it reached any real regularity. The die link studies of hvids proposed in this paper – as we shall see in chapter 3.6 – as well as the iconographic analyses of pennings, effectively suggest that coin production was actually performed only at two sites in Norway during the reign of King Hans, notably Bergen and Trondheim (Risvaag, 2006:368–372).

A theory of a small coin production in Oslo by King Hans has lately been put forth by Svein H. Gullbekk (Gullbekk, 2009b), on the basis of letters dating 1439, 1482 and 1499, mentioning a building named *Myntergard* (*Diplomatarium Norwegicum* V 677; V 919 and XIII 163), which might be read as indicating a mint or moneyer's house. The reference to the *Myntergard* is particularly clear in the letter of 1499 – coinciding suggestively with the newly re-established Norwegian coinage – mentioning Arne in the *Myntergard* due to pay 60 lodd in silver fines to the King for having a ship built for foreign coins (DN XIII:163)[xx]. In Gullbekk's view this is an indication of an Oslo coinage (2009b:18). This interpretation is, however, in our view not fully convincing, and it seems precocious to infer actual coin production from the name of this building. Two of the letters (1439 and 1482) date to a period where the Norwegian coinage was non-existent, and none of the letters mentioning the building can be related to coin production. The building is not recorded prior to

1439 (Bull, 1922:179) but seems to have been constructed sometime after the great fire of 1352, serving either as a mint, the residence of the moneyer of Oslo or both. Long lasting names of important buildings, even though their original use or meaning might be long gone, are not rare (Risvaag, 2009). It is therefore most likely that the name *Myntergard* is a reminiscent name of a prominent Oslo building dating back to the second half of the 14th century, a time where there indeed was a coin production in Oslo. On the basis of this, and since no traces of such activities from the period in question can be found, we find it more likely that Norwegian coin production from the period is geographically limited to Trondheim and Bergen.

Superimposed on the question of determining in which cities coin production took place, is the equally intriguing question of determining who in fact the issuer of the coins was, a question quintessential in understanding the political implications of the coinage. In what concerns the coin production in Bergen, the answer to this seems clear. The fact that the archbishops' coining privilege was located to Trondheim ("*I Trondhiem effther Nidross domkyrkes preuilegier*"), as well as the iconography of the coins marked "Bergen" (all being royal types), seems to establish well that the mint in Bergen was controlled exclusively by the king. Determining issuer in Trondheim, however, is more complicated. Whether the mint in the Archbishop's Palace was used solely by the archbishops, or also by the archbishops in cooperation with the king, is less obvious. These questions will be addressed in more detail in chapter 4.

The exact time of the resumption of the archbishops' coinage remains uncertain. The archaeological data from the excavations in the Archbishops Palace dates the first mint workshop to AD 1500 (Olsson, 2000). However, even considering that it might have taken some time to find a proper moneyer, it seems quite unlikely that Archbishop Gaute should abstain from issuing coins for seventeen years after obtaining the privilege. It is possible that coinage might have been

performed in a hitherto not identified mint workshop within the limits of the Archbishop's Palace, or at another location in the city, but no traces have so far been discovered of such activity taking place.

These uncertainties explain in part the difficulty linked to assessing the importance of coinage under Archbishop Gaute Ivarsson. Understanding its economic importance – that is to say which role it played in the system of exchange in the Norwegian society of the late Middle Ages – is also intrinsically complicated, since the amount of coins that are identifiable to this period is limited, and out of these the part of foreign coins (mostly German, Swedish and Dutch) is considerable. Furthermore, the majority of coins found that were issued under the authority of King Hans stems from the royal mint of Malmö, the major production site of the joint kingdoms of Norway and Denmark. A last complication in our attempt to understand the economic and political implications of Archbishop Gaute Ivarsson's coinage is that, as we shall see in the following, a large portion of the coin production from Norway during the reign of King Hans has been subject to some argument concerning attribution of issuer and production site.

2.5 CATEGORIES OF COINS, PRODUCTION SITES AND ISSUERS

The Norwegian coins from the turn of the 15th and 16th centuries consist of five denominations, notably gylden, skilling, søsling (half skilling, from German: Sechsling), hvid (from German: Witten) and a penning type commonly referred to as *hulpenning* (from German: Hohlpfennig). The hulpenning is a bracteate type, with impression on only one side of the coin, and will in the following pages be referred to as *penning*.

The skilling, søsling, hvid and penning all corresponded internally:

1 skilling = 2 søslings = 3 hvids = 12 pennings

The gylden was a preferred currency for international trade and did not correspond to this system. The weight of the skilling is on the other hand related to the mark of Cologne:

1 mark = 16 skilling

From King Hans in Bergen we have preserved gylden, skilling, søsling, hvid and penning, all clearly marked "Bergen". From Archbishop Gaute Ivarsson in Nidaros, the production seems to have been limited to two main types; we have hvids clearly identifiable by inscriptions stating the Archbishop in Nidaros, and pennings bearing the archbishopric's coat of arms. In determining the importance of the coinage performed under Gaute Ivarsson, our analysis will therefore be based on a study of hvids and pennings.

In addition to these coins clearly marked with production site, there exists a substantial number of hvids without direct reference to any specific mint. A key element in our analysis will be attempting to identify the mint in which these hitherto unidentified coins were produced.

2.5.1 Pennings – introductory remarks

The pennings are all without legends, but we maintain that attribution of issuer and place of coinage can be proposed on the basis of their iconography. There exist two categories, pennings bearing the Norwegian Lion and pennings bearing variations of the archbishopric's coat of arms.

The distinct division between the iconographic main types seems to point towards a clear separation between coins issued by the king and the archbishop, with the pennings bearing the Norwegian Lion being that of the king's coinage, and the pennings bearing variations of the archbishopric's coat of arms being that of the archbishops' coinage. Assessing the importance of the bracteate production under Gaute Ivarsson can as a result be based on the indicators

weight and external measurement of these archbishop's types. This analysis will be presented in chapter four.

Figure 2.2. Schive XIV, 37. Penning bearing the Norwegian Lion[xxi].

Figure 2.3. Schive XVII, 29 and 30. Two pennings bearing variations of the archbishopric's coat of arms.

2.5.2 Hvids – introductory remarks

The question of determining what level the hvid production reached under the office of Archbishop Gaute Ivarsson is not, however, so straightforward. Questions have arisen concerning the relationship between the coinage of King Hans and Archbishop Gaute, relating both to the location of the production site, and to which issuer the coins are to be attributed. These two questions constitute the veritable crux in our attempt to assess the importance of the coinage in the Trondheim mint, and after some preliminary remarks, they will be given ample attention in our following chapter 3.

The hvids can be divided into three categories:

1) Hvids produced in the name of King Hans and marked Bergen (90 specimens)
2) Hvids produced in the name of the archbishop and marked Nidaros (26 specimens)
3) Hvids produced in the name of King Hans or St Olav – undisclosed mint (166 specimens)

The coins marked Bergen must be considered as produced in the king's mint in Bergen, and the coins marked Nidaros as being coined in the archbishop's mint in Trondheim. The attribution of the third category of coins, stemming from an up to now undisclosed mint, however, poses problems. When considering the important number of coins stemming from this undisclosed mint, the questions of ascertaining what their production site is and determining who their issuer is, are crucial to the discussion on the importance of the coinage under Gaute Ivarsson.

3 GAUTE IVARSSON'S HVIDS

The coins marked Moneta Arepi Nidrosi are in the following considered to stem from the mint in the Archbishop's Palace, while the coins clearly marked Bergen are attributed to the king's coinage in Bergen. In this chapter, our first centre of attention is directed to the hvids bearing neither a clear reference to Trondheim nor Bergen, that is to say, the hvids from the undisclosed mint, and the questions of determining, firstly, their site of production, secondly, to which issuer they are to be attributed. After this examination, we will turn to their relationship to the coins clearly marked with production site.

3.1 ICONOGRAPHY OF HVIDS FROM THE UNDISCLOSED MINT

The coins from the undisclosed mint are for the most part characterized by an assortment of symbolic representations and legends associated with the king, with some appearances of Olav iconography and legends. The provenance of these coins has been disputed in the literature, a dispute which concerns:

1) Either the large assembly of coins which we later will group as type IV (141 specimens), or 17 specimens from this type (dies number 326, 327, 328 and 338), characterized by their Olav inscriptions in combination with crowned monogram **h** on the obverse.
2) The five specimens which we later will group as type V, combining crowned monogram **h** with Norwegian coat of arms and Olav inscriptions.
3) The two specimens which we later will group as type VI, which combines axe in shield over long cross with crowned monogram **h**.
4) The 18 specimens which we later will group as type VII, which combines axe in shield over long cross with crowned monogram **O**.

All of these main groups are illustrated in chapter 3.5. Schive, Schou and Skaare attribute most of these coins (types IV, VI and VII) to King Hans (Schive, 1865, 133 and XIV 32–33; Schou, 1926, no. 220; NMH I, 95–96; NMH II, no. 301), and suggest on basis of the formulations in the *Halmstadrecess* that the probable place of coinage is Oslo. This assumption is also made by Axel Ernst (1940:79). The certainty of this was questioned by Nils Ludvig Rasmusson, pointing to the fact that there is ample evidence of grants and regulations which never came into action. Rasmusson abstained from any conclusions, but suggested the possibility of these coins either being royal and ecclesiastical hybrids from Trondheim or royal coinage from Bergen (Rasmusson 1943:283–284). This middle position was followed up by Ahlström, Brekke and Hemmingsson in their catalogue on the coins of Norway, merely stating the lack of mint signature and the difficulties of identifying which coins belonging to the archbishop, and which should be considered royal (Ahlström et al. 1976:34–35). Karin Berg argues, in her incomplete catalogue over Norwegian Archbishops' coins, that the most probable issuer of type VII is Archbishop Gaute Ivarsson (Berg (unpublished manuscript), gruppe I a-b), which in consequence means they were coined in Trondheim. However, she did not take into consideration type VI, which shares the reverse with type VII. The Danish collector Jørgen Sømod goes even further, attributing all coins bearing St Olav inscription – i.e. our types V, VI, VII and the 17 coins from type IV (dies number 326, 327, 328 and 338) – to ecclesiastical coinage, most likely Trondheim (Sømod, 1975:9–13).

In our view, this last conclusion seems hastened when based solely on an iconographic interpretation. St Olav is represented in the general array of symbols used by as well King Hans as Archbishop Gaute. Both the kingdom and the archbishopric were deeply rooted in a tradition where significant shares of their authority stem from that of the saint. This is also reflected in the iconography of their respective coins and other expressions of secular power. Gaute Ivarsson's pennings bear the Olav axe, alone or in combination with a

crozier. The Olav axe is similarly used in the seal of both Olav Trondsson and Gaute Ivarsson, alone or in combination with the crozier (Risvaag 2001:151–152). From the side of the Crown, the axe was introduced in the Norwegian coat of arms already by King Eirik Magnusson, ca AD 1285, thus joining the archbishopric in their use of the Olav iconography for political purposes (Fjelde Larsen, 2003:101). It is therefore not straightforward to assume Olav iconography on coins necessarily implies ecclesiastical coinage.

Certain combinations of Olav iconography must none the less be interpreted as exclusively ecclesiastical. Taking into account the use of the axe in the archbishop's coat of arms, and also the thorough use of axe and axe in combination with crozier as the only symbols on the pennings of Gaute, it appears reasonable to interpret the axe in shield as the archbishop's or archbishopric's seal or coat of arms. This interpretation is supported by the find of a lead seal (T021437) with a variation of the axe in shield at Marinen, Trondheim, immediately adjacent to the Archbishop's Palace. The seal might be older than the time of Gaute Ivarsson, however, a similar lead seal was equally found in period 6, phase 2 (AD 1500–32) in the southern wing of the Palace (N170075), which seems to strengthen the hypothesis of this belonging to Gaute Ivarsson.

When considering these aspects, we find that the combination of the crowned O (St Olav) and the Olav axe as can be seen in the coins discussed is probably best attributed to ecclesiastical coinage, or, subsidiary, considered a type used equally by king and archbishop (Risvaag 2001:151–152). The hvid types VI and VII, one bearing the name of King Hans and one that of St Olav, are both imprinted with an axe in shield on the reverse, and we therefore find it most probable that these coins are issued by the archbishop, i.e. in the mint of the Archbishop's Palace.

How refined it may be, such a procedure based solely on the analysis of iconography will none the less contain a certain element of conjecture, and will not reach an unambiguous conclusion. This concerns both the question of determining the issuer and production site. In order to determine the question of production site with more certainty, a more technical approach has been chosen. This consists of a die link study and the analysis of weight, size, production technology, and die axis positioning.

3.2 DIE LINK STUDY – DESCRIPTION OF THE PROCEDURES

In order to establish the importance of the coinage in the Archbishop's Palace, a die link study of the coins identifiable to King Hans and to Archbishop Gaute Ivarsson has been performed (Risvaag, 2006:366–394). In order to avoid confusion, the naming of types, chains and coins used here are in accordance with the ones used in earlier publications.

Contemporary illustrations and treatises on coin production describe the consecutive steps of the production process of coins in the Middle Ages. As well the archaeological evidence as the metallurgical analysis performed in part II, confirm that similar procedures were used in the mint in the Archbishop's Palace. What occupies us in this chapter, are the procedures involved in the actual striking of the coins.

All coins, with the notable exception of pennings, are imprinted at the front (obverse) and at the back (reverse), with a different die being used at each side. One of the dies, often, but not exclusively, the obverse, was attached to a tree stump at a workbench. The blank was placed on top of this fixed die. The other die, often the reverse, was handheld by the workman, and was given one or

Figure 3.1. The procedures of medieval coinage as depicted in Olaus Magnus' History of the Nordic countries (Historia de gentibus septentrionalibus), *from AD 1555. Olaus Magnus was the last Archbishop of Uppsala, nominated in 1544, but could not exercise his office due to the Reformation in Sweden. His book was the main source for knowledge of the Nordic countries in Europe for more than a century. The figure shows no details of dies, but indicates how the workers are sitting at their workbenches.*

several strokes with a hammer so that the patterns of the dies were impressed on both sides of the blank. Following a general rule of the obverse being fixed, Brita Malmer points out that in Viking Age Sigtuna it was not uncommon for one obverse to have four or five reverse die links (Malmer, 2010:43). In the following, note that the die considered the reverse is as a rule the fixed one in the Trondheim coinage.

Figure 3.2: Mounted and hand held die in medieval coin production. When producing coins, a blank is placed between two engraved dies. The lower die is mounted to a tree stump at a workbench, while the upper die is hand held. Illustration by Lars F. Stenvik, NTNU, Vitenskapsmuseet

The objects used to make the imprints themselves, the dies, are impossible to recover, as they were consequently destructed after use in fear of counterfeit. However, from the imprints on the coins, we can observe that each die is individually engraved, and has its own exclusive characteristics. Due to the extra wear caused by the loose handling of the hand held die, this would be worn faster than the mounted die, and therefore replaced more often. Eventually, when this too was worn, the mounted die would also be substituted, but at a

slower pace than the replacement of the hand held die. In return, once the mounted die was worn out, one of the hand held dies was coupled with two mounted dies. It is this interchanging of dies that creates a chain of coins being issued, with alternating dies on each side of different coins. The die link study is an attempt, by examining the coins, to identify each die being used in the production, and to identify which obverse- and reverse dies that are connected on each individual coin.

By establishing such connections between the imprints on obverses and reverses, we can assess the number of combinations existing, and thus give an estimate of the number of dies involved in the production of coins. When combining this number with an estimation of how many coins one die possibly could imprint, we can in effect give a qualified appraisal of the number of coins produced in the mint workshop of the archbishop. However, due to them being systematically destroyed, the endurance of the tool cannot fully be assessed, and the estimated number cannot be unequivocally confirmed.

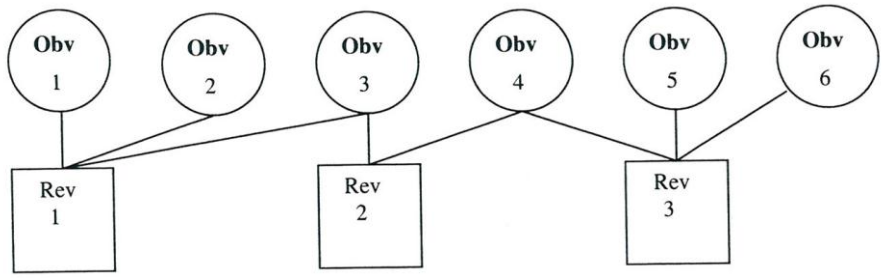


Figure 3.3. Die link chain: basic principle. Due to the extra wear of the hand-held upper die, it is replaced more often than the mounted die. Since each die displays individual characteristics, we can establish links between different dies. In the graphic representation of chains, note that the reverses are marked as squares, while the obverses are represented by circles.

One remark on a methodical level needs to be made to this somewhat idealized picture establishing a chain of dies. The fact is that the coins are often in a meagre condition. The interpretation of their imprints might be revealing, but the uncertainty linked to their deteriorated state obliges us to explicitly acknowledge its inherent limitations.

3.3 HYPOTHESIS

Dies used in coin production were manually engraved by using punches and therefore show individual characteristics. Whether these dies were locally manufactured, we do not know. However, considering the time involved of travel and the inconveniences implied by the distances, and especially the administrative and political strains implied in such a traffic, we may assume that they were not sent from one mint to another according to demand. When combining this assumption with the establishing of die link chains, we reach the conclusion that all dies involved in a chain of dies have been used in the same mint. The following die link study will demonstrate that all hvids dated to the office of Gaute Ivarsson marked neither with Bergen nor Nidaros, or clearly identifying the archbishop as issuer, must be coined at the same location. In our view, the most probable production site is Trondheim.

3.4 DIE LINK STUDY – TYPES AND LEGENDS

Not all known specimens of the hvid types of King Hans and Archbishop Gaute Ivarsson are included in the study. This is mainly due to the fact that many coins are in a very poor state, thus being unidentifiable on die-level, and partly that some specimens have been unavailable for studies. As a result, the number of coins represented in the chains is *lower* than that found in the general description of the types, where all specimens identifiable to main types are included.

For the identification of dies, the principles stated in Brita Malmers catalogues on Swedish Viking Age coinage, "every die which can be proved to be different from another die, even if only in one single letter, has its own number" (Malmer 1989; Malmer 1997) has been followed. A total of 282 hvids from Norwegian coinage exist from this period, of which 90 are clearly marked Bergen. 192 coins referring to Trondheim or produced in the undisclosed mint are included in this study, of which 18 are in such a state that the individual die has proven to be impossible to ascertain, and they are not identified more closely than to main types[xxii] (IV, V etc). From the remaining 174 coins, 51 obverse and 29 reverse dies have been identified[xxiii].

All types bear legends between two circles of pearls. Obverses consist of five main themes referring to:

1) King Hans
2) St Olav
3) Archbishop
4) Mint (moneta) of Norway
5) New Mint (moneta nova) of Nidaros.

Reverses consist of three main themes referring to:

1) King Hans
2) St Olav
3) The Mint (moneta) of Norway.

These can be assembled into more general types, permitting us to explain the cohesion of the coinage, to give an impression of the relative chronology of the coins and help us to understand how they are linked.

3.5 TYPES

Five distinct types have been identified, and the illustrations are all typical examples from these types. Note that the enumeration of the types is based on earlier publications (Risvaag, 2006), and in order not to create confusion they are not changed. The hvid types I, II, and III, 90 specimens, are all produced in Bergen, and are not extensively discussed in this paper.

Hvid type IV (141 specimens)

Obverse:

Crowned monogram **h**, sometimes bordering in shape to **n**. Open or closed crown. Sometimes additional symbol: ○, ● or ⁘.

Legend between two circles of pearls: Variations of:

1) IOhAnS/hAnS DGR nORWEI (25 dies)
2) SAnTVS OLLAVVS (4 dies)
3) MOnETA nORWEI (1 die)

Reverse:

Norwegian Lion over long cross. Sometimes additional symbol: ○ or ●.

Legend between two circles of pearls: Variations of:

1) MOnETA nORWEI (15 dies)
2) IOhAnS DGR nORWEI (1 die)

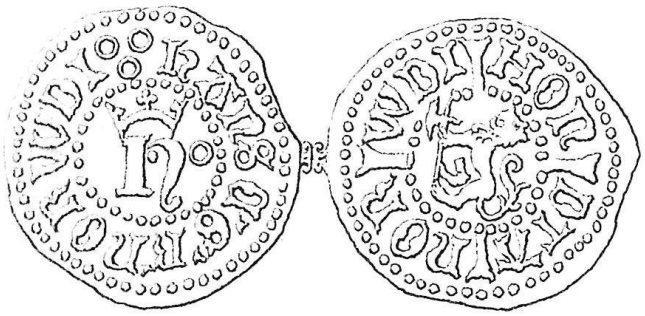


*Figure 3.4a. Schive XIV, 14. Typical example of coin type IV, crowned monogram **h** (obverse) and Norwegian lion (reverse)*

Hvid type V (5 specimens)

Obverse: Crowned monogram **h**. Open crown. Sometimes additional symbol: ○.

Legend between two circles of pearls: Variations of:

1) IhAnS DGR nORWEI (2 dies)
2) SAnTVS OLAVV (1 die)

Reverse: Norwegian coat of arms over long cross.

Legend between two circles of pearls: Variations of:

1) MOnETA nORWEI (1 die)
2) SAnD T On AWS REX (1 die)

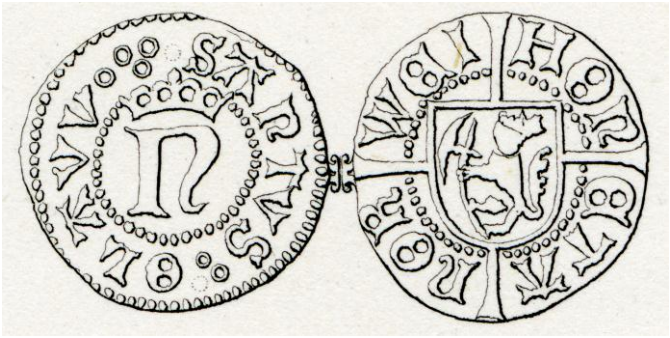


Figure 3.4b. Schive XIV, 34.
*Typical example of type V, with crowned monogram **h** (obverse) and Norwegian coat of arms over long cross (reverse). Note that the monogram **h** sometimes borders **n**.*

Hvid type VI (2 specimens)

Obverse: Crowned monogram **h**. Closed crown.

Legend between two circles of pearls: Variation of

hAnS DGR nORWEI (1 die)

Reverse: Axe in shield over long cross

Legend between two circles of pearls: Variation of

MOnETA nORWEI (1 die)

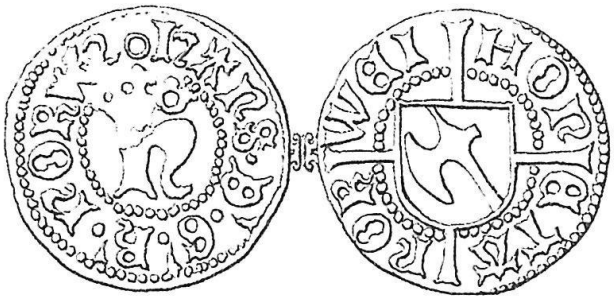


Figure 3.4c. Schive XIV, 31. Obv. 317/rev. 1401.
Typical example of coin type VI, with crowned monogram ***h*** *(obverse) and axe in shield over long cross (reverse).*

Hvid type VII (18 specimens)

Obverse: Crowned monogram **O**. Closed crown.

Legend between two circles of pearls:

SAnTVS OLAVVS (3 dies)

Reverse: Axe in shield over long cross

Legend between two circles of pearls: Variation of

MOnETA nORWEI (2 dies)

Figure 3.4d. Schive XIV, 32. Obv. 402/rev. 1402.
*Typical example of coin type VII, with crowned monogram **O** (obverse) and axe in shield over long cross (reverse)*

Archbishop type hvid (26 specimens)

Obverse: **n**

Legend between two circles of pearls: Variations of:

1) MOn AREPI nIDROSI (12 dies)

2) MOn nOVA nIDROS (2 dies)

Reverse: Norwegian coat of arms over long cross

Legend between two circles of pearls: Variations of:

SAn OLA WS REX (8 dies)

Figure 3.4e. Schive XVII, 26.
Typical example of coin of the archbishop type hvid, with ***n*** *(obverse right) and Norwegian coat of arms over long cross. Note that Schive argues the opposite distribution of obverse and reverse; in our view, this distribution is non-consequential.*

3.6 CHAINS

The following chains 7, 8 and 9 consist of the coins stemming from the undisclosed mint. The chains 10–14 are the chains referred to as the archbishop type hvid, seeing that all are clearly imprinted with **n**, referring to the archbishopric, as well as Olav inscriptions.

3.6.1 Chain 7 – types IV, VI and VII

The largest chain in the investigation (chain number 7) includes all variants of hvids type IV, VI and VII, i.e. hvids with crowned monogram **h**/Hans- or St Olav legend on the obverse and Norwegian lion/Moneta Norwei on the reverse, hvids with crowned monogram **h**/Hans legend on the obverse and axe in shield on the reverse, as well as crowned monogram **O** on the obverse and axe in shield on the reverse. These observations permit us to infer the following:

The fact that a link has been established between the types IV, VI and VII enables us to propose, firstly, that a continuum of dies were used, i.e. their coinage was performed in the same mint.

None of the dies from the Bergen mint correspond to either the undisclosed mint or to coins clearly marked Trondheim. This leads us, secondly, to conclude that Bergen with all probability was not the production site of these coins.

Once this established, the question is, thirdly, in what mint they were produced. It was argued in chapter 3.2 that the manifest Olav iconography of the types VI and VII indicated that their production site most probably was Trondheim.

This clear link between Hans/Moneta Norwei coins (type IV) with what in our view has to be interpreted as indications of ecclesiastical iconography (Olav legend, crowned **O** and axe in shield (type VII)), is the most convincing sign

Chain 7:

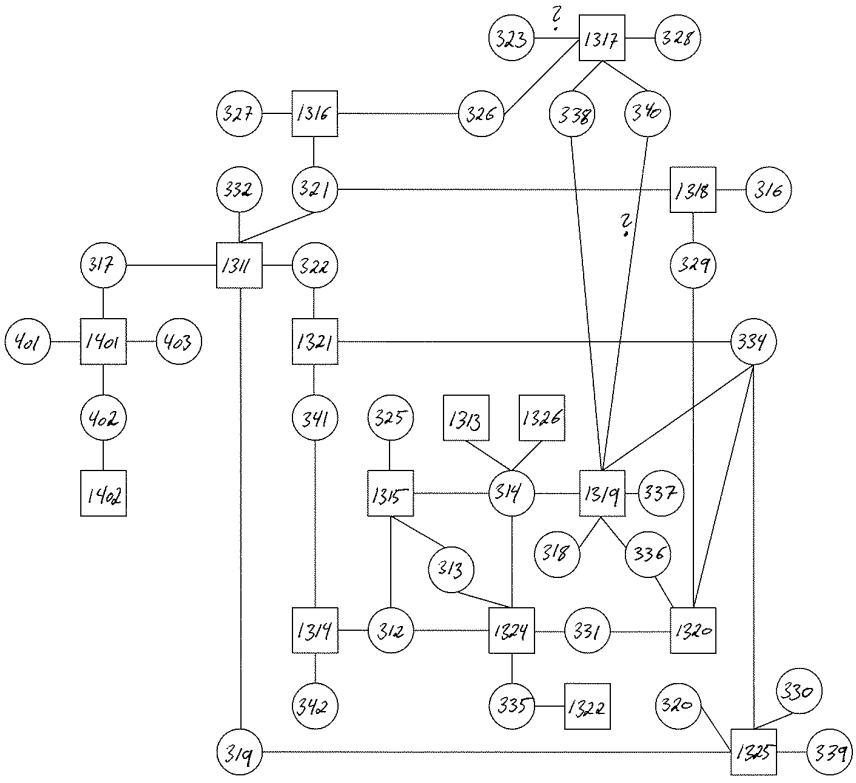
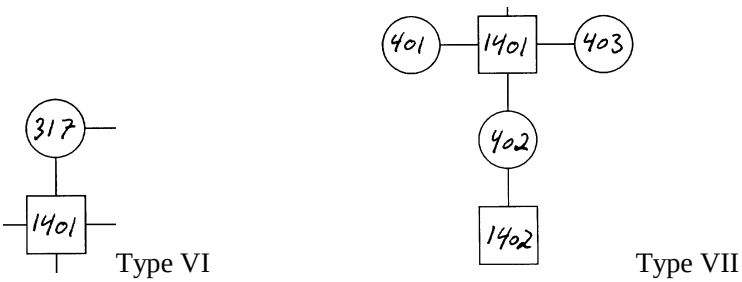


Figure 3.5. Chain 7, the largest of the chains, consists of 124 specimens identifiable on a die level. In addition, 17 coins have been identified as belonging to the type IV, without certain attribution of die. By this chain, we can observe how the three types IV (the main bulk of the chain), VI and VII (see figure 3.6) are linked together, thus linking the broadest part of the coins from the undisclosed mint with coins bearing clear iconographical indications of ecclesiastical coinage. It is this link that suggests that all of these coins were coined in the same mint workshop. The link 317–1311 is represented by two specimens.

that leads us to suggest Trondheim as site of production. This position is reinforced by the thorough use of Olav legends on the obverse of the hvids where only the archbishop is indicated as issuer. Notably four of the obverses (nos. 326, 327, 328, 338) of the type IV coins also bear St Olav inscriptions.



Type VI Type VII

Figure 3.6. Types VI (two specimens) and VII (18 specimens). The key element in this largest of the chains involved in this paper is the interconnection of obverse 317 with reverse 1311 and reverse 1401. This links the type IV with type VI, which in turn is linked with type VII via their common reverse 1401. We can therefore maintain that there exists a chain of dies between the Hans iconography (types IV and VI) and the manifest Olav iconography (type VI and VII). Note that the link 317–1401 is represented by two specimens.

As we shall see in the following chapters, other material elements than iconography and the chains point towards Trondheim as production site of the coins from the undisclosed mint.

Establishing that the whole of chain 7 most probably is coined in Trondheim brings significant new light on the importance of the coinage performed in the Archbishop's Palace during the office of Gaute Ivarsson. Opposed to the previous number of 26 undisputed coins of the archbishop type, we can now

suggest that the 124 coins of chain 7 (plus the 17 from type IV without attribution of die) are to be included in the total number of coins stemming from the Trondheim mint. The question which will occupy us in the following is whether the five coins stemming from the undisclosed mint but not connected to the chain 7 are equally coined in the mint in the Archbishop's Palace.

3.6.2 Chains 8 and 9 – type V

The two chains 8 and 9 constituting the type V are characterized by crowned monogram **h** on the obverse and Norwegian coat of arms over long cross on the reverse. Only five specimens are known of this type, which suggests a very limited production.

In passing from the coins constituting chain 7 to the type V, one can observe a marked deviation in types, notably the introduction of the Norwegian coat of arms over long cross on the reverse. As illustrated in the concordance diagram in chapter 3.7, a similar deviation is observable in the Bergen counterparts (the development from type III to types I and II).

The type V hvid seems to be a transitional type. The similarity in iconography indicates that it gave way to the archbishop type hvid, bearing the single **n** and St Olav or archbishop legend on the obverse, and Norwegian coat of arms over long cross. We can observe how, even though no link is established, chain 8 type has a parallel in archbishop's coins, bearing Norwegian coat of arms and legend variations over San Olav Rex on the reverse. The transitional character of this type is further underlined in that the chain 9 shares characteristics with four dies (327, 328, 329 and 338) from type IV and obverse type VII. It thus seems reasonable to conclude that the type V was produced between the types included in chain 7 (IV, VI and VII) and the archbishop type.

The type V cannot so far be linked to neither the large chain 7 nor any chain relating to the archbishop type. However, since they share certain of their

characteristics, it may be assumed that the type V eventually can be linked to one or more of the archbishop chains or to chain 7. We will come back to this question in chapter 3.7.

Chain 8; 3 specimens Chain 9; 2 specimens

Figure 3.7. The two chains constituting the type V, with a total of five coins identifiable on a die level.

The interpretation of Olav iconography and legend references as indicating Trondheim as site of production is further strengthened when we consider the hvid type V (obverse: crowned monogram **h**/ reverse: Norwegian coat of arms over long cross).

In our view, the most probable production site of hvid type V is Trondheim, due to the fact that all coins are given Olav legends on the obverse or the reverse. It seems plausible that all the different types of Trondheim have been coined in a parallel manner to those of Bergen. No record has been preserved concerning this change of type, but the limited amount of coins and the inconveniences involved in issuing several types of coins at the same time lead us to conclude that they occur at the same time at both places.

3.6.3 Chains 10–14 – archbishop type

Five chains (10–14) with a total of 25 specimens refer explicitly to the archbishopric. In addition, the type contains one specimen not identifiable on a die-level. On all obverses are imprinted the letter **n**, referring to Nidaros, while

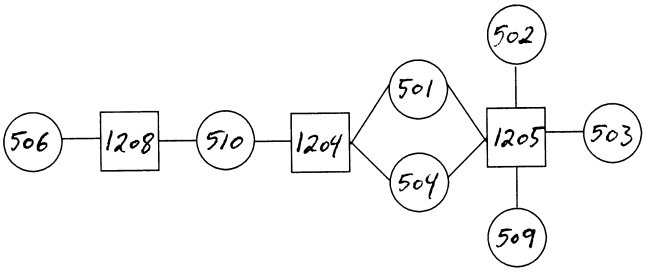
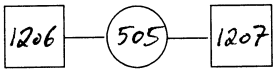
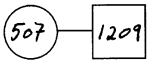


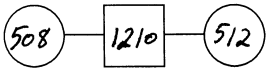
Figure 3.8. Chain 10, consisting of 15 specimens identifiable on a die level. In this chain, we can see how the realities of the actual production complicates the image of die link studies we outlined in our figure 3.3, in that there might exist several connections between obverse- and reverse dies. This might be due to pure coincidence, such as an interchanging of dies between workers.



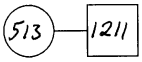
Chain 11; 5 specimens



Chain 12; 1 specimen



Chain 13; 3 specimens



Chain 14; 1 specimen

Figure 3.9. Chains 11–14. The four remaining chains making up the archbishop type, consisting of a total of 10 specimens identifiable on a die level.

their legends display variations over the theme of St Olav or Nidaros. The reverses display variations over Norwegian coat of arms over long cross and St Olav Rex-legends.

Even though no direct link between these five different chains has been established, we can observe how the reverses of these coins are to a large extent quite similar, all bearing Norwegian coat of arms over long cross with Olav legends. We therefore find it probable that, as more coins may be discovered, several, and maybe even all, of these chains might eventually be linked together. It is also on basis of these similarities between the different reverses and the reverse of type V that we consider it most likely, if more coins are found, that also the type V is connected to the archbishop's chains.

On the basis of this discussion, we might therefore draw the following conclusions from the die link analysis:

1) On basis of chain 7, the majority of coins from the undisclosed mint were produced at the same location.
2) Chain 7 also establishes a direct link between the majority of coins from the undisclosed mint and the Olav-iconography.
3) The Olav iconography (axe in shield over long cross and crowned monogram O) suggests Trondheim as most probable place of production, an interpretation that is reinforced by the use of Olav legends.
4) This latest point is reinforced by the manifest Olav iconography on the archbishop's coins.
5) The St Olav legends of the five coins constituting type V suggests that they also were issued in Trondheim.

3.7 LOCATION OF THE MINT AND ATTRIBUTION OF ISSUER

Establishing that all hvids stemming from the undisclosed mint (chains 7–9) were produced at the same location raises two further questions; firstly the question of location of the mint, secondly the question of attributing issuer. The first of these questions might be reformulated in the following manner: either all or none of the coins from the undisclosed mint were coined in Trondheim. The manifest iconography, with St Olav legend, St Olav's axe and the crowned monogram O, are indications that Trondheim is the most probable production site. The possibility certainly exists that the king might have used this iconography in Bergen or Oslo, but the use of the axe alone or in combination with a cross or crozier have an overall probability of being exclusively ecclesiastical symbols, an interpretation that the thorough use of axe or axe and crozier as the only symbol used on Gaute Ivarsson's pennings seems to reinforce.

Establishing the issuer of the coins is less straightforward. However, a consideration of the relative chronology of the coins might help us enlighten certain characteristics that have appeared over time, and which might be possible indicators.

Establishing the relative chronology of the coins is not evident either, given that no record regulating their design features has been preserved, and that no indication of production year is visible on any of the coins. Certain elements can none the less provide us with revealing clues.

The most significant of these clues is the fact that the coins bearing clear **n** resemble coins identifiable as issued by the archbishops following Gaute Ivarsson. We therefore find it most probable that these coins were produced *later* than the coins which strongly resemble the king's coins.

From this starting point, we can organize the main types into a concordance diagram, indicating the relative chronology of the coins.

The question of determining the relative chronology of the other types is based on a typological development. Given the extent of the coinage as well as practical considerations, it seems unlikely that different types have been imprinted at the same time, providing us with more or less discrete types that allows for a systematic typology.

In the diagram below we have included the coins from the king's coinage in Bergen, as the similarities and dissimilarities in iconographic representations between the two coinages, Bergen and Trondheim, will aid us to identify the respective development steps with a higher probability. We can see how the types III and IV share iconological representations, whilst the type VI is bearing first an axe in shield, not to be found in the Bergen samples, and later on the type VII is combining this axe in shield with the crowned monogram of Olav. This indicates a gradual development of dissimilarity in iconography, pointing towards more independence in the Trondheim coinage.

Table 3.1. (Next page) Concordance diagram. Note that the concordance diagram only indicates the iconographical representations of which the main types are organised. The Bergen coins are all marked clearly "Bergen", and the archbishop's coins all have St Olav legends and direct reference to Nidaros. The coins from the undisclosed mint (types IV, V, VI and VII) does not comport such clear indications of origin. Note also that the enumeration of the types is based on earlier publications (Risvaag, 2006), and in order not to create confusion they are not changed. The seemingly haphazard enumeration stems from the fact that the relative chronology of the coins has not before been at the centre of our attention.

Bergen					Trondheim				
Type	Obverse	Reverse	Med./mean weight gram	Chain	Type	Obverse	Reverse	Med./mean weight gram	Chain
III	Crowned monogr. **h**	Norweg. Lion /long cross	0.59/0.56	6	IV	Crowned monogr. **h**	Norweg. Lion /long cross	0.64/0.63	7
					VI	Crowned monogr. **h**	Axe in shield /long cross	0.71/0.71	7
					VII	Crowned monogr. **O**	Axe in shield /long cross	0.60/0.60	7
I	Crowned monogr. **h**	Norw. coat of arms/long cross	0.75/0.71	5					
II	Crowned monogr. **h**	Norw. coat of arms/long cross	0.80/0.79	5	V	Crowned monogr. **h**	Norw. coat of arms/long cross	0.62/0.64	8-9
					Gaute Ivarsson	**n**	Norw. coat of arms/long cross	0.63/0.64	10-14

This interpretation of relative chronology is also supported by another factor pointing towards the proposed concordance diagram; notably the differences in weight between the coins, mainly observable in the Bergen material. Even if possible, it seems highly unlikely that there should appear a lessening in the quality of the coins produced in the Bergen mint, an assumption that leads us to think that the heavier coins are struck the last, possibly in an effort to adjust the Norwegian coinage to the Danish.

Obverses of types IV, V and VII bear variations over the St Olav legend. The reverses of types V and Gaute Ivarsson, on the other hand, have both iconographic representations (Norwegian coat of arms over long cross) and legend variations (San Olaws Rex) in common. We can observe how the legends gradually shift from Hans/Moneta Norwei to legends referring to the archbishop, St Olav and Nidaros. We can thus identify a shift from legends referring to royal and national coinage, to legends explicitly exposing the prestige of the archbishopric. Based on all these indicators, the proposed concordance between the different types of coins seems reasonable.

Assembled, these observations and their political implications seem to represent a confusing picture. In our view, the most probable interpretation of the simultaneities of the reverses between the Trondheim and Bergen mints is that it is an indication of royal supremacy over the coinage, since paralleled shifts in iconographic representations only seems explainable by the fact that they were ordered by royal decree. The widening discrepancy of the obverses, on the other hand, seems to point towards a steadily increasing independence in the design of the coins' iconographic representation on part of the archbishopric. In our view, such a shift might be interpreted as a sign of strengthened position of the archbishopric in relation to the Crown. If following this interpretation, the iconography of the coins assembled gives a potent representation of the rivalry between the Crown and the archbishopric in the early 16th century.

The above diagram indicates the relative internal chronology of the coins produced in Norway by King Hans in Bergen (coinage ~ 1500–1513) and under Archbishop Gaute Ivarsson in Nidaros (coinage ~ 1500–1510). Note the slide in obverse representation in the Trondheim types, starting off by being essentially identical to the Bergen obverse, before gradually introducing a more manifestly independent Olav-iconography, with axe in shield over long cross. Note also the shift in reverse type that arrives simultaneously in the two mints. This diagram also illustrates our assumption that the type V is an intermediary type, seeing that it shares characteristics with both the anterior types IV, VI and VII, and the later archbishop's coins.

The interpretation of the relative chronology of the coins is strengthened by a systematic consideration of the legends from the Trondheim material. The diagram on the next page displays the types of the Trondheim mint according to the relative chronology, including a tentative relative sequence of the inscriptions.

Table 3.2. Concordance diagram, including legends, Trondheim mint

Type	Obverse	Obv. legends (variations)	Reverse	Rev. legends (variations)	Ch.
IV	Crowned monogram **h**	IOhAnS / hAnS DGR nORWEI MOnETA nORWEI SAnTVS OLLAVVS	Norwegian Lion over long cross	MOnETA nORWEI IOhAnS DGR nORWEI	7
VI	Crowned monogram **h**	hAnS DGR nORWEI	Axe in shield over long cross	MOnETA nORWEI	7
VII	Crowned monogram **O**	SAnTVS OLLAVVS	Axe in shield over long cross	MOnETA nORWEI	7
V	Crowned monogram **h**	IhAnS DGR nORWEI SAnTVS OLLAVV	Norwegian coat of arms over long cross	MOnETA nORWEI SAnD T On AWS REX	8-9
Gaute Ivarsson	**n**	MOn AREPI nIDROSI MOn nOVA nIDROS	Norwegian coat of arms over long cross	SAn OLA WS REX	10-14

3.8 TWO SCENARIOS FOR THE COINAGE IN TRONDHEIM

On the basis of the link established in chain 7 and the concordance diagram above, two scenarios for coinage during the office of Gaute Ivarsson in Trondheim appear, both possible.

1) The king and the archbishop collaborated in the production of coins in a first period, before the coinage was entirely left to the archbishop.
2) The king was not involved in the coin production. The archbishop issued, according to the privilege of 1222, coins in the name of the king, before gradually issuing them in his own name.

The two last archbishops, Erik Valkendorf and Olav Engelbrektsson, issued coins bearing their proper names and coats of arms. The extent of this later coinage suggests that a general acceptance from the king must have existed; at any rate, based on a consideration of the iconographic representations of the coins, King Hans appears not to have been involved in the issuing of coins in Trondheim during the last part of his rule, if indeed ever. But the fact that the archbishops appear on the coins as issuers by the obverse legends, seems also to entail a visualizing of the ecclesiastical leaders pre-eminence on a national level as we have seen in chapter 1, leaders to whom the faded royal authority had to bestow considerable concessions.

This picture built on iconographic analysis, die link study and concordance diagrams can be deepened by further technical examination of the coins. Of prime importance is the analysis of weight, since, as we shall see in the following, this underlines the discrepancies between Danish and Norwegian coinage in general, as well as between the king's coinage in Bergen and the archbishop's coinage in Trondheim in particular.

3.9 WEIGHT

Coins from the Middle Ages like hvids and pennings were used in everyday transactions and are transmitted to us in a worn state. The result is that their weight is lower than it was on the time of the coinage. The number of coins, however, assures statistical reliability between the different types and therefore, with the exception of damaged coins which have been taken out of the batch, no correction for weight has been done in this study.

It is the standard of Lübeck that should form the base for the weight of the Norwegian and Danish coins. Their actual relation to the standard is nevertheless not homogeneous. According to W. Jesse (1928:210), the weight of the Witten of Lübeck was in AD 1502 set to 1.08 gram, a standard much higher than found in the contemporary Danish and Norwegian hvids. From the find of 1545 Danish and Norwegian coins (Tpq. 1526) at Assens, Fyn, Denmark, the average weight of the Galster 31 type hvid produced by King Hans in Malmö (734 specimens) is 0.75 gram and hvids produced in Aalborg (329 specimens) 0.74 gram (Galster, 1929:227–228. Jensen et al, 1992:264–267). As we have described, according to the *Halmstadrecess*, the Norwegian coinage should be equal to the Danish ("*jaffngod mynt wid Danske penning*"). However, the Norwegian hvids are generally of lower weight. Only the hvids of the Bergen die link chain number 5 (21 complete specimens) match the Danish hvids with an average weight of 0.73 gram (median weight: 0.76 gram). (cf. Risvaag, 2006:368, 374–375).

For studies of the weight of hvids produced in Trondheim for King Hans and/or Archbishop Gaute Ivarsson, 180 complete specimens were available (see appendix 1), with a weight range from 0.32 gram to 0.92 gram. Both the average and the median weights of the Trondheim hvids are consistently lower than the

Table 3.3. Weight of hvids, types IV, V, VI, VII and archbishop type (see appendix 1). Note that several coins are not complete and are therefore taken out.

Type	Number of coins	Min. gram	Max. gram	Median gram	Average gram
IV	132	0.32	0.88	0.64	0.63
V	5	0.51	0.78	0.62	0.64
VI	2	0.70	0.72	0.71	0.71
VII	16	0.37	0.92	0.60	0.60
(VI+VII)	(18)	(0.37)	(0.92)	(0.61)	(0.61)
Archbishop	25	0.36	0.83	0.63	0.64

Danish hvids, ranging between 0.60 and 0.64 gram. Type VI differs significantly from the others; we consider it to be statistically unreliable, viewed that it consists of only two complete specimens. Sharing its reverse (1401) with type VII, it seems more plausible to regard the types VI and VII as one group, the average and the median weight thus being 0.61 gram. Compared to the Bergen chain 6 (62 complete specimens, see table 3.4) the Trondheim hvids are slightly, but not significantly, heavier than the Bergen hvids which holds an average weight of 0.60 gram (median: 0.59 gram) (cf. Risvaag, 2006:368, 376–379). By comparison the main die link chain of Trondheim, chain 7 (150 complete specimens), consisting of the types IV, VI and VII holds an average of 0.63 gram and a median of 0.64 gram. One revealing fact is that, at a later stage, seemingly the Bergen hvid was adjusted to the Danish standards, as seen in the hvids of Bergen chain 5 (see table 3.4), while the weight of the Trondheim hvid remained stable throughout the time of Gaute Ivarsson.

As we can observe in the table above, inconsistency in weight is observable in all categories. This variation stems from the production process, in which one larger piece of metal, the weight and alloy of which was subject to rigid control, was cut down into smaller pieces according to a given ratio of specimens to the weight (*al marco*) before coinage. In chapter 5, we will come back to the study of such hammered rods, which were actually found during the archaeological excavations of the mint in the Archbishop's Palace. The central point here is that the control of weight and silver content was exercised on a superior level to that of the individual coins. Small variations in the individual weight would result from limited accuracy in the process of cutting and hammering of the rods. What is of special interest in this context is that there is a consistency in the Trondheim material concerning the relation between the median and the average weight which corresponds to a desire of consistency, i.e. of that of a standard. That the median and average weights do not differ more than slightly indicates that, even though the types are altered, a common standard of weight has been used in the process of making the coins.

The Bergen material, on the other hand, shows a different picture. As we can observe, the median and average weight varies according to which type is coined. No written evidence explains this shift in weight in the Bergen coins, nor for the consistency in the Trondheim specimens, therefore does the interpretation of this deviance remain indecisive. However, considering the fact that the coinage in Bergen was entirely placed under the control of the Crown, and that the weight of chain 5 is significantly higher, we are led to think that this implies integration into the Danish weight standard. The fact that the Trondheim coins do not vary, i.e. does not incorporate into the Danish system, might indicate either that the king was unable to impose the new weight onto the archbishop's coinage, or that he did not consider it very important.

Table 3.4. Weight of hvids, chain 7 (see appendix 1) and Bergen chains 5 and 6 (see Risvaag, 2006:368)

Chain	Number of coins	Min. gram	Max. gram	Median gram	Average gram
Trondheim 7	150	0.32	0.92	0.64	0.63
Bergen 5	21	0.41	0.94	0.76	0.73
Bergen 6	62	0.40	0.83	0.59	0.60

The Trondheim chain 7 and the Bergen chains 5 and 6 are the chains containing enough specimens for statistical reliability. As we can observe from the measurement of chain 7 (150 complete specimens), the picture of will to consistency in the Trondheim coinage is observable in the limited difference between the median and average weights.

There is no evidence suggesting that the king made any effort in forcing an adjustment of the ecclesiastical hvid to Danish standards. Even though the Hans/Gaute hvid type V and the archbishop type hvid in its iconography follow the heavier Bergen hvid type II, the weight standard of Trondheim remains the same. This observation seems to reinforce the impression that the king in general took little interest in the Norwegian coinage or the archbishop's overall strong position.

3.10 DIAMETER

Although varying internally from a minimum of 14 mm to a maximum of 18 mm (see also chapter 9), the overall part of the diameter of the hvids lies between 16 and 17 mm. This is also the case for the Bergen hvids. (Risvaag, 2006:375–379).

3.11 DIE AXIS

The term "die axis-analysis" refers to an analysis of the relative positioning, rotation, of the obverse and the reverse dies. Following Malmer's definition of regularity in die axis, "[i]f a die-combination has four different measurements and if these are 90° to each other, the die axis is absolutely regular whether or not the measurements begin with 0°" (Malmer, 1997:38), the die axis of the Trondheim type IV is nearly regular (74.1%). This is corresponding well with the Bergen type III, argued to have been in production at the same time, having 71.7% regularity. The type VII, also in production simultaneously with the Bergen type III, shows a totally different pattern with only 41.2% regularity. This irregularity in die axis is upheld at the Trondheim mint, with the ecclesiastical type hvid having a regularity of 44%. The Bergen mint on its part upheld the higher percentage of regularity with the 77.8% of the corresponding type I. The types I, II, V and VI are not taken into consideration, all having less than ten specimens each. See also appendix 2.

In contrast to the strict maintenance in weights seen in chapter 3.6, the motivation for the sudden change in die axis technique at the Trondheim mint is not clear. This may have just been caused by a shift in the mint's staff, as a deliberate change in attitude or technology. However, as a consequence of both consistency in weights and the randomness of die axis, the archbishop's coinage stands out even more from its royal parallel.

3.12 SILVER CONTENT

During the years 1966 to 1988, a series of neutron activation analysis on Norwegian medieval coins were conducted at Institute for Energy Technology (IFE) at Kjeller (Skaare et al., 1966). The main part of the analysis conducted was of coins issued prior to 1387, these are in full published by Svein H. Gullbekk (2009a:354–375). Eight Norwegian coins of King Hans and Archbishop Gaute were analysed. These analyses are too scarce to provide a

reliable picture of the silver content, and must be regarded as random samples which at best might give some indication of the standards of the time.

As we can see, the silver content of the different categories of hvids is very stable, giving the overall impression of skilled craftsmen. Note that hvids type I stem from the Bergen mint.

Table 3.5. Chemical composition of eight hvids (Gullbekk, 2009a:354–375).

Type	Chain	Weight gram	Ag %	Cu %	Zn %	Au %	Provenance
I	5	0.76	29.3	70.5	<0.5	0.16	Museum of Cultural History, Oslo
I	5	0.77	28.1	71.5	<0.5	0.44	Museum of Cultural History, Oslo
IV	7	0.65	32.9	66.9	<0.5	0.27	Museum of Cultural History, Oslo
IV	7	0.54	32.0	67.7	<0.5	0.30	Bergen Museum
V	8	0.51	28.8	70.9	<0.5	0.30	Dønnes church, Nordland
VII	7	0.60	26.0	73.9	<0.5	0.15	Museum of Cultural History, Oslo
VII	7	0.52	26.9	72.9	<0.5	0.25	Museum of Cultural History, Oslo
Archbishop	10	0.60	30.3	69.1	<0.5	0.58	Museum of Cultural History, Oslo?

4 GAUTE IVARSSON'S PENNINGS

In addition to the production of hvids, a production of bracteate pennings of the Hohlpfennig-type took place both in Bergen and Trondheim. Based firstly on the few identifiable dies and secondly on the low number of archaeological finds, we consider this coinage to have been of a limited and sporadic character.

These pennings are only imprinted on one of the sides. Establishing die link chains is therefore not possible. As a result, estimating the number of pennings produced in the Archbishop's Palace cannot reach the same level of precision as that of hvids. This does not exclude, however, that a certain assessment can be carried out, based on the number of dies identified on the coins, the number retrieved, their geographical spread, and a general discussion on how many coins can be produced by each die.

From the imprints on the coins, there have been identified a total of seven dies, five of which can be attributed to the archbishop on the basis of their iconography. We thus have identified far less penning dies than those of hvids. At the same time the dies presumably would have lasted longer due to the thinness of the flans and that they possibly were struck against a soft base, resulting in less wear and tear on the dies. Conclusively each penning die might produce more coins than the dies used to produce the hvids. However, a higher coin output per die does not necessarily signify a very extensive production. Due to the small number of dies, it seems reasonable to assume that the number of pennings produced was significantly lower than that of hvids.

4.1 TYPES AND DIES

We find five types of Norwegian pennings from the period when Gaute Ivarsson was in office. The five types are named as follows:

1) Norwegian Lion in radiant circle (royal type)
2) Axe in radiant circle (type I)
3) Axe in shield in radiant circle (type II)
4) Crossed axe and crozier in shield in radiant circle (type III)
5) Two crossed axes and crozier in radiant circle (type IV)

Schive and Schou assumed the royal type to be produced in Oslo (Schive, 1865:134; Schou, 1926:12). There are two known die variations of this type, one with and one without additional symbol ○. In our view, the additional symbol is not to be interpreted as an O for Oslo, but rather as a mark of demarcation between emissions. The iconography of the coins gives clues to their provenance; it is, however, not univocal. In our view, it is most probable to interpret the royal type, Norwegian Lion in radiant circle, as stemming from the royal mint in Bergen. The modest Norwegian coin output taken into consideration, a small coinage solely of pennings in Oslo seems a rather unlikely assumption. Based on the established fact that in Bergen there was coinage for King Hans alone, with a differentiated nominal system ranging from the gylden and down, we find Bergen more likely as the production site of this penning.

The four resting types of pennings must in our view all be reckoned to be coined in Trondheim for Archbishop Gaute Ivarsson. All types are bearing the St Olav's axe and evolving towards the archbishopric's coat of arms established at the time of Archbishop Erik Valkendorf. As it has been argued in chapter 3.1, considering the thorough use of axe alone or in combination with crozier, it appears reasonable to interpret the axe in shield as an early version of the archbishop's or archbishopric's seal.

Figure 4.1. Pennings of Gaute Ivarsson, in slightly augmented format. Note that they are pictured in their correct format in the catalogue. Photo Håkon Ingvaldsen, UiO, Kulturhistorisk museum.

Five dies are identified for the Trondheim pennings. The axe in radiant circle (type I) is the only type with two die variations. The simplicity in motive and crudeness of manufacture of the type I dies compared to the other pennings indicates the type as being the first in production.

4.2 DIAMETER

Based on visual observation, the penning seems to have been cut out with shears, either prior to or after the striking, resulting in a normal variation in diameter of 0.5–1.0 mm for the individual specimen. As a consequence of their production process, the variations in the diameters of the pennings are, as one may expect, much greater than those of the hvids, ranging from 11 to 15 mm for undamaged specimens. The hvid was hammered round after cutting, prior to the striking, thus ensuring a more perfect roundness and stable diameter. One can discern a slight evolvement in the size of the penning from type I through IV. The type I penning having a normal diameter of 12.5 mm, the type II a normal variation of 12.5–13.5 mm, type III 13–14 mm, and finally the smallest group, consisting of only six specimens, the type IV with a normal variation of 13,5–15 mm. The type III and IV are more in accordance with the Bergen pennings, having a normal variation of 13.5–14 mm for undamaged specimens.

4.3 WEIGHT

The weight of the pennings seems to fit in with Danish coinage, averaging just slightly over ¼ of the Norwegian hvid, thus placing itself between the standards of Norwegian and the Danish hvid. In contrast to what we have seen being the case with the hvids, where the later Bergen types were significantly heavier than their Trondheim counterparts, there is little difference between the archbishop's pennings and the type struck for King Hans in Bergen. One remarkable feature is the significantly heavier type III with an average of 0.26 gram (median: 0.27). The high number of specimens indicates that the higher weight is not purely coincidental. One solution might be to consider it to be a two penning coin; it seems however more likely that this is an attempt to fit it into the standard of Lübeck, in fact fitting perfectly with ¼ of the Lübeck Witten of 1.08 gram. The motivation for this remains unclear. This deviation in weight from the other pennings might be an indication of this being the latest of the penning types.

As we can see, there exists a relation of homogeneity between the weights of the types II, IV and Hans, as well as with the slightly heavier type I. Type III differs markedly from the other groups.

Table 4.1. Weight of pennings, types I-IV (see appendix 1) and Royal, Bergen (see Risvaag, 2006:368)

Type	Number of coins	Min. gram	Max. gram	Median gram	Average gram
I	17	0.12	0.28	0.20	0.20
II	14	0.10	0.21	0.175	0.17
III	19	0.19	0.33	0.27	0.26
IV	5	0.14	0.19	0.15	0.16
Royal	21	0.12	0.30	0.18	0.17

4.4 SILVER CONTENT

In addition to the neutron activation analysis of eight hvids of King Hans and Archbishop Gaute Ivarsson, six pennings were subjected to the same analysis (Gullbekk, 2009a:354–375). Again the analysis are too scarce to provide a statistically reliable appraisal of the silver content, and must be regarded as random samples which at best might give some indication of the standards of the time.

It is worth remarking that the silver content of the pennings, itself stable, is significantly lower than that of the hvids, as described in chapter 3.12.

Table 4.2. Chemical composition of six pennings (Gullbekk, 2009a:354–375)

Type	Weight gram	Ag %	Cu %	Zn %	Au %	Provenance
Royal	0.15	16.8	83.0	<0.5	0.21	Lom church, Oppland
I	0.28	17.4	79.45		0.15	Hvaler church, Østfold
I	0.26	20.26	79.5		0.24	Dønnes church, Nordland
II	0.17	17.98	81.77		0.25	Museum of Cultural History, Oslo
III	0.27	17.76	82.19		0.05	Grindaker Church, Oppland
IV	0.19	20.19	79.55		0.26	Museum of Cultural History, Oslo

4.5 SUMMARY PART 1 – THE NUMBER OF COINS PRODUCED

In order to assess the importance of the coinage in Archbishop's Palace a technical analysis of the coins has been performed, of which the key factor has been a die link study of the coins called hvid. The die link study has identified 51 obverse dies and 29 reverse dies, and ascertained that they most probably all have been used in the mint in the Archbishop's Palace. This constitutes the starting point for our estimation of the quantity of coins produced in the Archbishop's Palace.

Establishing the number of coins produced solely on the basis of the number of dies is evidently highly problematic, due both to the fact that only a small fraction of the coins produced by any single die has been discovered and to the fact that no die has been found, leaving us no possibility to evaluate its authentic durability. Certain qualified assessments can none the less be made. The most common and most accepted method used to estimate the number of coins one die could produce in the Middle Ages is based on contemporary accounts of coinage, preferably from mints where a substantial coinage was carried out. The first accounts preserved in England are from Canterbury and dates from ca AD 1222, where 34,027 tower pounds of silver corresponding to ca eight million pennies were produced over a period of just over two years. From London at the same time, 9,013 tower pounds of silver is accounted coined, representing about two million pennies (Mayhew, 1992:30). Ian Stewart argues that a typical reverse die could produce approximately 15,000 coins in the year 1300 (Stewart, 1963:106). In a study of Northumbrian coinage, Metcalf proposes approximately 10,000 coins per die as a conservative estimation for English *sceattas* as early as AD 738–88 (Metcalf, 1984:113).

Several scholars have presented important contributions to the methodology of calculating coin output either on the basis of dies, coin finds or a combination of the two, many of which were presented in the publication following a roundtable

discussion on statistics and numismatics in Paris, September 1979 (Carcassonne and Hackens, 1981). Of particular interest are the two papers by Giles F. Carter on die link statistics, presenting the main features of the methodology of calculations (1981a; 1981b). Calculating coin production based on dies has been heavily challenged, or rather dismissed by Ted Buttrey (1993; 1994). Although limiting the critique to works on ancient Roman coinage, several elements – certainly estimations on number of coins struck per die – are applicable to works on medieval and modern coinage. Buttrey's critique was countered by François de Callataÿ, pointing out that some of Buttrey's examples, particularly on calculations of coins per die were questionable or irrelevant, and stressing his view on the reliability of several calculations on medieval coinage (1995:296–302). Bearing in mind all uncertainties regarding the total number of dies of Archbishop Gaute, the durability of the dies and the possibility of several dies being used at the same time, we will propose two estimates, one based on obverse dies and one on reverse dies, on the coin output during Gaute's office.

No estimations of die durability concerned in Norwegian coinage after AD 1100 has been made, but for the period ca AD 1050–1100 numbers ranging from approximately 5,000–15,000 coins per die has been proposed (Suchodolski, 1972:33; Skaare, 1974:441f; Gullbekk, 1994:79f; Gullbekk, 2009a:242–244). In one find from Kalfarlien outside Bergen in 1910 there was found more than 1800 false pennings from the time of King Eirik Magnusson (1280–1299) (Morgenstierne, 1915). We do not know whether this find includes all coins from this counterfeit, but significantly in this context is the fact that they all were coined with the same pair of dies, demonstrating that counterfeiters at the end of the 13th century have been able to produce large quantities of coins out of the individual dies. The techniques involved in coin production would most probably not have declined and the official know-how would most probably not have been lower than the unofficial The interpellations in the *Halmstadrecess* indicating that this was work carried out by highly specialized workmen not

easily at hand within the kingdom, being organized in international guilds. These aspects seen together, we find it reasonable to situate our assumption of how many coins can be produced per die in the higher segment of the span proposed for Norwegian medieval coinage, i.e. approximately 15,000.

If using an estimation of 15,000 coins per hand held die (the obverse dies), we arrive at indications of a production of 750,000 coins. When considering that maybe not the entire stock of die imprints has been retrieved, this number can be augmented to possibly 800,000 coins produced. The first sure trace of coin production within the Archbishop's Palace (the first mint), is dated to AD 1500, and the office of Gaute ended in AD 1510, i.e. confirmed production under his office in a period of 10 years. Based on these assumptions, we might infer that the production of coins in the mint in the Archbishop's Palace was approximately 80,000 per year. If the intermediary estimation of 15,000 coins is applied on the mounted die (the reverse dies), we arrive at indications of a production of 420,000 coins, i.e. a production of 42,000 coins per year. Even though several of the indicators on which such estimation is based are uncertain – still unfound coins might reveal further dies, and the number of coins produced per die is uncertain – it seems justifiable to conclude that the coinage in the Archbishop's Palace did not reach a very substantial level.

The study of the pennings indicates a similar picture. Due to the fact that they are imprinted only on one side, and possibly struck against a soft base, the durance of these dies was probably longer than the hand-held hvid obverse dies, i.e. more coins could be produced out of each die. However, a mere total of five dies of the ecclesiastical types have been identified and even if more coins could be struck, the total number of pennings produced was probably considerably lower than that of the hvids.

PART II

A TECHNOLOGICAL PERSPECTIVE

5 DOCUMENTATION OF COIN PRODUCTION RELATED TO FINDS

As we have seen in the introduction, the archaeological excavations performed in the Archbishop's Palace (1991–95) identified three successive mints. We have also seen that coins were issued under three archbishops, notably Gaute Ivarsson, Erik Valkendorf and Olav Engelbrektsson. The focus in this chapter will be on finds identified as belonging to the oldest mint complex. According to dendrochronological dating, this mint was built in the years about AD 1500 (Olsson, 2000), and we can therefore assume that it was in function for the last ten years of the office of Archbishop Gaute Ivarsson. Finds from this period are exemplary, as objects from the whole range of coin production is represented, thereby permitting research of the whole chain of processes involved in the production of hvids. In this chapter, we discuss outer features and inner microstructures of objects from different stages of the coin manufacturing process in order to document the actual procedures in detail.

5.1 INTRODUCTION

As well the sheer size of the mint complex (see figure 1.3) as the workforce limitations imposed by the *Halmstadrecess* and the die link analysis described in chapter 3, are indications that the scale on which coin production was conducted within the Archbishop's Palace was relatively limited. The minute scale of the coinage becomes even more striking when compared with the extent it reached in contemporary mints, including The Royal Mint in Malmø, the main mint in which the king exercised his minting privileges. However, as we shall see in this chapter, despite the small production area and limited workforce, the work appears to have been organised according to the principles established by the leading mints of continental Europe, illustrated in figure 5.1. Marked spatial division of different processing steps, the organisation of the main workshop with paralleled workbenches, a centrally placed hearth, tiles on the floor and

easy access to charcoal, as well as the rich finds of highly specialised artefacts connected to coin production, all indicate that a skilled craftsman organised the mint. As we shall see in this chapter, this craftsmanship can be traced right into the microstructures of the unearthed objects.

The different operations of work performed in a mint from this period have been illustrated and described in several contemporary written sources. However, the descriptions vary in many details, perhaps because the production was strictly secured and visitors were not allowed to stay in the workshop. Cooper (1988:35), in describing the moneyers' workshops, states that one of the most informative descriptions is the stained glass window from AD 1565, dedicated to Werner Zenckgraff, the Schaffhausen mint master.

According to Demmler and von Schrötter (1933:251–261), eight of the nine panels in the stained glass window in figure 5.1 illustrate well-defined work sequences of late medieval coin production. The only exception is the lower one in the middle, a motive from the Holy Bible showing Jesus meeting with the Samaritan woman at the well (Ev. Joh. 4, 5–19). We number the panels illustrating coin production from upper to lower: The left ones are 1, 2 and 3, the middle ones are 4 and 5, and the right ones are 6, 7 and 8. The pattern of the windows seen in the background in number 1 and 4 are the same and so are number 5 and 7. This seems to indicate that the production therefore may take

Figure 5.1. (Next page) The stained glass window in the Schaffhausen Mint AD 1565. Schaffhausen, capital of the canton with the same name situated in north Switzerland, maintained an important minting tradition in the Middle Ages. Reproduced from Denis R. Cooper, The Art and Craft of Coin Making – A History of Minting Technologies (1988:36), by permission of Mrs. Cooper.

place in at least 6 rooms. There is no window shown in number 3 and 8 thus indicating that the annealings taking place in these rooms are done in the basement or in another building. According to Demmler and von Schrötter, the shown persons are clearly portraits of well-dressed men where the mint master is shown in number 1, 2, 3, 4 and 7 and two mint workers in 2, 3, 5 and 6. The peculiar costume worn by the person in 8 illustrates that he is an apprentice.

By following the descriptions by Demmler and von Schrötter, the first panel shows the hammering of a cast bar over an anvil. In number 2 the hammered bar is cut into pieces by hammering on to another hammer which is sharp at one end. In 3 the ductility of an annealed hammered bar is tested by bending. In 4 the hammered and annealed bar is cut by large shears into squares and adjusted for the correct weight. After hammering, 5, the pieces are piled in a kind of cramp and hammered round – 7. Then the blanks are heat treated in a pan – 8 – before being imprinted – 6.

Sixty years separate the production in the Archbishop's Palace from this illustration. Coin production processes, however, remained stable throughout this period (Cooper, 1988:34), and it is therefore reasonable to assume that the functions of a well-organized mint at the time of Gaute Ivarsson would resemble work sequences shown in these illustrations, an assumption confirmed by the following description of the archaeological finds.

Among the excavated artefacts from the Archbishop's Palace, some of the manufacture stages in the mint are represented with a high number of objects, others are scarce. Even though the number of objects from the different stages varies, the artefacts, when examined together, permit us to establish a coherent and convincing picture of how the coin named hvid was produced. We concentrate the attention on this coin, due to the fact that the pennings also produced in the mint are so thin and in such a condition that a proper examination would prove irresponsible, and to the fact that only blanks clearly

intended to be coined as hvids are preserved. In the following, we discuss all production stages from metal selection to finished hvid, by describing the outer features and inner structures which may be indicators of the process details. In comparing the procedures involved in the coin production, as seen in the Schaffhausen glass window, with the archaeological evidence from the excavations in the Archbishop's Palace, we shall see that we can actually identify each of the consecutive steps described in the Schaffhausen window, from casting, via hammered rods to blanks and finished hvids.

5.2 BONE-ASH CUPELS AND CRUCIBLES

The art of coin production involves strict regimes concerning the fineness of the coins. As seen in chapter 3.12 and table 5.1, the hvids had a typical fineness of 25–30 % silver (Ag) and 70–75 % copper (Cu), a diameter of 16–17 mm and a mean weight of 0.6–0.7 gram. The limited variations in these relations indicate clear, centrally imposed regulations. Ascertaining these levels of fineness in a charge of metal, however, is not evident. On the basis of the archaeological evidence, especially since silver was not locally produced, we may assume that the coin metal, bullion, stemmed from an assortment of objects containing silver, such as spoons, bracelets and other domestic items, without fixed fineness. In order to ascertain a correct fineness of the melt to be used for the casting, bone-ash cupels were used for assaying samples of the metal, whilst larger crucibles were used for melting.

The large number of objects connected to coin production unearthed in the immediate vicinity of the three building structures, in particular bone-ash cupels and crucibles, consolidates the assumption that the houses were in fact used as mint workshops in the Archbishop's Palace. During the excavations, a total of 1858 crucible and cupel fragments were recorded[xxiv], making the assemblage of crucibles and bone-ash cupels found in the Archbishop's Palace into one of the

largest collections so far found in a European excavation (Saunders, 2001:27–28)

5.2.1 Bone-ash cupels

Due to their inherent capacity to separate precious metals from others and thereby permitting calculations of the fineness of a sample, bone-ash cupels were traditionally used in the assaying of precious metals. The number of bone-ash cupels found in the vicinity of the mint workshop tells us that this was an activity frequently performed.

The effectiveness of a bone-ash cupel in assaying samples relies on the differentiated permeability of the cupel surface. By using a cupel of high quality, a sample of silver-containing material was weighed and then melted with a certain quantity of lead in the cupel.

A hot air blast would help oxidise the lead *while precious metals like silver do not oxidise*. At high temperatures the lead oxide, litharge, with a melting point near to 900 ^{o}C, will dissolve oxides from other metals. The surface tension relations are such that only the litharge will be soaked into the porous bone-ash and taking with it other impurities, leaving the pure silver as a fine bead in the cupel. Having in this way separated the silver from the other metallic elements of the sample, the remaining silver may then be re-weighed, permitting the materials original silver content to be calculated.

In order to achieve the desired effect of the assaying, considerable technical knowledge of the correct procedure was required in producing the bone-ash cupels. According to the classical treatises of Biringuccio ((1540)1966), Agricola ((1556)1950) and Ercker ((1574)1951) cupels were made preferably from ashes from bones of animals or fish, see figure 5.3. These authors all

Figure 5.2. Four samples of bone-ash cupels found in the mint complex. The photographs are taken from two different positions. The cupels are typically 40 mm in diameter and 25 mm high. Photograph by Bruce Sampsson, NTNU Vitenskapsmuseet.

underline the importance of high quality cupels to obtain a precise result in the assaying and therefore give detailed descriptions of procedures necessary to obtain the best cupels. Calf's skulls or ram's horns were preferred, without further explanations given. The bones were burnt (calcined), pounded, sifted and washed. Mixed with water, balls of ashes were put into wooden or bronze moulds and pressed to cupels by beating with a convex bottomed stamp. After drying, the cupels were finally burnt to make them ready for use.

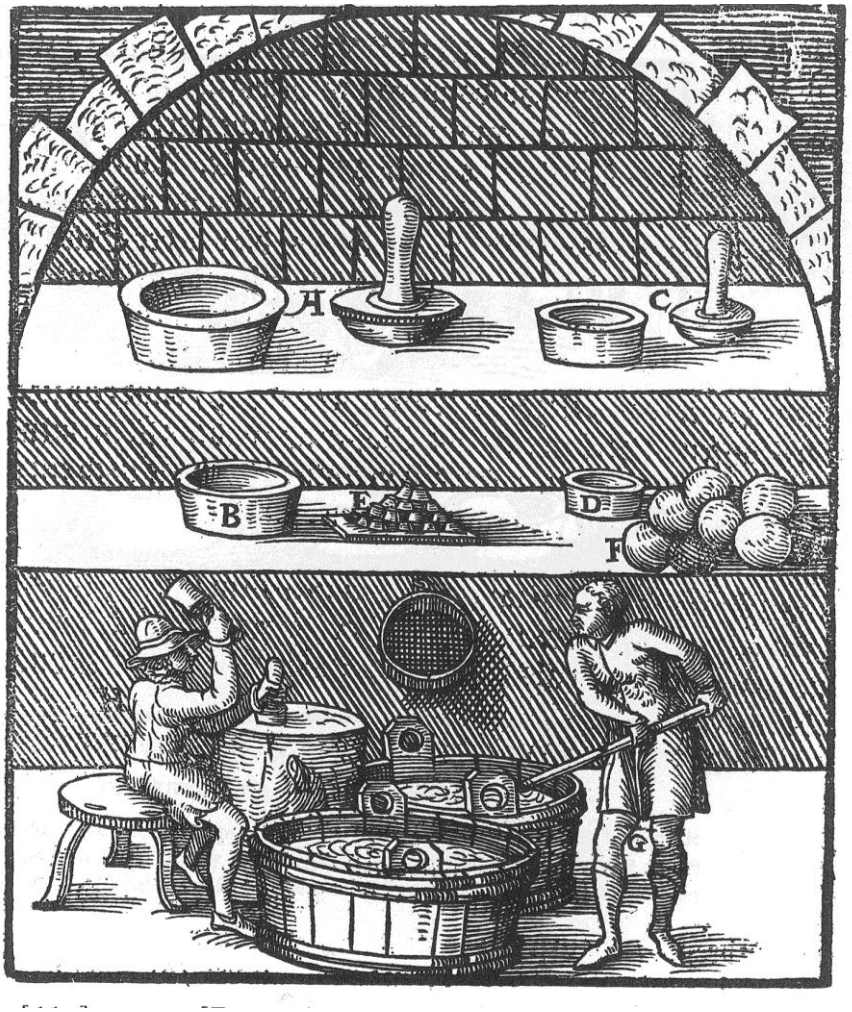


Figure 5.3. The different stages in cupel production. A and C are moulds and stamps for cupels, B and D are cupels made from A and C, E is a stack of cupels, F are balls of washed ashes, G shows a man washing ashes and H shows a man pounding cupels. A sieve is hanging on the wall. Reproduced from Lazarus Ercker's treatise ((1574)1951:32).

The cupels recovered from the excavations were all heavy in weight, suggesting they contained lead oxide, litharge, after use. A small sample of a cupel has been examined using an X-ray fluorescence analysis (Bergstøl and Nordeide, 1992). The analysis confirmed this assumption, as it revealed concentrations of lead as well as traces of other metals such as copper, nickel and zinc

The high number of cupels recovered tells us that assaying was an important activity in the mint. This is not surprising. Quantitative measurements of the silver content of different materials used for production of coin metal were important for the reputation of the quality of the coins and for the economy of the mint. Except from the used cupels, we have no other clear finds pointing to how assaying was performed.

The cupels found stem from the whole period during which the three last archbishops produced coins in the Archbishop's Palace and not only from years when Gaute Ivarsson held office. We do not, however, consider this to be of any major importance to our conclusions; as Cyrel Stanley Smith states in the introduction in Ercker's treatise (1951:XVII), there were no basic changes in assaying techniques for three hundred years after Ercker. We might therefore expect that the assaying procedures in the mint remained unchanged for the period 1483–1537. As a consequence, it has not been found necessary to distinguish between the cupels.

One particularity of the archaeological finds in the Archbishop's Palace is the absence of larger cupels (the so-called "cherbles") (Bergstøl and Nordeide, 1992:5). In late medieval minting, these were used to determine the silver content in ore.

The absence of cherbles may be explained by the fact that the archbishop did not have direct access to silver mines; thus, rather than being in the form of ore, the metal resources coming to the mint were most likely in the form of other metal objects which were to be melted, thereby eliminating the need of assaying the silver content in ore. Also, the large quantity of small cupels indicates a great and constant need to assess silver content of metal objects.

Quantities of bones were found during the excavations (Nordeide, 2003:303), not only indicating a generous boarding at the Palace, but also pointing to the ease of getting good quality bones for the cupels. The cupels bear no mark pointing to where they are produced. They may thus have been produced locally at the mint, and can as such be interpreted as a technical skill of high level involved in the coin production process. On the other hand, they may as well have been imported as they are small and easy to transport, e.g. from Saxony where assaying of silver was common.

5.2.2 Crucibles

As was the case with the bone-ash cupels, no distinction is made between crucibles stemming from the different mints. Since the production technology is not considered to have been altered significantly during this period, this is not considered to be of consequence to the discussion.

Even though the crucibles found were all crushed, the profuse remnants permit a certain reconstruction of the mainly metalworking ceramics designed to operate at high temperatures. The excavations revealed a diverse range of crucible forms, including both thick- and thin-walled crucibles, and of varying sizes and shapes[xxv]. This diversity reflects the complexity of coin production, and probably indicates that other metalworking took place in the same workshop. When taking the extent of the coin production into concern, it is noteworthy that the largest of the crucibles had brimful volumes of between one and two litres,

suggesting a capacity of about 10–15 kg of metal to be melted at a time. According to Saunders (2001:28), the assembly of crucibles represents a highly specialised ceramic assemblage almost certainly imported to Trondheim from abroad, probably from the German area of Hessen, which was the pre-eminent crucible manufacture centre at the time.

a) b)

Figure 5.4. A broken crucible with a triangular shape at the top (N121989) has been partly restored. The internal volume of the crucible has been about 1dm^3. The bottom of the crucible bears starlike marks resembling production stamps, b). However, these have not been identified, and one can thus not confirm where the crucibles have been manufactured. But they are most likely not produced locally, since such production stamps are unlikely to be used in a local workshop only supplying its own needs. Photograph by Bruce Sampsson, NTNU Vitenskapsmuseet

Certain crucible fragments were equally subjected to the above X-ray fluorescence analysis. This analysis revealed different metal oxides vitrified on the inside of the crucibles, indicative of melting alloys containing silver as well as copper. Significant quantities of zinc and lead were also observed in several of the samples analysed, as well as traces of nickel, cobalt, tin and arsenic, metals which might have constituted part of the alloys melted to produce the coin metal. The presence of zinc may for instance result from the melting of brass, one of the most common copper alloys. Worth mentioning is that one of the samples revealed traces of gold, indicating that other metal workshop activities than minting silver coins were at some time conducted in the mint.

5.3 HAMMERED RODS

In order to achieve a reliable average weight of coins produced, and seeing the low weight of each coin, an intermediary step was used in the coinage procedures. This procedure consisted in the casting of rods which in turn were elongated and made thinner by hammering. As depicted in the Schaffhausen glass window, the hammering of rods was the leading technology at the time for obtaining the desired width and thickness. Once attained the wanted dimension, the rods were subsequently cut into smaller pieces, ready for being worked into round blanks.

No cast bars/rods have been found. However, six hammered rods from period 6 were unearthed during the excavations, and have been investigated; see table 5.1 and the figures 5.5–5.7 (Lohne and Ulseth, 2004). The outer features provide information of the mechanical processing steps while inner microstructure tells us how the material has been cast, deformed and heat treated.

Table 5.1. Descriptions of six hammered rods from period 6. The chemical compositions have been measured by using scanning electron microscope (SEM) equipped with EDS on samples being slightly ground. The silver (Ag) content varies from 25–30 weight %. In addition to copper (Cu), some carbon (C) is found.

Specimen number	Period/ Phase	Length mm	Width mm	Thickness mm	Weight gram	Mean chemical composition wt%
N125026	6.3	29	7	3.5 – 4.5	6	Ag + Cu
N125036a	6.2	63	6.5 – 8.0	2.0 – 2.5	8	25 Ag + 75 Cu
N125036b	6.2	80	6,4 – 7.1	1.5 – 2.0	9	26 Ag + 74 Cu
N125039	6.2	60	6.5 - 7.0	2.5 – 3.5	10	25 Ag + 74 Cu + 1 C
N138716a	6.1	85	8	1.6	9	26 Ag + 72 Cu + 2 C
N138716b	6.1	100	8	1.6 – 1.8	10	30 Ag + 70 Cu

The chemical compositions of the hammered rods are in close agreement with the composition of hvids given by Schive (1865:table XVII) and as presented in table 3.5. The rods can therefore be considered as an early stage in the process of making hvids.

5.3.1 Descriptions of the surface topography

From the six rods, we have identified three different types – thick, thin and long – all presenting different traces of the production process, and can as such help understanding the different processing steps.

The thick rods, figure 5.5 (N125026) and figure 5.6 (N125039), have a wavy surface on one side and a smoother surface on the other. This indicates that the rods have been hammered over a cylindrical anvil with a small diameter, possibly between 5 and 10 mm. The fact that the sides are convex indicates that the cross-section of the starting billet had a circular shape.

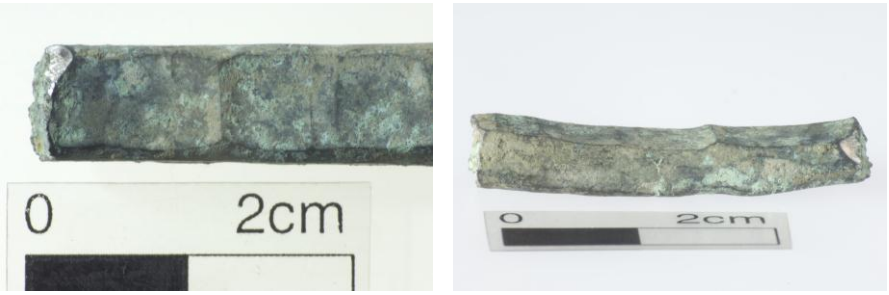


Figure 5.5. Pictures of the thick rod N125026. It is the lightest rod and broken in both ends. Note the wavy appearance of the surface, whilst the opposite surface is smooth. This indicates hammering with a larger hammer over a cylindrical anvil. Photograph by Bruce Sampsson, NTNU Vitenskapsmuseet

Figure 5.6. Pictures of thick rod N125039. Note the wavy appearance of the surface in the upper figure. Microstructures are studied on the lightly ground corner at the right end (lower picture). Photograph by Bruce Sampsson, NTNU Vitenskapsmuseet

The long rods have also a hammered surface appearance but are more even on both sides compared to the thick ones, figure 5.7. They both bear marks of hammering on the edge surfaces.

The longest ones (N138716a and b) are curved in a smooth way. This shape probably indicates hammering over an anvil with a diameter larger than on the thicker samples above, thus indicating that the mint contained several anvils. This is another clear indication of the level of technical sophistication involved in the coin production.

Figure 5.7. Picture of the long rods (N138716 a and b). Note that the curvature in the bend is quite smooth on both rods and may indicate hammering over an anvil of about 20 mm or more in diameter. According to weight, each rod may result in about 15 hvids. Photograph by Bruce Sampsson, NTNU Vitenskapsmuseet.

The outer features of the hammered rods can in this way convey significant clues. By their internal differences, we can observe how they have been subject to hammering to obtain the desired dimension, assuring a confirmed average weight of the pieces later cut from the rods.

5.3.2 Microstructures

Metallographical methods permit revealing the internal structure of metals by using various types of microscopes. The microstructure gives information about the chemical composition and its variations. The microstructure can also provide information of some steps of the manufacturing process.

Coins do neither have a homogeneous structure nor the same composition throughout the thickness. From a documentation point of view it would therefore be best to cut the investigated object in two halves to reveal the changes from centre to surface. In practice people at the museums are not enthusiastic about having their objects cut in half. A compromise in this investigation has therefore been to grind a small flat area at an edge of the specimens to reveal the structure from a certain depth and up to the surface. Corners of the hammered rods have been lightly ground to reveal the microstructure, e.g. figure 5.6.

It is worth noting that the microstructures were not identical in the different types of rods. The microstructures of the thick rods are shown in figure 5.8 a) and b). The structure is typical for so-called dendritic solidification with nearly pure copper in the cells and a eutectic structure consisting of a mixture of silver and copper phases side by side in the walls. This is a typical cast structure as expected for silver-copper alloys with compositions as shown in table 5.1. The cells are nearly equiaxed, showing that the metal in these objects has only been slightly deformed after casting. The size of the cells is about 20 µm = 0.020 mm.

The solidification time of the alloys depends on the ability of the mould to transport heat. When casting alloys with the same chemical composition in moulds of different materials, the size of the cells will vary due to the fact that the heat flow out of the alloys will vary. When lowering the solidification time the cells become finer. Microstructures from casting experiments performed in our laboratories on alloys of 30 % silver and 70 % copper are shown in figure 5.9. The cell size obtained after casting pencil sized bars in an iron mould is about 10 μm, much finer than in the thick rods. In steatite- and sand moulds the

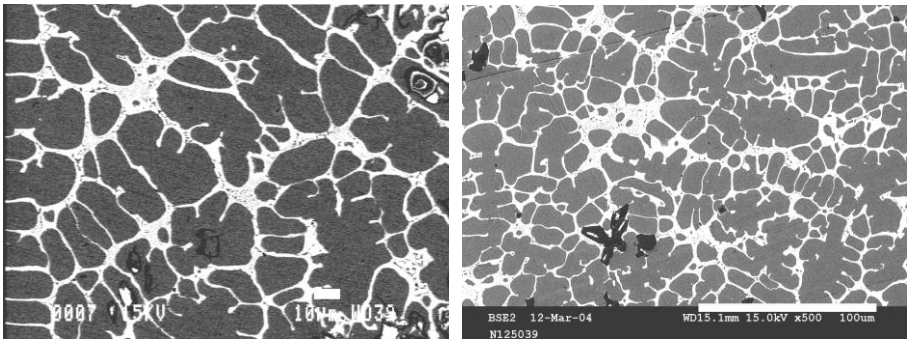


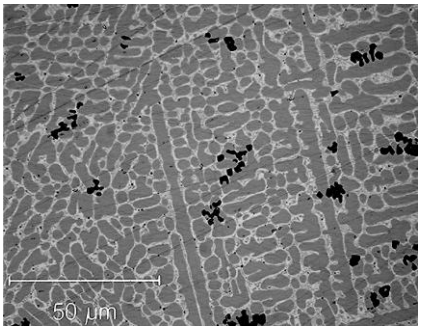
Figure 5.8. Scanning electron microscopy pictures of ground edges from the thick rods a) N125026 (left) and b) N125039. The microstructure consists of copper rich nearly equiaxed cells surrounded by silver rich walls. This structure is as expected for cast material of 25–30 % silver and 70–75 % copper alloys. Broken walls indicate that the material may have been heat treated. The coarse size of the cells shows that the material was not cast in iron moulds, but more likely in sand moulds (note different magnifications in the pictures). Black spots in b) are carbon inclusions. Scale bars: Left 0.01 mm and right 0.1 mm (Lohne and Ulseth, 2004).

cell size is typically 15–20 μm. This indicates that the rods found during the excavations are not cast in an iron mould, but more likely in stone or sand moulds.

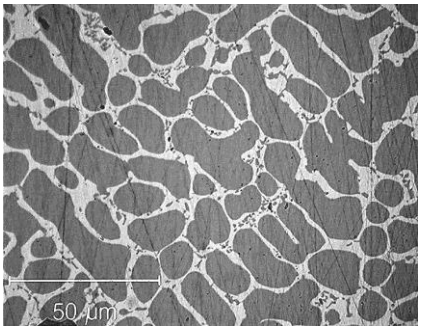
The cell structure in the thick rods in this way indicates that the rods probably were cast in sand moulds, and that they have not been significantly worked since their casting. Their cross sections, about 25–30 mm², may therefore be close to the cross section of the castings.

The cell structure becomes more elongated in the thinnest rods, see figure 5.10 (Lohne and Ulseth, 2004). The explanation for this difference is that it has been altered during hammering described in 5.3.1. The more hammered, the more the cell structure is elongated. The length of the cells is about twice its thickness and is comparable to the reduction in thickness of the rods, from 3–4 mm to 1.6 mm. We can therefore assume that the rods N138716 represent a later stage in the hammering process than N125026 and N125039. Note also that not all the silver rich walls are continuous. This is a further indication that the metal has been elongated by hammering and heat treated to such a temperature that some cell walls were rearranged in their structure, even disappearing at some places.

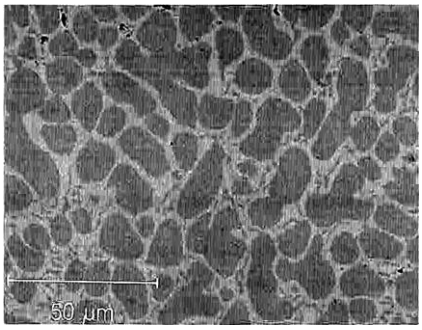
Did the fires that devastated the buildings in 1532 and 1987 have any influence on the microstructures in the metal objects? This cannot be entirely ruled out. However, as the artefacts from the hvid production in period 6 have been covered by a layer of sand/clay more than 0.2–0.3 m thick, the temperature at that depth did most likely not exceed 100–200 ^{o}C. This temperature is not high enough to cause any changes in the microstructures.



a) Cast in an iron mould



b) Cast in a steatite mould



c) Cast in a sand mould

Figure 5.9. Microstructure of laboratory produced pencil thick rods of 30 % Ag and 70 % Cu cast in a) an iron, b) in a steatite and c) in a sand mould. Note that the cell size in a) is much finer than the cell size seen in figure 5.8. Note also that the cell walls are mainly continuous in the castings. The black spots in a) are carbon inclusions stemming from the carbon powder which covered the melt. Scale bars: 0.05 mm. (Lohne and Ulseth, 1998a:7).

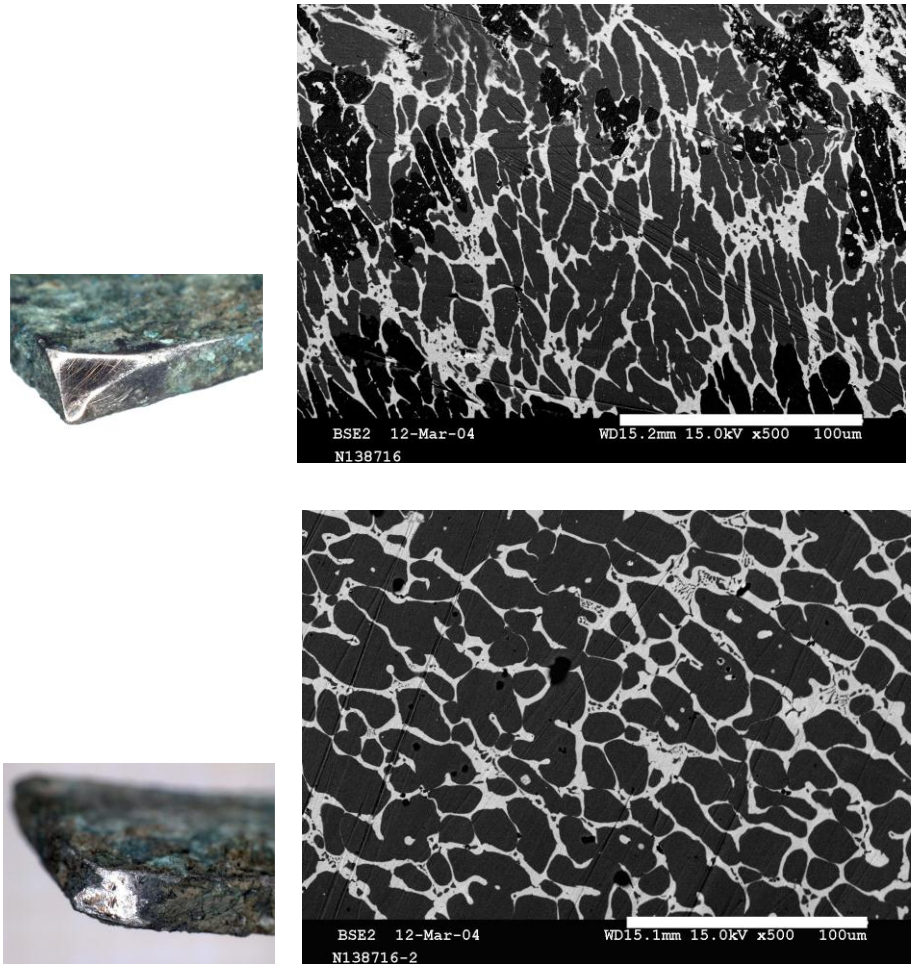


Figure 5.10. Optical micrographs (left) of N138716a (upper) and N138716b show the corners from where the material used for grinding has been taken. The microstructures are taken by SEM and show an elongated cell structure, a clear evidence showing that the rods have been deformed. Note that some of the silver rich walls are discontinuous in the lower picture. This indicates that the material has undergone a high temperature heat treatment. Scale bars: 0.1 mm.

5.4 BLANKS

We have only a few examples of blanks coming from the production of hvids. One is shown in figure 5.11 (Lohne and Ulseth, 2005).

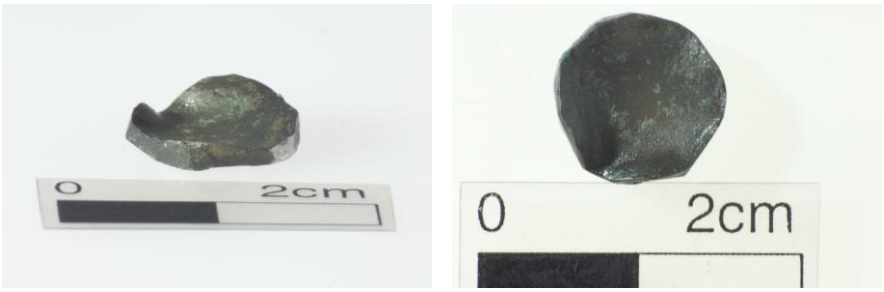


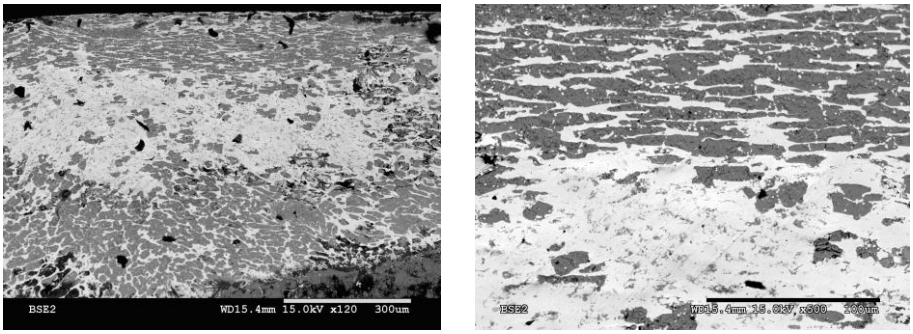
Figure 5.11. Blank N119889b (period 6 / phase 3) from two perspectives. Note the bowl shaped appearance, some straight sides and the hammered corners. This is due to cutting of corners before hammering a pile of blanks. Microstructures see figure 5.12. Photograph by Bruce Sampsson, NTNU Vitenskapsmuseet.

The blank in figure 5.11 has a diameter of 10.5 mm, a minimum thickness of 1.45 mm and a weight of 0.77 gram. The mean chemical composition at a small investigated area at the edge is about 23 % Ag, 64 % Cu, 3 % C and 12 % O, i.e. a chemical composition equal to that of the hvids. The weight corresponds to the weight of finished hvids. The high oxygen content is possibly due to formation of oxides, resulting from heat treatments intended to make the material softer and easier to work, as well as to avoid cracking.

The thickness of the blank is a bit lesser than the thickness of the thinnest rods and the diameter a bit larger than the width of the rods. This corresponds to a

process in which the hammered thin rods have been cut into squares and further hammered to increase the cross section and reduce the thickness. The cut surfaces are straight, see figure 5.11, and may have obtained this shape by the use of a pair of shears. After cutting away corners to create a polygonal shape, some corners are clearly seen to have been hammered to make the blank circular. The bowl shape is probably a result of hammering a pile of blanks held in a kind of cramp being beaten on a flat surface with a hammer, as seen in panel 7 in the stained glass window from Schaffhausen, figure 5.1. Before coining the blank must have been flattened.

The microstructure at the ground edge is shown in figure 5.12 (Lohne and Ulseth, 2005). The surface reveals an elongated cell structure resulting from a heavy deformation. A part of the hammered edge is also showing a silver coated area. This may come either from a heat treatment above 146 ^{o}C, where silver oxide transform to silver and oxygen (Arles et al., 2007), or from a cleaning/etching operation of the surface after a heat treatment in which copper oxides and copper have been etched away. Upon further hammering the silver rich surface area will have been smeared out, in a similar way to as we shall see is done in the last stage after "white washing" before impressing the die.



a) b)

Figure 5.12. SEM pictures showing the microstructure of the ground edge of the blank in figure 5.11 at two different magnifications. Note that the cells are heavily elongated and that the silver rich walls at some places are broken up into smaller particles. Note also that some areas are covered by silver (white). Scale bars: in a) 0.3 mm and in b) 0.1 mm.

5.5 SURFACE PREPARATION OF BLANKS BEFORE STRIKING – "WHITE WASHING"

The term "white washing" denotes a chemical procedure by which the surface of a blank is prepared before striking in order to obtain a shining impression. As the surface microstructure of hvids has not been investigated, we cannot document how the microstructure looks like just before the blank was made a coin. However, a cross section of a skilling produced under Archbishop Olav Engelbrektsson has been investigated, figure 5.13 (Lohne and Ulseth, 1998b:4). This skilling was produced about 15–30 years later than the production of Gaute Ivarsson's hvids. However, it is likely that the same common surface treatment process also was performed when producing hvids in the same workshop.

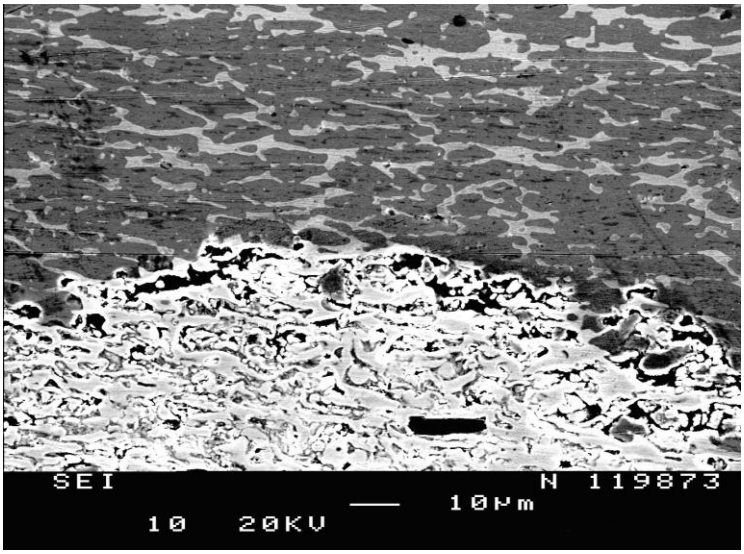


Figure 5.13. SEM micrograph of a ground cross section near to the surface of a skilling produced under Archbishop Olav Engelbrektsson. Note the crushed white lamellae near to the lower surface. The volume with the crushed lamellae has a chemical composition of 80–85 % silver, 12–15 % copper and 3 % lead. Deeper into the skilling (upper part) the microstructure shows a deformed cell structure similar to that in figure 5.12. Scale bar: 0.01 mm.

Near the surface a volume of crushed silver lamellae is seen. The chemical composition of the volume of the crushed lamellae is about 80–85 % silver, 12–15 % copper and 3 % lead. This structure is most likely a result of etching away copper and copper oxide of the hammered surface of the blank before the final stroke. A common way of blanching was to etch the blanks in a boiling solution of tartar, salt and some rock alum (Biringuccio, (1540)1966:362).

5.6 DIES

So far no artefact from the excavations can be traced back to die tools. According to Cooper (1988:28), the most common tool material at this time was wrought iron. After a tool has been worn out, however, it may have been soft annealed, ground, re-engraved and hardened, or destroyed to avoid counterfeiter production. As long as no dies used in the mint were found during the excavations, we refrain from further speculations on this matter.

5.7 HVIDS

The end result of the process is the finished coin – hvid. The patterns of hvids have been described in chapter 3. The chemical compositions and microstructure of finished hvids have not been investigated in this work. As we have seen, the outer shapes of the coins deviate from being perfectly circular. By using the numbers given in the catalogue in chapter 11, i.e. coin number 304, 305 and 313, the diameter varies by 1–2 mm by taking the largest and the smallest figures. It is possible that the variations in diameter were caused by clipping. However, we find it more likely that it is caused by a lack in the technical performance as it may be difficult to obtain a circular object of the small hvids when using the rough hammering technique.

5.8 SUMMARY PART II – THE PROCESSING STEPS IN THE PRODUCTION OF HVIDS

The silver rich artefacts found in and around the mint complex are doubtless objects coming from the production of hvids. From the artefacts presented in chapters 5.1–5.7, the production steps in making hvids in Gaute Ivarsson's days may be outlined as follows:

- Silver-containing materials and bullion are assayed in bone-ash cupels. The incoming material came from silver-containing objects and not from ore production.
- Copper- and silver-containing materials were charged in metalworking crucibles and melted. The melt may have been covered by some charcoal powder as fine carbon inclusions are found in the hammered rods.
- The correct fineness of the bullion was obtained by assaying in bone-ash cupels.
- The melt was cast in sand or stone moulds to give rods with a rectangular or circular cross section. Typical cross section area is about 30 mm^2.
- The rods were hammered over cylindrical anvils with various diameters, a small one about 5–10 mm and later a larger one about 20 mm. The material was thus stretched and given the specified width and thickness.
- The rods were heat treated to make them more workable, possibly several times.
- At a certain thickness and width the rods were cut into squares. Corners were cut. The pieces were weighed and adjusted.
- Then hammered flat and then round to blanks, possibly in a pile hold in a "cramp"
- The blanks were then flattened and annealed to avoid cracking during the last finish.
- The blanks were blanched in a hot liquor, possibly containing tartar, salt and water, to dissolve copper and copper oxide.
- The "white washed" blank was then placed between two engraved dies and by a heavy stroke given the final size and pattern. The top die was a hand held punch, most likely made from wrought iron. The lower was made of a tapered block of iron embedded like an anvil in a tree stump

(see remnants of the wooden poles in the workbench sites in the figures 1.4 and 1.5).

The process is laborious and the number of coins produced must have been rather limited, possibly about 10–15 finished hvids per man per hour. If the workforce consisted of two men working ten hours per day, 200 days a year, the production could have been about 50,000–60,000 hvids pr year.

6 CONCLUSIONS AND CONTEXT

6.1 CONCLUSIONS FROM THE NUMISMATIC AND TECHNOLOGICAL PERSPECTIVES

This publication has aimed at presenting a coherent analysis of the coin production in the Archbishop's Palace from a numismatic and a metallurgical perspective. The archaeological finds document coinage related activity in specified houses and provide information about the production chain of hvids, from the assaying of silver-containing materials through casting, hammering and to the selection of dies. We will in the following give a summary of our finds concerning the production procedures and of which coins were produced in the archbishop's mint as well as their numerical importance, before turning to the political and monetary implications of the coinage.

In the excavated material there is a lack of the so-called cherbles, crucibles used for assaying ore. However, a high number of small bone-ash cupels were unearthed. These two observations permit us to maintain that the raw material for coin production was coming from silver-containing objects and not from ore production.

We have also found that the copper- and silver-containing materials were charged in metalworking crucibles and melted. As some fine carbon inclusions are found in the cast metal rods, it seems likely that the melt has been covered by some charcoal, either to protect the melt from oxidation or as a result of dust coming from the use of bellows to obtain a high temperature around the crucible during melting. The inclusions have consequently followed the melt during pouring into the mould.

From comparisons of the microstructures of objects found with materials cast in our laboratory, we have concluded that the rods were cast in sand or stone

moulds giving a rectangular or circular cross section. The typical cross section area is about 30 mm^2. Furthermore, when combining this analysis with observations of features visible on the surface of the rods, we have seen how the rods were subsequently hammered over anvils with various diameters, a small one about 5–10 mm and later a larger one of about 20 mm. The material was thus stretched and given a certain width and thickness. The microstructures of the objects have also revealed that the rods were heat treated to make them more workable, possibly several times. Repeated heat treatments are in harmony with the observation of heavy wear on the tiled floor between the work benches and the hearth in the corner, as seen in figure 1.4.

Having attained the wanted width and thickness, the rods were cut into squares. Corners were cut in order to obtain a preliminary roundness. Thereafter, they were hammered round, possibly being piled and held in a "cramp". After the hammering, these blanks were flattened with intermittingly annealing to avoid cracking during the subsequent imprinting stroke.

In order to obtain a silvery exterior, the blanks were blanched in hot liquor, probably containing tartar, salt and water to dissolve copper and copper oxide. These "white washed" blanks were then placed between two engraved dies and by a heavy stroke given the final size and pattern. The top die was a hand-held punch, most likely made from wrought iron, whilst the lower was made of a tapered block of iron embedded like an anvil in a tree stump (see remnants of the tree stumps in the work benches in the figures 1.4 and 1.5).

The sophistication of the processes corresponds closely to those described in contemporary treatises on coin production. It is here reason to underline the craftsmanship of the mint master. He must have mastered the use of cupels in assaying, melt treatments and casting, hammering and annealing, the chemistry of blanching, die production and engraving, as well as the administration of the mint.

As seen through these production steps, the coinage as performed in the Archbishop's Palace must have been labour intensive, and the complexity of these processes indicates that coin production was a time consuming activity. When considered together with the limited workforce permitted by the royal decree, the metallurgical finds thus seem to indicate that the coin production was of a relatively limited numerical extent. An estimate of about 50–60,000 hvids produced per year seems reasonable as an upper limit (chapter 5.8) with a staff of two. Considering both the three work benches in the workshop and the likelihood that assaying, melting and casting were performed in another building, the possibility certainly exists that the mint master has hired a third person for less skilled work. However, speculations of this nature remain solely conjectural. Such a circumvention of the royal decree would at any rate have been easy to detect by royal inspectors and could set the whole coin production at stake. It seems therefore reasonable to infer that the use of three work benches has been a fixed set-up of different production equipments, needed for the mint to be efficient.

Since the sheer number of coins still existing is by far too low to give any trustworthy appraisal of the numerical scale of the coinage, a numismatic analysis of the coins has been performed, of which the key factor has been a die-link study of the hvids. The die-link study has identified 51 obverse dies and 29 reverse dies, and ascertained that they most probably all have been used in the mint in the Archbishop's Palace.

Establishing the number of coins produced solely on the basis of the number of dies is highly problematic, due to the fact that only a fraction of the coins produced by any single die has been discovered and to the fact that no die has been found, leaving us no possibility to evaluate its authentic durability. On the other hand, we do not know either whether all dies were completely worn out. The literature estimates the number of coins produced by each individual die as

being typically between 5,000 and 30,000. However rough such estimation might be, and even if the existence of some further dies is probable, it gives us a certain idea of the quantity of coins resulting from the coinage, especially since the extensive linkage of the dies in chains indicates that the number of dies included in the die link study probably is close to its upper limit. If using an intermediary estimation of 15,000 coins produced per hand held die (the obverse dies), we arrive at indications of a total production of 750,000 coins. When considering that maybe not the entire stock of die imprints has been retrieved, this number can be augmented to possibly 800,000 coins produced. If, on the other hand, the intermediary estimation of 15,000 coins is applied on the mounted die (the reverse dies), we arrive at indications of a production of 435,000 coins. The first sure trace of coin production within the Archbishop's Palace (the first mint), is dated to approximately AD 1500, and the office of Gaute ended in AD 1510, i.e. confirmed production under his office in a period of 10 years. Based on these assumptions, we might infer that the annual production of coins in the mint in the Archbishop's Palace was between approximately 40,000 and 80,000. Even though several of the indicators on which such an estimation is based are uncertain – still unfound coins might reveal further dies, and the number of coins produced per die is uncertain – it seems justifiable to conclude from a numismatic perspective that the coinage in the Archbishop's Palace did not reach a very substantial level, especially when compared to contemporary European mints. Taking the numismatic and technological estimates together, we end up with a conservative estimation concerning the production of hvids of totally 600,000 during the office of Gaute Ivarsson.

The study of the pennings indicates a similar picture. Due to the fact that they are imprinted only on one side, and the die therefore could be mounted, the durance of these was probably longer than the hand-held hvid obverse dies, i.e. more coins could be produced out of each die. However, a mere total of seven

dies have been identified and only five of these are assumed to have been in use in the Archbishop's Palace. Even if more coins could be printed, the total number of pennings produced was probably considerably lower than that of the hvids.

6.2 THE ECONOMIC AND POLITICAL EFFECTS OF THE COIN PRODUCTION

On the basis of the conclusions in this paper, how is one to judge the importance of the coinage performed in the Archbishop's Palace during the office of Gaute Ivarsson? To be answered properly, we must address two aspects of the question separately; firstly, it's purely economic significance, secondly, its politico-symbolic implications.

6.2.1 Economic effects

To what extent did the coinage have any effect on the general economic situation? When considering the economic importance of the coin production in the Archbishop's Palace, a comparison with other products is of interest. Several problems, however, are intrinsic to such an assessment, such as inflationary questions and variation in prices between different products such as stockfish and corn, as well as the general lack of coins and other pecuniary questions. Two publications have none the less been able to shed some light onto the question of economic relations in the early 16th century, notably Brøgger and Steinnes *Gammel mål og vekt i Norge* ((1936)1982) and Dybdahl *Tiendeskatten som kilde til folk og samfunn ca. 1520* (2005). According to the first of these publications, the following relations can be established (remark that the term "mark" refers both to a monetary and a weight unit):

Weight units (Brøgger and Steinnes 1982):

- 1 mark = 214.3 g
- 1 lodd = 1 / 16 mark = 13.4 g
- 1 bucket of butter (à 15.4 kg) = 3 bismerpund (à 5.14 kg) = 72 mark (à 214.3 g)

Monetary units

- 1 mark money = 16 skilling = 48 hvid

Some prices at AD 1520 (Dybdahl, 2005a:207)

• 1 lodd of silver	1	mark	money
• 1 mark of copper (214.3 g)	1/12	"	"
• 1 bucket of butter	1.5	"	"
• 1 cow	2	"	"
• 1 våg of stockfish (18.5 kg)	1.5	"	"

Such comparisons are in effect essential when trading in an economy mixed between a monetary system and a barter system with fixed relations between different products. The main income sources to the archbishopric were tithe, land-rent, the royal revenues collected as lensherre in Trøndelag (land-rent, fines and leidang) and surplus on trading of goods, especially stockfish from the north of Norway. The land-rent in Trøndelag was most often calculated in terms of buckets of butter. Nearly all of the income from land-rent and tithe was paid in kind, e.g. corn, malt, meat, fish and fur (Nissen, 1998:28). Fines, on the other hand, were mostly to be paid in money or silver.

There is little information about the details of the economy during the office of Gaute Ivarsson. To get some knowledge of the income to Gaute Ivarsson, we may use the well documented cadastres of the earlier and later archbishops

Aslak Bolt and Olav Engelbrektsson. In addition the account books of Olav Engelbrektsson from the years AD 1532–36 are preserved.

From the cadastres from Aslak Bolt, Dybdahl (2005b:62) has estimated that the annual land-rent of the archbishopric was about 1280 buckets of butter or about 2000 mark in money from Trøndelag alone. The numbers from about AD 1530 are 1400 buckets of butter. In addition comes land-rent from outside Trøndelag, estimated to about 700 buckets of butter. The relative similarity of these figures suggests that the annual land-rent paid to the archbishopric during the office of Gaute may have been something in between, estimated to about 2000 buckets of butter at a value of 3000 mark.

The land-rent to the Crown collected by Gaute Ivarsson as lensherre has been less significant as the Crown possessed a smaller number of farms. But we may expect that the archbishop was an efficient tax collector and may have made a surplus on the activity.

The tithe was the dominating income. From the end of the Middle Ages, Dybdahl (2005b:102) has estimated the amount to have a value of about 3000 buckets of butter or 4500 mark annually.

If we accept that the total production of hvids under Gaute Ivarsson was about 600,000 or annually about 60,000 hvid equal to 1250 mark, thus representing the order of 1/4 of the tithe. Even though the coin production in the mint was comparatively small, it was probably of great importance to the daily running of the archbishop's different activities and of commerce in Nidaros. The archbishop's coins were widespread in Norway (Risvaag, 2006:373–394) alongside the kings' coins (see also catalogue, chapter 11). This indicates that the coinage met a need for currency and that the coins were generally accepted.

Taking all the reservations necessary, the numbers one arrive at if using these numbers, is that the estimated 600,000 hvids = 12,500 mark would represent 6,250 cows or 130 tons of butter or 150 tons of stockfish. Even if divided over a period of ten years or so, the picture of a small but by no means negligible coinage emerges.

In view of the small but constant influx of various silver-containing objects given or paid to the church, e.g. from dues and fines, the establishment of the mint must have been a practical way to convert these into convertible currency for the archbishop. One traditionally attractive side of issuing coins is that their nominal value usually is set higher than the price of the bullion material involved, and a certain profit can be obtained by the coinage. A rough estimate of the value of the metal in a hvid of 0.63 gram of fineness of 30 % silver (chapter 8, chain 7) gives:

0.19 gram silver costs	0.68 hvid
0.44 gram copper costs	0.01 "
Cost of the metal in a hvid:	0.69 hvid

However, the labour force in the mint had to be paid and the annual cost of running the mint must be considered before the net surplus can be estimated. It is therefore difficult to assume that the potential surplus can have been larger than 10–20% or about 200 mark annually, being 4% of the tithe and 7% of the land-rent.

An annual production of 60,000 hvids corresponds to about 12 kg silver. From where did the silver come? The income from tithe and land-rent were paid in kind. However, the different types of dues and fines were paid mainly in money and silver.

After the Reformation the Crown took over most of the properties of the archbishop, the church and the monasteries, and was administrated from Steinsvikholm Castle. If we use the records from Steinsvikholm len in the year 1548–49 (Nissen, 1998:30) the main components of the income from different fines are 222 daler, 185 mark and 75 lodd silver. The daler was a coin established after the time of Gaute Ivarsson and contains about 26 gram silver (purity > 90 %). If we suppose that the records from Steinsvikholm give a reasonable figure of the total income to the archbishopric when Gaute Ivarsson was in office, the above figures of daler and silver may be converted to a total of about 6.8 kg silver. With a surplus in money and silver on trading different products in Bergen and elsewhere, the estimate of 12 kg silver annually to cover the activity in the mint may balance.

The process by which the coins were produced was labour intensive and, with a limited workforce, a slow one. This might have represented an impediment for an archbishop in sudden need of ready money. We have no record of the use of bullion (paiment), i.e. the cast rods intended for being made into coins, as means of payment during the office of Gaute Ivarsson. From the later Archbishop Olav Engelbrektsson, records of the use of bullion exist in 1536 (*Rekneskapsbøker*, 1936:159). It is worth remarking that the time of this latter archbishop was a time of considerable turmoil, a fact that might have influenced his ways of payment. We cannot therefore exclude the use of bullion as means of payment also by Gaute Ivarsson.

However, the use of bullion might have been less convenient for everyday business purposes. But was this and a possible surplus from the coining a sufficient reason for the coinage itself? In order to answer this question properly, we have to turn to its political and symbolic significance.

6.2.2 Political and symbolic significance

Gaute Ivarsson crowned King Hans in the Nidaros Cathedral on the 20th of July, 1483. At this time, the archbishop, ten years the king's senior, had already held the office for eight years and led the Norwegian Council of the Realm for the same period. We can therefore safely assume that he had built the power base necessary for his authority, a fact to which the actions of the Norwegian Council of the Realm prior to the acceptance of Hans as Norwegian king as described in our introduction attest.

The *Halmstadrecess*, the document conditioning Hans' acceptance on the throne of Norway, is itself the most telling manifestation of this prelate's imposing leadership of the Council. According to Albrechtsen (1997:252), it is the sign of the king at his absolute weakest moment, especially concerning to his abilities to employ his power over the Norwegian institutions, including the church. Significantly, at the very heart of the conditions Gaute Ivarsson included in the *Halmstadrecess* was the right to issue coins by the Archbishop of Nidaros. When considering the limited economic profit involved in the coinage, it seems reasonable to underline the issuing of coins as a powerful symbolic marker of the archbishopric's preponderance.

The authority Gaute Ivarsson exercised remained for a long time neglected in present day historical accounts of the late Middle Ages. This is partly due to the scarcity of written evidence from the period of his holding office, where his predecessor Aslak Bolt stands out thanks to the cadastres he established, partly to the central role his successor Olav Engelbrektsson played in the Reformation of Norway. Newer sources, however, in particular through the work of Sæbjørg Walaker Nordeide (2003:210) who bases her conclusions on the archaeological evidence from the excavations in the Archbishop's Palace, tend to emphasize the role of Gaute Ivarsson, especially based on the profound alterations and expansions of the building structure, indicating intensified economic activity

during his office. We also know Archbishop Gaute received the northernmost county of Finnmark as fief from the king, along with the crown revenues from Trondheim and most parts of Trøndelag (Risvaag, 2006:42–43). The results presented in this paper reinforce an image of a potent prelate.

The establishment of the mint might evidently have been just a practical and easy way to convert various silver-containing objects given or paid to the church into practical and convertible items for the archbishop. We argue, however, that the coinage performed is probably best seen as a clear symbolic marker of the archbishop's dominant position. The fact that he was issuing coins equivalent to the king's would not have gone the contemporaries by unremarked. In addition, the minting rights and the establishing of his own mint may also have increased his authority further at a time when coins were lacking. A further consideration of the technical skills needed in proper coin production and the difficulties involved in obtaining the right to issue coins further distances the idea of the coinage as only a practical means to transform precious metals into ready money.

Together, the finds related to the technology of minting depicts a mint workshop with a level of sophistication in the production process comparable to the production processes described in the contemporary treatises on coin production, which were based on experiences from much larger mints operating elsewhere in Europe. The finds of cupels and crucibles, however, indicates that relatively small amounts of precious metal have been melted in the mint. The image from the numismatic analysis is thus reinforced, in that the scale of the production seems not to have been anywhere near what was produced at other contemporary mints. This impression of the scale of the coin production is reinforced by a consideration of the size of the actual workshop, being only a 5.5m x 8.5m structure, with three workbenches. The limited production seems to be an indication that the Crown did not want ecclesiastical authority to be

excessively stated by an extensive coinage. The production facilities seem actually to be in relative accordance with the privilege stated in the *Halmstadrecess*, allowing one master moneyer and one assistant to perform the coinage.

In fact, when considering the extent of the coinage actually being produced, the emphasis the Norwegian Council of the Realm lay on re-establishing minting activity in Norway, as well in the reconfirmation of the 1277 *Settargjerd* obtained when accepting Hans as heir to the Norwegian Crown in 1458, as in the *Halmstadrecess* of 1483, cannot solely be explained by the lack of coins in Norway expressed in several letters of complaint from the Norwegian Council of the Realm to the king. It seems, in effect, that the minting rights acquired by the archbishopric said more of the status thus inherently acknowledged, than had any substantial economic meaning.

Even though placed under the authority of the king, the relative chronology of the coins indicates a slide in the nature of the iconographic representations. No written royal instructions of which symbolic configurations should appear on the coins are preserved. The close resemblance of the coins produced by the king at the Bergen mint in the early days of the coinage seems to indicate that a strict regime was imposed by the king. We have seen a similar absence of clearly identifiable ecclesiastical coins in earlier coinages, and called it likely to be explained by the king's overall authority concerning the coinage. As the minting under Gaute Ivarsson progresses, however, the disparity between the royal coinage and the one performed in the mint in the Archbishop's Palace increases. The Olav iconography gradually becomes more manifest, a development that reaches its apex by the introduction of a thorough ecclesiastical iconography. The legend of archbishop, moneta Norwei and Nidaros is a further manifestation of this independent position.

The two last archbishops went further and issued coins bearing their proper epigraphs and symbols. The extent of this coinage suggests that a general acceptance from the king must have existed; at any rate, the King appears not to have been involved in the minting in Trondheim before the Reformation, if indeed ever. The archbishops' issuing of coins seems to fall into a general European pattern for the late middle ages, with several issuers of coins under the authority of the secular ruler. But the fact that the archbishops appear on the coins as issuers seems also to entail a visualizing of the ecclesiastical leaders pre-eminence on a national level, leaders to whom the faded royal authority had to bestow considerable concessions.

6.3 EPILOGUE

The in situ presentation of the mint makes it a rare and valuable part of the museum in the Archbishop`s Palace. It reflects a time when the Roman Church had a strong position at the geographical border of European settlements. Combined with a good exhibition of authentic artefacts, the mint deserves a much higher attention than given today; the museum contains within its walls a true gem.

6.4 ACKNOWLEGEMENTS

The authors would like to acknowledge and thank The Royal Norwegian Society of Sciences and Letters (DKNVS), for their generous and patient support throughout the whole project period.

Norsk Numismatisk Forening and the Foundation of Industrial and Technical Research at NTH (SINTEF) are acknowledged for their economic support covering the analyses of chemistry and microstructures founding the base for the scientific work preceding the start of this project.

The following institutions have willingly given access to numismatic material: Museum of Archaeology, University of Stavanger; Bergen Museum, University of Bergen; Fitzwilliam Museum, Cambridge; Museum of Cultural History, University of Oslo; Kalmar Länsmuseum, Kalmar; The Royal Coin Cabinet. National Museum of Economy, Stockholm; Royal Collection of Coins and Medals, The National Museum, Copenhagen; Münzkabinett Berlin; Münzkabinett Dresden; Stockholm Stadsmuseum, Stockholm; Museum of Natural History and Archaeology, Norwegian University of Science and Technology, Trondheim. We are them all grateful.

We would like to thank former Over-inspector of the Royal Coin Cabinet, Copenhagen, Jørgen Steen Jensen and Professor Audun Dybdahl, Department of History, Norwegian University of Science and Technology, whose comments were important in providing focus and ascertaining the quality of the material. We would also thank Ole Bjørn Pedersen and Torbjørn Aasvang for their assistance at the archaeological collections of the Museum of Natural History and Archaeology, and Helge Ebbesen Ødegaard for his valuable aid during the layout work.

National Museum of Economy, Stockholm and Associate Professor Håkon Ingvaldsen, Museum of Cultural History, University of Oslo, have allowed us to publish their photographs free of charge, of which we are deeply grateful.

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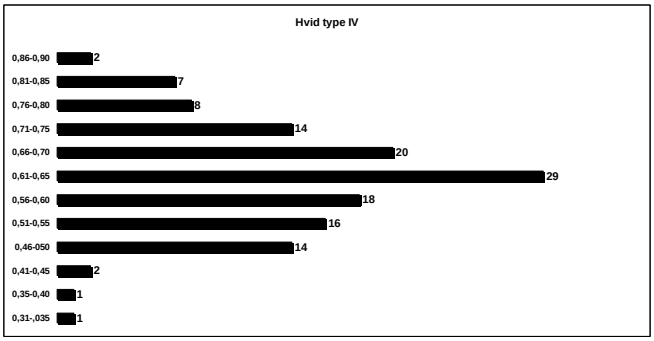
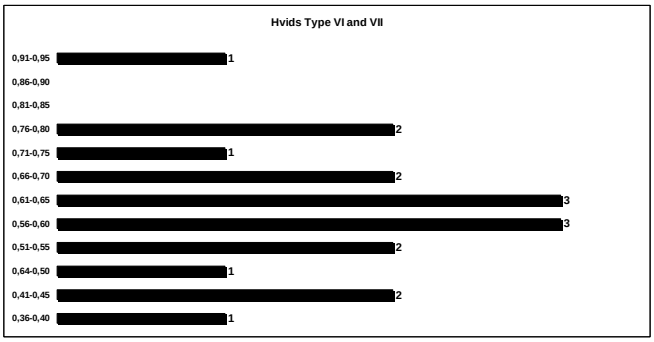
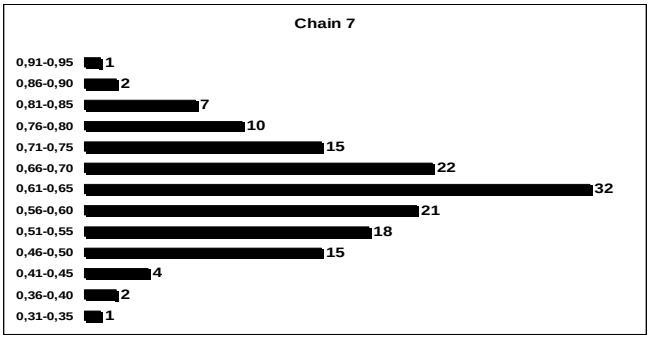
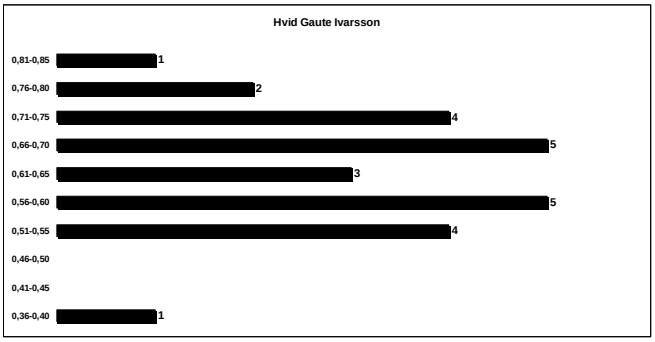
APPENDICES

8 APPENDIX 1 WEIGHT DISTRIBUTION WITHIN THE TYPES

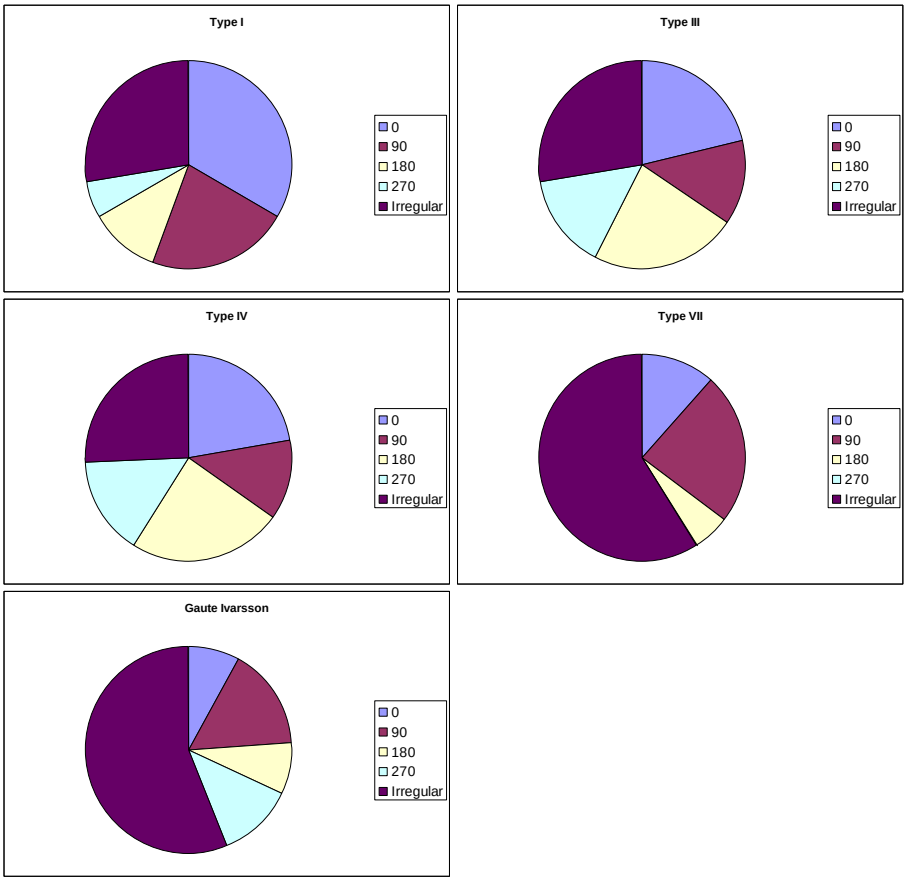








9 APPENDIX 2 DIAGRAM DIE AXIS



10 Appendix 3 Kings and archbishops of Medieval Norway

Archbishops of Nidaros

Jon Birgersson (1153–1157)
Eystein Erlendsson (1158/59–1188)
Eirik Ivarsson (1188–1205)
Tore I Gudmudsson Den Vikværske (1206–1214)
Guttorm (1215–1224)
Brynjulfsson av Husastad (1225–1226)
Tore II den Trøndske (1227–1230)
Sigurd Eindtidesson Tafse (1231–1252)
Sørle Sǫrli (1253–54)
Einar Gunnarsson Smjorbak (1255–63)
Håkon (1267)
Jon Raude (1267–1282)
Jørund (1287–1309)
Eiliv Arnesson Korte (1309–1331)
Pål Bårdsson (1333–1346)
Arne Einarsson Vade (1346–1349)
Olav (1350–1370)
Trond Gardarsson (1371–1381)
Nikolas Jacobsson Finkenow (Nicolaus Rusare) (1382–1386)
Vinald Henriksson (1387–1402)
Eskill (1402(4)–1428)
Aslak Harniktsson Bolt (1428–1450)
Henrik Kalteisen (1452–1458)
Olav Trondsson (1459–1474)
Gaute Ivarsson (1475–1510)
Erik Valkendorf (1510– 1522)
Olav Engelbrektsson (1523–1537)

Kings of Norway at the time of the archbishopric

Sigurd II Haraldsson Munn (1136–1155)
Inge Haraldsson Krokrygg (1136–1161)
Øystein II Haraldsson (1142–1157)
Håkon II Sigurdsson Herdebrei (1159–1162)
Magnus V Erlingsson (1161–1184)
Sverre Sigurdsson (1177–1202)
Håkon III Sverresson (1202–1204)
Guttorm Sigurdsson (1204)
Inge II Bårdsson (1204–1217)
Håkon IV Håkonsson (1217–1263)
Magnus VI Håkonsson Lagabøte (1263–1280)
Eirik II Magnusson (1280–1299)
Håkon V Magnusson (1299–1319)
Magnus VII Eriksson (1319–1355)
Håkon VI Magnusson (1355–1380)
Olav IV Håkonsson (1380–1387)
Margrete Valdemarsdotter (Queen) (1388–1412)
Erik III av Pommern (1389–1442)
Christoffer av Bayern (1442–1448)
Karl I Knutsson Bonde (1449–1450)
Christian I (1450–1481)
Hans (1483–1513)
Christian II (1513–1523)
Fredrik I (1524–1533)
Christian III (1536–1559)

11 APPENDIX 4 INTRODUCTION TO THE CATALOGUE AND CATALOGUE

The catalogue is organised as follows:

Issuer

Type

Obv: Description *Rev: Description*

Obv. Number: Description
Legend:

Rev. Number: Description
Legend:

No.	Obv/Rev	Chain	Collection	Find location	Weight (Gram)	Fineness (%)	Diameter (mm)	Axis

Inscriptions are written in **Inscription Numismatic** (© Fitzwilliam Museum, Cambridge).
Photos of specimens are marked*

Abbreviations of names of collections:

AMS:	Museum of Archaeology, University of Stavanger, Stavanger
BM:	Bergen Museum, University of Bergen
FM:	Fitzwilliam Museum, Cambridge
KHM:	Museum of Cultural History, University of Oslo, Oslo
KL:	Kalmar Länsmuseum, Kalmar
KMK:	The Royal Coin Cabinet. National Museum of Economy, Stockholm
KMM:	Royal Collection of Coins and Medals, The National Museum, Copenhagen
MB:	Münzkabinett Berlin
MD:	Münzkabinett Dresden
StS:	Stockholm Stadsmuseum, Stockholm
VM:	Museum of Natural History and Archaeology, Norwegian University of Science and Technology, Trondheim

Photos:

Lill-Ann Chepstow-Lusty: 337, 341, 509
Gabriel Hildebrand: 334, 512, 1320
Håkon Ingvaldsen: 313, 318, 322, 326, 328, 329, 331, 339, 340, 343, 345, 402, 403, 504, 505, 507, 508, 1202, 1203, 1204, 1209, 1210, 1313, 1315, 1316, 1317, 1319, 1325, 1326, 1402, 5101, 5102, 5201, 5301, 5401
Jon Anders Risvaag: 312, 314, 316, 317, 319, 320, 321, 323, 325, 327, 330, 332, 335, 336, 338, 344, 401, 501, 502, 503, 506, 510, 513, 1205, 1206, 1208, 1211, 1311, 1314, 1318, 1321, 1322, 1324, 1401

Archbishop Gaute Ivarsson (and King Hans?)

Hvid, type IV
Obv: Crowned monogram ᚺ (Additional symbols: ○, ●, ⁘)
Rev: Norwegian Lion over long cross (Additional symbols: ○, ●)

Obv. 312: Crowned monogram ᚺ. Open crown.
Between two circles of pearls: ᚺᚨᚾᛋ ᛞ'ᚷ'ᚱ' ᚾᛟᚱᚹᛞᛁ⁘

Obv. 313: Crowned monogram ᚺ. Open crown.
Between two circles of pearls: ᚺᚨᚾᛋ ᛞ·ᚷ·ᚱ· ᚾᛟᚱᚹᛞᛁ⁘

Obv. 314: Crowned monogram ᚺ. Open crown.
Between two circles of pearls: ᚺᚨᚾᛋ ᛞ'ᚷ'ᚱ' ᚾᛟᚱᛞᛁ·⁘

Obv. 315: Crowned monogram ᚺ. Open crown.
Legend between two circles of pearls: ᚺᚨᚾᛋ ᛞ'ᚷ'ᚱ' ᚾᛟᚱᚹᛞᛁ⁘

Obv. 316: Crowned monogram ᚺ. Open crown.
Between two circles of pearls: ᚺᚨᚾᛋ ᛞ'ᚷ'ᚱ' ᚾᛟᚱᚹᛞ'

Obv. 317: Crowned monogram ᚺ. Closed crown.
Between two circles of pearls: ᚺᚨᚾᛋ· ᛒ·ᚷ·ᚱ'· ᚾᛟᚱᚹᛋ·

Obv. 318: Crowned monogram ᚺ. Open crown.
Between two circles of pearls: ᚺᚨᚾᛋ' ᚳ'ᚷ'ᚱ ᚾᛟᚱᚹᛞᛁ·⁘

Obv. 319: Crowned monogram ᚺ. Open crown. On each side of monogram: ○
Between two circles of pearls: ᛁᛟᚺᚨᛊ ᛞ'ᚷ'ᚱ' ᚾᛟᚱᚹᛞᛁ·

Obv. 320: Crowned monogram ᚺ. Open crown. On each side of monogram: ○
Between two circles of pearls: ᛁᛟᚺᚨᚾᛋ ᛞ'ᚷ'ᚱ' ᚾᛟᚱᚹᛞᛁ

Obv. 321: Crowned monogram ᚺ. Open crown. On each side of monogram: ○
Between two circles of pearls: ᚺᚨᚾᛋ ᛞ'ᚷ'ᚱ' ᚾᛟᚱᚹᛞᛁ·

Obv. 322: Crowned monogram ᚺ. Open crown. On each side of monogram: ○
Between two circles of pearls: ᚺᚨᚾᛋ ᛞ'ᚷ'ᚱ' ᚾᛟᚱᚹᚧᛁ·

Obv. 323: Crowned monogram ᚺ. Open crown. On each side of monogram: ○
Between two circles of pearls: ᛁᚨᚾᛋ ᛞ ᚷ ᚱ ᚾᛟᚱᚡᚡᛞᛁ⁂

Obv. 324: Crowned monogram h. Open crown. On each side of monogram: ○
Between two circles of pearls: IOhΛS D'G'R' ΠORVVDI⁂

Obv. 325: Crowned monogram h. Open crown. On each side of monogram: ○
Between two circles of pearls: IIOΠƆTΛΠORWƆI•°•

Obv. 326: Crowned monogram h. Open crown. On each side of monogram: ○
Between two circles of pearls: SΛΠTVS•°• OLLΛVVS•°•

Obv. 327: Crowned monogram h. Open crown. On each side of monogram: ○
Between two circles of pearls: SΛΠTVS•°• OƆLΛVVS•°•

Obv. 328: Crowned monogram h. Open crown.
Between two circles of pearls: SΛIITVOLLΛVVSRD'

Obv. 329: Crowned monogram h. Open crown. Left of monogram: ○
Between two circles of pearls: hΛΠS D'G'R' ΠORWDI

Obv. 330: Crowned monogram h. Open crown. Left of monogram: ○
Between two circles of pearls: hΛΠS D'G'R' ΠORWDI⁂

Obv. 331: Crowned monogram h. Open crown. Left of monogram: ○
Between two circles of pearls: hΛΠS D'G'R' ΠORWDI⁂

Obv. 332: Crowned monogram h. Closed crown. Left of monogram: ○
Between two circles of pearls: hΛΠS Ə'G'R' ΠORWƏI

Obv. 333: Crowned monogram h. Open crown. Left of monogram: ○
Between two circles of pearls: hΛ'S D'G'R ΠORWDI •°• ⁘

Obv. 334: Crowned monogram h. Open crown. Left of monogram: ○
Between two circles of pearls: hΛΠS D'G'R' ΠORWDI•°•

Obv. 335: Crowned monogram h. Open crown. Left of monogram: ●
Between two circles of pearls: Legend identical to 312

Obv. 336: Crowned monogram h. Open crown. Right of monogram: ○
Between two circles of pearls: Legend identical to 312

Obv. 337: Crowned monogram h. Open crown. Right of monogram: ○
Between two circles of pearls: SΛΠTVVS •°• OƆLΛVVS •°•

Obv. 338: Crowned monogram h. Open crown. On each side of monogram: ⁘
Between two circles of pearls: Legend identical to 337

Obv. 339: Crowned monogram ꞥ. Open crown.
Between two circles of pearls: ꞥᗅᑎS ᗞ'G'R' ᑎOƧWᙡI

Obv. 340: Crowned monogram ꞥ. Open crown.
Between two circles of pearls: ꞥᗅᑎS ᗞ'G'R' ᑎORWƎI∘∘

Obv. 341: Crowned monogram ꞥ. Open crown. Left of monogram: ●
Between two circles of pearls: ꞥᗅᑎS ᗞ'G'R' ᑎORWƎI⁘

Obv. 342: Crowned monogram ꞥ. Open crown.
Between two circles of pearls: ꞥᗅᑎS ᗞ'G'R' ᑎORWᗡII⁘

Rev. 1311: Norwegian Lion over long cross
Between two circles of pearls: HOᑎ ᙡTᗅ ᑎOR WᙡI

Rev. 1312: Norwegian Lion over long cross.
Between two circles of pearls: HOᑎ ᙡTᗅ ᑎOR WЄI

Rev. 1313: Norwegian Lion over long cross.
Between two circles of pearls: MOᑎ ᙡTᗅ ᑎOR WЄI

Rev. 1314: Norwegian Lion over long cross.
Between two circles of pearls: WOᑎ ᑎᙡT ᗅ∘ᑎO RWᙡI

Rev. 1315: Norwegian Lion over long cross.
Between two circles of pearls: IHO ᑎᗞT ᗅᑎO RWᗡ

Rev. 1316: Norwegian Lion over long cross.
Between two circles of pearls: IOᑎS ᗞ'G'R' ᑎOR WЄI

Rev. 1317: Norwegian Lion over long cross.
Between two circles of pearls: HOᑎ ᗞTᗅ ᑎOR WᗡI

Rev. 1318: Norwegian Lion over long cross. In front of Lion: ○
Between two circles of pearls: Legend identical to 1311

Rev. 1319: Norwegian Lion over long cross. In front of Lion:○
Between two circles of pearls: Legend identical to 1317

Rev. 1320: Norwegian Lion over long cross. In front of Lion:○
Between two circles of pearls: HOᑎ ᗞTᗅ ᑎOR WƎI

Rev. 1321: Norwegian Lion over long cross. In front of Lion:○
Between two circles of pearls: HOᑎ ƎTᗅ ᑎOR WᗡI

Rev. 1322: Norwegian Lion over long cross. In front of Lion:●
Between two circles of pearls: HON ᚳTᛏ ᚿOR WᚳI◦

Rev. 1323: Norwegian Lion over long cross. In front of Lion:●
Between two circles of pearls: HON ᚳTᛏ◦ ᚿOR WᚳI◦

Rev. 1324: Norwegian Lion over long cross. In front of Lion:●
Between two circles of pearls: MON ᚳTᛏ ᚿOR WᚹI

Rev. 1325: Norwegian Lion over long cross. In front of Lion:○
Between two circles of pearls: NON ᚹTᛏ ᚿOR WᚹI

Rev. 1326: Norwegian Lion over long cross.
Between two circles of pearls: Legend identical to 1325

No. Obv/Rev	Chain	Collection	Find location	Weight	Fineness	Diameter	Axis
132. 312*/1314*	7	KMM		0.69g		17	40°
133. 312/1315	7	KHM		0.54g		16/16.5	90°
134. 312/1324	7	BM		0.68g		17	0°
135. 313*/1315*	7	KHM	Ål church	0.73g		17/17.5	180°
136. 313?/1324	7	KHM		0.85g		17	0°?
137. 313/1324*	7	KMM		0.84g		17	220°
138. 314/1313*	7	VM	Dønnes church	0.75g		17/18	0°
139. 314/1315	7	VM	Dønnes church	0.73g		17	0°
140. 314/1319	7	KMM	Næs, Assens	0.65g		16.5/17	40°
141. 314/1324	7	VM	Alstahaug church	0.70g		16/17	0°
142. 314/1324	7	VM	Dønnes church	0.54g		16/17	0°
143. 314/1324	7	KMM		0.48g		16.5	0°
144. 314*/1324	7	KMM	Årup chapel	0.64g		17	70°
145. 314/1326*	7	BM		0.65g	32.9%	16/17	0°
146. 316*/1318*	7	KMM		0.69g		17	0°
147. 316/1318	7	KMK		0.58g		15/16.5	330°
148. 317*/1311*	7	KMM	Roskilde	0.62g		16	0°
149. 317/1311	7	KMK		0.66g		15.5/17	140°
150. 318*/1319*	7	KHM		0.85g		16	0°
151. ___/1319	7	KMM	Gurreby church	0.65g		16/17	(180°)
152. 319/1311	7	KHM		0.68g		16/17	270°
153. 319/1311	7	BM		0.54g		15.5/16.5	90°
154. 319*/1311	7	KMM		0.67g		16/17	90°
155. 319/1311	7	KMM	Årup chapel	(0.64g)		16.5/17	(180°)
156. 319/1325	7	KMM	Årup chapel				180°
157. 319/1325	7	KHM	Hvaler church	0.74g		16.5/17	270°
158. 320*/1325	7	KMM		0.74g		15.5/17	0°
159. 321/1311	7	KHM		0.60g		14.5/16	270°
160. 321/1316	7	BM		0.84g		16/17	90°?
161. 321*/1318	7	KMM	Næs, Assens	0.84g		16/16.5	0°
162. 321/1325	7	KHM	Ringebu church	0.38g		15.5/17	270°
163. 322*/1311	7	KHM		0.62g		16	0°
164. 322/1311	7	KMM	Voldtofte, Fyn	0.59g		16	90°
165. 322/1321*	7	KMK		0.78g		16	180/200
166. 323?*/1317	7	KMM	Bangsbo strand	(0.38g)		15.5/17	0°
167. 325*/1315	7	KMM		0.59g			340°
168. 326*/1316*	7	KHM	Funn 39,91	0.60g		17	180°

No.	Obv/Rev	Chain	Collection	Find location	Weight	Fineness	Diameter	Axis
169.	326?/1316	7	KMM		0.48g		15.5/16	240°
170.	326/1316	7	KMM	Øster Starup church	0.73g		16.5/17	320°
171.	326/1317	7	KMM		0.72g		16.5/17	30°
172.	327/1316	7	KHM		0.57g		16.5/17	0°?
173.	327/1316	7	KHM		0.63g		16/17	180°
174.	327/1316	7	BM		0.54g	32.0%	16/17	90°
175.	327/1316	7	KMM		0.85g		16/17	130°
176.	327*/1316	7	KMM		0.88g		16/17	150°
177.	327/1316	7	KMK		0.77g		17	
178.	328*/1317*	7	KHM		0.62g		16/17	90°
179.	328/1317	7	BM		0.58g			130°?
180.	328/1317	7	KMM		0.78g		16/17	0°
181.	329/1318	7	KHM		0.48g		16.5/17	270°
182.	329/1318	7	KHM		0.64g		15.5/16,5	270°
183.	329/1318	7	KHM		0.52g		15.5/16	0°
184.	329*/1318	7	KHM	Maria church,Oslo	0.50g		16.5/17	270°
185.	329/1318	7	KHM	Lom church	0.70g		17/18	90°
186.	329/1318	7	KMK		0.73g		16/16.5	40°
187.	329/1319	7	KHM		0.61g		17	270°
188.	329/1320	7	KHM		0.55g		16	90°
189.	329/1320	7	KHM		0.59g		16	180°
190.	329/1321	7	KHM		0.43g		16	270°
191.	329/1321	7	KHM	Haug ch, Hokksund	0.46g		16/16.5	270°
192.	330*/1325	7	KMK		0.60g		16.5	
193.	331/1319	7	KHM		0.86g		16/16.5	0°
194.	331/1319	7	KMM		0.67g		16/17	150°
195.	331/1319	7	MD		0.78g		16.5	
196.	331/1320	7	KHM		0.59g		15.5/16	180?
197.	331/1320	7	VM	Mære church	0.71g		16	180°
198.	331/1321	7	KHM		0.63g		16/17	270°
199.	331/1321	7	KHM	Hoprekstad church	0.76g		17/18	180°
200.	331/1324	7	KHM	Volbu church	0.50g		16/16.5	0°
201.	331*/1325*	7	KHM		0.70g		16/17	240°
202.	331/1325	7	KHM		0.64g		15.5/16	270°
203.	331/1325	7	KHM	Lom church	0.66g		15.5/17	0°
204.	331/1325	7	KHM	Ål church	0.65g		16/17	180°
205.	331/1325	7	KHM	Ål church	0.63g		16/18	0°
206.	331/1325	7	KHM	Ål church	0.51g		15/17	180°
207.	331/1325	7	KHM	Ål church	0.65g		17/18	180°
208.	331/1325	7	BM		0.59g		16/17	180°
209.	331/1325	7	VM	Alstahaug church	0,69g		17/18	
210.	331/1325	7	VM	Alstahaug church	0.85g		15/18	90°
211.	331/1325	7	VM	Dønnes church	0.64g		17/17.5	210°
212.	331/1325	7	KMK		0.64g		16/17	180°
213.	332/1311	7	BM		0.55g		16/16.5	180°
214.	332/1311	7	KMM	Nykøbing s. (church)	0.74g		17	180°
215.	332*/1311	7	KMM		0.49g		16/16.5	180°
216.	332/1311	7	KMK	Vår frue church, Enkjöping	0.48g		16.5	
217.	334/1319	7	KHM		0.46g		16	180°?
218.	334/1319	7	KHM		0.63g		16/17	270°?
219.	334/1319	7	KHM		0.59g		16	340/0°?
220.	334/1319	7	BM		0.46g		15.5/17	180°
221.	334*/1320*	7	KMK	Källa ödekyrka	0.68g		17	
222.	334/1321	7	FM		0.77g			290°
223.	334/1325	7	KHM		0.59g		16/17	180°
224.	334/1325	7	KHM	Maria church, Oslo	0.54g		16/17	0°

No.	Obv/Rev	Chain	Collection	Find location	Weight	Fineness	Diameter	Axis
225.	334/1325	7	BM		0.61g		15.5/17	180°
226.	334?/1325	7	BM		0.71g		16	0°
227.	334/1325	7	VM	Alstahaug church	0.53g		14.5/17	270°
228.	334/1325	7	VM	Dønnes church	0.68g		16/17	180°
229.	334/1325	7	VM	Dønnes church	0.65g		15.5/18	90°
230.	334/1325	7	KMM		0.54g		16/16.5	30°
231.	334/1325	7	KMM	Næs, Assens	0.49g		16.5/17.5	180°
232.	334/1325	7	MM	Gundsømagle church	0.65g		17	320°
233.	334/___	7	KHM	Funn 30/7-1970			16/16.5	0°
234.	335/1322	7	KHM		0,62g		16.5	180°
235.	335*/1322*	7	KMM	Voldtofte, Fyn	0.64g		16/17	130°
236.	335/1322	7	KMK		0.65g		16/17	210°
237.	335/1324	7	VM	Dønnes church	0.64g		17	180°
238.	336/1319	7	BM		0.62g		15.5/16.5	0°
239.	336*/1319	7	KMM		0.60g		16/17	180°
240.	336/1320	7	KMM	Torup church	0.66g		16/17	0°
241.	336/1320	7	KMK		0.72g		17/18	270°
242.	337*/1319	7	BM		0.66g		17/18	90°
243.	338*/1316	7	KMM	Voldtofte, Fyn	0.32g		16/17	30°
244.	338/1317	7	KHM		0.52g		16/17	0°?
245.	338/1317	7	KHM		0.54g		15/17	180°
246.	338/1317	7	BM		0.55g		17/18	90°
247.	338/1317	7	KMM		0.62g		16.5/17	270°
248.	339?/1325	7	KHM		0.72g		16/17	270°
249.	339*/1325	7	BM		0.58g		16/17	180°
250.	___/1325	7	VM	Archbishop's Palace	0.45g		16.5	180°
251.	340*/1317	7	KHM		0.66g		16/17	90°?
252.	340?/1319	7	KMM		0.60g		17	300°
253.	341*/1321	7	KHM		0.49g		15/17	140°
254.	341/1314	7	VM	Dønnes church	0.59g		16/17	
255.	342/1314	7	BM		0.69g		17/18	90°
256.			KHM		0.47g		16/16.5	200°?
257.			KHM		0.79g		15/17	0°?
258.			KHM		0.70g		16	
259.			KHM	Ringebu church	0.51g		16.5	
260.			KHM	Hemsedal church	0,64g		16.5/17	0°
261.			KHM	Ål church (4 pieces)	(0.39g)			180°?
262.			KHM	Berg church	0.78g		16/17	90°
263.			BM		0.51g		16/17	180°
264.			BM		(0.31g)		10/17	
265.			KMM	Fårevejle churchyard	0.71g		16/16.5	140°
266.			KMM	Gundsømagle church	(0.68g)		15.5/17	240°
267.			KMM	Thekildemarken Lindholms gods	0.67g		16/17	150°
268.			KMM	Tjæreby church	(0.55g)		15/17	40°?
269.			KMM	Årup chapel	0.65g		17	270°
270.			KMM		0.58g		15/17mm	330°
271.			KMM		0.50g		17/17,5	90°?
272.			KMK		(0.53g)		15/17	300°

Three obverse dies are not represented in this study: Nos. 315, 324 and 333, but corresponds with the following coins of Schou: 315: Schou 203 – Hauberg collection?
324: Schou 211 – BM?
333: Schou 212 – Guildal collection

Two reverse dies dies are not represented in this study: Nos. 1312 and 1323, but corresponds with the following coins of Schou: 1312: Schou 196 – collection unknown
1323: Schou 197 – collection unknown

Hvid, type V
Obv: Crowned monogram ᚺ *Rev: Norwegian coat of arms over long cross*
(Additional symbol: ○)

Obv. 343: Crowned monogram **h**. Open crown.
Between two circles of pearls: ᛁᚿᚪᚾᛋ ᛞ᛫ᚷ᛫ᚱ᛫ ᚿᛟᚱᚹᛞᛁ᛫᛫

Obv. 344: Crowned monogram ᚺ. Open crown. On each side of monogram: ○
Between two circles of pearls: Legend identical to 343

Obv. 345: Crowned monogram ᚿ. Closed crown. (ᚿ = ᚺ)
Between two circles of pearls: ᛊᚪᚿᛏᚢᛊ ᛫᛫ ᛟᛚᚪᚢᚢ᛫ ᛫᛫ ᛫

Rev. 1202: Norwegian coat of arms over long cross
Between two circles of pearls: ᛊᚪᚿᛞ ᛏ᛫ᛟᚿ ᚪᚹᛊ ᚱᛞᚷ᛬

Rev. 1203: Norwegian coat of arms over long cross
Between two circles of pearls: ᚺᛟᚿ ᛫ᛏᚪ ᚿᛟᚱ ᚹ᛫ᛁ

No.	Obv/Rev	Chain	Collection	Find location	Weight	Fineness	Diameter	Axis
273.	343*/1202*	8	VM	Dønnes church	0.51g	28.8%	17/18	30°
274.	344*/1202	8	KMM		0.62g		17.5/18	150°
275.	344/1202	8	KMM		0.71g		17.5	0°
276.	345*/1203*	9	VM	Alstahaug church	0.78g		17	270°
277.	345/1203	9	KMM		0.60g		16/17	120°

Hvid, type VI
Obv: Crowned monogram Ʞ *Rev: Axe in shield over long cross*

Obv. 317: (Cf: Hvid, type IV)

Rev. 1401: Axe in shield over long cross
Between two circles of pearls: Legend identical to 1203 (cf: Hvid, type V)

No.	Obv/Rev	Chain	Collection	Find location	Weight	Fineness	Diameter	Axis
278.	317/1401	7	KMM		0.72g		16	200°
279.	317/1401	7	KMM	Jyderup church	0.70g		16/17.5	200°

Hvid, type VII
Obv: Crowned monogram ᛜ *Rev: Axe in shield over long cross*

Obv. 401: Crowned monogram ᛜ. closed crown.
Between two circles of pearls: ᛋᚪᚿᛏᚢᛋ ᛫᛬᛫ ᛜᛚᚪᚢᚢᛋ ᛫᛬᛫
Variation: ᛋ᛫᛬᛫ ᛋ

Obv. 402: Crowned monogram ᛜ. closed crown.
Between two circles of pearls: Legend similar to 401
Variation: ᛋ᛫᛬᛫ᛋ

Obv. 403: Crowned monogram ᛜ. closed crown.
Between two circles of pearls: Legend similar to 401
Variation: ᛋ ᛫᛬᛫ᛋ

Rev. 1401: (Cf: Hvid, type V)

Rev. 1402: Axe in shield over long cross
Between two circles of pearls: Legend identical to 1401

No.	Obv/Rev	Chain	Collection	Find location	Weight	Fineness	Diameter	Axis
280.	401/1401	7	KHM		0.60g	26.0%	16/17	90°
281.	401/1401	7	KHM		0.59g		16/17	140°
282.	401/1401	7	KHM		0.37g		15/16	300°
283.	401/1401	7	KHM	Ringebu church				180°
284.	401/1401	7	BM		0.62g		16/17	90°
285.	401*/1401*	7	KMM		0.78g		16.5	60°
286.	401/1401	7	KMM	Dalby churchyard	0.64g		16.5	210°
287.	401/1401	7	KMM	Vorgod church	0.44g		15/16.5	60°
288.	401/1401	7	KMM	Øm monastery	0.42g		15.5/16	160°
289.	401/1402	7	KMM		0.77g		15.5	90°
290.	402/1401	7	KHM		(0.58g)		14/16	0°
291.	402*/1401	7	KHM		0.52g	26.9%		340°
292.	402/1401	7	StS	Klara churchyard	0.48g			
293.	402/1401	7	MB		0.92g			90°
294.	402*/1402*	7	KHM		0.67g		17	0°
295.	402/1402	7	KHM		0.52g		16.5/17	30°
296.	403*/1401	7	KHM		0.63g		16	50°
297.	403/1401	7	KMK		0.60g		16/16.5	60°

Archbishop Gaute Ivarsson (alone)

Hvid
Obv: ᚿ *Rev: Norwegian coat of arms over long cross*

Obv. 501: ᚿ
Between two circles of pearls: ᚺᛟᚿ᛫ᚪᚱ᛫ᛈᛁ᛫ᚿᛁᚦᚱᛟᛊᛁ᛫

Obv. 502: ᚿ
Between two circles of pearls: ᚺᛟᚿ᛫ᚪᚱ᛫ᛈᛁ᛫ᚿᛁᚦᚱᛟᛊ᛫

Obv. 503: ᚿ
Between two circles of pearls: ᚺᛟ᛫ᚪᚱ᛫ᛈᛁ᛫ᚿᛁᚦᚱᛟᛊᛁ

Obv. 504: ᚿ
Between two circles of pearls: ᚺᛟ᛫ᚪᚱ᛫ᛈᛁ᛫ᚿᛁᚦᚱᛟᛊ᛫

Obv. 505: ᚿ
Between two circles of pearls: ᚺᛟ᛫ᚪᚱ᛫ᛈᛁ᛫ᚿᛁᚦᚱᛟᛊ᛫

Obv. 506: ᚿ
Between two circles of pearls: ᚺᛟ᛫ᚪᚱ᛫ᛈᛁ᛫ᚿᛁᚦᚱᛟᛊᛁ᛫ᚿ᛫

Obv. 507: ᚿ
Between two circles of pearls: ᛗᛟ᛫ᚪᚱ᛫ᛈᛁ᛫ᚿᛁᚦᚱᛟ᛫

Obv. 508: ᚿ
Between two circles of pearls: ᛗᛟ᛫ᚪᚱᚪᛁᚪᛁ᛫ᚢᛁᚦ᛫

Obv. 509: ᚿ
Between two circles of pearls: ᚺᛟᚿ᛫ᚪᚱ᛫ᛈᛁ᛫ᚿᛁᚦᚱᛟᛊ᛫

Obv. 510: ᚿ
Between two circles of pearls: ᛗᛟᚿ᛫ᚪᚱ᛫ᛈᛁ᛫ᚿᛁᚦᚱᛟᛊ

Obv. 511: ᚿ
Between two circles of pearls: ᚺᛟᚿ᛫ᚪᚱ᛫ᛈᛁ᛫ᚿᛁᚦᚱᛟᛊᛁ᛫᛫

Obv. 512: ᚿ
Between two circles of pearls: ᛗᛟ᛫ᚪᚱ᛫ᛈᛁ᛫ᚿᛁᚦᚱᛟᛊᛁ᛫

Obv. 513: ᚿ
Between two circles of pearls: ᚺᛟᚿ᛫ᛋᚿᛟᚡᚪ᛫ᚿᛁᚦᚱᛟᛊ᛫

Obv. 514: ᚿ
Between two circles of pearls: ᛗᛟᚿᚿᛟᚡᛦ★ᚿᛁᛞᚱᛟᛊ

Rev. 1204: Norwegian coat of arms over long cross
Between two circles of pearls: ᛊᛦᚿ ᛟᛚᛦ ᚹᛊ◦ ᚱ᛫ᚷ

Rev. 1205: Norwegian coat of arms over long cross
Between two circles of pearls: ᛊᛦᚿ ᛟᛚᛦ ᚹᛊ ᚱ᛫ᚷ

Rev. 1206: Norwegian coat of arms over long cross
Between two circles of pearls: ᛊᛦᛏ ᛟᛚᛦ ᚹᛊ ᚱ᛫ᚷ

Rev. 1207: Norwegian coat of arms over long cross
Between two circles of pearls: ᛊᛦᛏ ᛟᛚᛦ ᚹᛊ◦ ᚱ᛫ᚷ

Rev. 1208: Norwegian coat of arms over long cross
Between two circles of pearls: ᛊᛦᚿ ᛟᛚᛦ◦ ᚹᛊ᛭ ᚱ᛫ᚷ

Rev. 1209: Norwegian coat of arms over long cross
Between two circles of pearls: ᛊᛦᚿ ᛏ᛭ᛟ ᛚᛦᚡ ᛊ◦ᚱ᛫᛭

Rev. 1210: Norwegian coat of arms over long cross
Between two circles of pearls: ᛊᛦᚿ ᚳᛏ◦ᛟ ᛚᛦᚹ ᛊ◦ᚱ᛫

Rev. 1211: Norwegian coat of arms over long cross
Between two circles of pearls: ᛊᛦᛟ᛭ ᛟᛚᛦ ᚹᛊ ᚱ᛫ᚷ

No.	Obv/Rev	Chain	Collection	Find location	Weight	Fineness	Diameter	Axis
298.	501/1204	10	KMM		0.74g		16.5/17	40°
299.	501/1205	10	KHM		0.56g		16.5/18	0°
300.	501*/1205	10	KMM	Vroue church	0.63g		16.5	220°
301.	502/1205	10	KHM	Uvdal church	0.57g			180°
302.	502/1205	10	BM		0.53g			270°
303.	502*/1205	10	KMM		0.74g		16	270°
304.	503*/1205*	10	KMM		0.53g		15/17	90°
305.	504*/1204*	10	VM	Dønnes church	0.53g		16/17	90°
306.	504/1205	10	BM		0.55g			90°
307.	504/1205	10	VM	Dønnes church	0.63g		18	210°
308.	505/1207	11	KMK		0.70g		16.5/17	250°
309.	505*/1207	11	KHM		0.70g		12	30°
310.	505/1206	11	BM?		0.69g			180°
311.	505/1206*	11	KMM		0.75g		16.5/17	40°
312.	505/1207	11	KMM		0.36g		16.5/17	340°
313.	506*/1208	10	KMM		0.58g		17/18	330°
314.	507*/1209*	12	BM	Hoprekstad church	0.58g		16.5/17.5	210°
315.	508*/1210*	13	VM	Dønnes church	0.69g		18.5	210°
316.	509*/1205	10	KHM		0.83g			300°

No.	Obv/Rev	Chain	Collection	Find location	Weight	Finness	Diameter	Axis
317.	510*/1204	10	KHM?		0.60g	30.3%	16/17	210°
318.	510/1208*	10	KMM		0.78g		16/16.5	50°
319.	510/1208	10	KMK		0.72g		17/18	0°
320.	512*/1210	13	KMK		0.69g		17	270°
321.	___/1210	13	VM	Archbishop's Palace				
322.	513*/1211*	14	KMM		0.80g		15/16	90°
323.			KMM	Hovgårds eng, Anisse	0.62g		16/17	110°

The Schive types XIV 35 og XIV 36 have proved impossible to identify among the coins included in this survey. According to description the NMH II, no. 303 corresponds to the Schive types. However the description and the depiction of the NMH catalogue do not correspond; the depiction being identical to the present study's no. 317.

Penning, type I
Axe in radiant circle

Obv. 5101: Axe in radiant circle

Obv. 5102: Axe in radiant circle. Axe smaller, radiant circle broader than 5051

No.	Obv	Collection	Find location	Weight	Fineness	Diameter
324.	5101	KHM				14
325.	5101	KHM	Hvaler church	0.28g	17.4%	12.5
326.	5101*	KHM	Lom church	0.23g		13.5
327.	5101	KHM	Lom church	0.16g		12/12.5
328.	5101	KHM	Lom church	0.17g		12.5
329.	5101	KHM	Lom church	0.16g		12.5
330.	5101	KHM	Ringebu church	(0,05g)		
331.	5101	KHM	Ringebu church	(0.15g)		11.5/12.5
332.	5101	KHM	Ringebu church	0.16g		12.5/13
333.	5101	KHM	Ål church	0.17g		11/12
334.	5101	KHM	Ål church	(0.09g)		11/11.5
335.	5101	KHM	Ål church	0.14g		11.5/13.5
336.	5101	AMS?	Sandeid church	0.22g		13
337.	5101	BM?	Røldal church	0.17g		13.5
338.	5101	BM?	Jordanger church	(0.17g)		12.5
339.	5101	VM	Tingvoll church	0.21g		12.5/13
340.	5101	VM	Alstahaug church	0.27g		13
341.	5101	VM	Dønnes church	0.26g	20.3%	12.5/13
342.	5101	KMK		(0.12g)		8/13
343.	5102	KHM		0.23g		13/13.5
344.	5102	KHM	Ål church	(0.12g)		
345.	5102	KHM	Uvdal church	0.28g		12.5/13.5
346.	5102*	BM?	Jordanger church	0.20g		13.5

Penning, type II
Axe in shield in radiant circle

Obv. 5201: Axe in shield in radiant circle

No.	Obv	Collection	Find location	Weight	Fineness	Diameter
347.	5201	KHM		0.19g		12.5mm
348.	5201	KHM		0.21g		13.5/14mm
349.	5201	KHM		(0.11g)		12.5mm
350.	5201	KHM		0.16g		13/14mm
351.	5201*	KHM		0.17g	18.0%	12.5/13.5mm
352.	5201	KHM		0.13g		12/13mm
353.	5201	KHM	Lom church	(0.20g)		12.5mm
354.	5201	KHM	Lom church	0.18g		13/14mm
355.	5201	KHM	Reinli church	0.16g		13/13.5mm
356.	5201	KHM	Hemsedal church	0.21g		12.5/13mm
357.	5201	KHM	Uvdal church	0.18g		12/14.5mm
358.	5201	KHM	Vike church	(0.11g)		13/14mm
359.	5201	BM?	Kinsarvik church	0.10g		12/12.5mm
360.	5201	BM	Kaupanger church	0.19g		13/14mm
361.	5201	VM	Mære church	0.20g		12.5/13.5mm
362.	5201	VM	Alstahaug church	(0.09g)		
363.	5201	KMM		0.17g		13mm
364.	5201	KMK		0.16g		

Penning, type III
Crossed axe and crozier in shield in radiant circle

Obv. 5301: Crossed axe and crozier in radiant circle

No.	Obv	Collection	Find location	Weight	Fineness	Diameter
365.	5301*	KHM		0.28g		12/14mm
366.	5301	KHM		0.28g		13/14mm
367.	5301	KHM		0.25g		13mm
368.	5301	KHM	Eidskog church	(0.10g)		
369.	5301	KHM	Grindaker church	(0.29g)		12.5/14mm
370.	5301	KHM	Grindaker church	0.27g	17.8%	14mm
371.	5301	KHM	Høre church	0.33g		13/13.5mm
372.	5301	KHM	Høre church	0.25g		13/14.5mm
373.	5301	KHM	Lom church	0.22g		13/14mm
374.	5301	KHM	Lom church	0.30g		13/14mm
375.	5301	KHM	Lom church	(0.24g)		12/14mm
376.	5301	KHM	Ringebu church	(0.11g)		
377.	5301	KHM	Ringebu church	0.21g		13/14mm
378.	5301	KHM	Ringebu church	0.30g		13/14mm
379.	5301	KHM	Ringebu church	0.26g		12.5/14mm
380.	5301	KHM	Ringebu church	(0.09g)		7/10.5mm
381.	5301	KHM	Uvdal church	0.31g		13/14mm
382.	5301	KHM	Stange church	0.31g		13.5/15mm
383.	5301	BM?	Kinsarvik church	0.30g		13/13.5mm
384.	5301	BM?	Urnes church	0.19g		13/14mm
385.	5301	VM	Værnes church	(0.23g)		12/14mm
386.	5301	VM	Alstahaug church	0.27g		12/14.5mm
387.	5301	VM	Alstahaug church	0.25g		13/14.5mm
388.	5301	VM	Dønnes church	0.21g		14mm
389.	5301	VM	Dønnes church	0.23g		12.5/15mm

Penning, type IV
Two crossed axes and crozier in radiant circle

Obv. 5401: Two crossed axes and crozier in radiant circle

No.	Obv	Collection	Find location	Weight	Fineness	Diameter
390.	5401	KHM		0.19g	20.2%	14.5mm
391.	5401	KHM	Lom church			14.5/15mm
392.	5401*	KHM	Lom church	0.15g		12.5/13.5mm
393.	5401	BM		0.17g		13/15mm
394.	5401	VM	Værnes church	0.15g		15mm
395.	5401	KL	Törnsfalls church	0.14g		13.5mm

12 APPENDIX 5 PLATES

Obverses plate I

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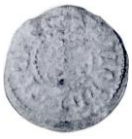

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Obverses plate II

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Obverses plate III

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Reverses plate I

1202

1203

1204

1205

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1319

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1325

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1401

1402

Pennings plate I

5101

5102

5201

5301

5401

NOTES

Chapter 1

[i] Although several known production locations exist (Kŭtna Hora in the Czech Republic, Sigtuna in Sweden, Porto in Portugal); none of these sites, however, contain original reminiscences of actual coin production.

[ii] For a more extensive description of the excavation sequence during the time span that is of interest in this connection, the referred buildings in particular and a discussion of their function, see Nordeide 2003:171-.

[iii] The history of the archbishopric of Nidaros spans over a period of almost four centuries, from its establishment in 1151-54 to the Reformation in Norway in 1537, and both its political influence and the territorial extent of the archdiocese varied throughout this period.

The obedience of two British bishoprics, Sudor (the Hebrides and the Isle of Man) and the Orkney Islands (including Shetland), was for instance transferred to the newly established archbishopric of St. Andrews in Scotland in 1472. The see of the Færoes, on the other hand, is first mentioned in a precision of the archdiocese of Nidaros in 1202 (Nordeide, 2002:95-96), and the bishoprics of Island and (especially) Greenland were increasingly left to themselves during the late Middle Ages. It is worth noting that the see of the Orkneys was transferred to St. Andrews before the office of Gaute Ivarsson commenced. The protest of this transfer addressed to Pope Alexander 6 in AD 1500 was not acknowledged.

Neither was the level of political influence of the see uniform throughout the period. The literature usually recons three separate periods of greatness, before the turmoil brought about by the Black Death; the first from the establishing of the archbishopric until ca AD 1220; the second marked by the 1277 *Settargjerd* (securing the see wide privileges); and a third from 1320-50, with a consolidation of the ecclesiastical organisation.

The political influence of the archbishopric in its late period is more complex, since the loss of control over the bishoprics at the borders of the church province is compensated by the archbishopric's steady growing influence over Norwegian politics, especially in the last century before 1537.

However, even taking into account these variations of degree and nature of the authority exercised, both on a political and more purely ecclesiastical level, the picture remains of the Archbishop of Nidaros as a dominant factor within the area corresponding more or less to the borders of Norway in the late Middle Ages. It is also noteworthy to remark that the fall of the Nidaros Province in 1537 also put an

end to the existence of Norway as an autonomous (if not fully independent) kingdom within the union with Denmark.

For a slightly more extensive discussion of the history of the Nidaros Province, see Imsen, 2003. For an extensive and detailed account, see Hamre, 1955**.**

[iv] Phasing stratigraphy: The dating of the materials found during the excavations was structured into 12 different periods, which were in turn subdivided into different phases, on the basis of the sequence of successive buildings and site-wide complexes that occupied the excavation area (Saunders, 2000:33). According to the phasing stratigraphy utilised in the excavations, the excavated material came exclusively from the four phases of Period 6 and the first phase of period 7. Period 6 dates from AD 1500 to 1532, and is subdivided into four phases. Period 7, phase 1 refers to the period from AD 1532 to 1537.

[v] According to the article consecrated to Gaute Ivarsson in *Norsk biografisk leksikon*, the opinion commonly accepted that Gaute Ivarsson is said to have been born at Aspa in Frei (Nordmøre), as son of Ivar Trondsson and thereby nephew of the precursor in the chair as archbishop in Nidaros can at present day be refused. There exists a family tree for the Aspa clan, a family of low noblesse, where both Olav and Ivar Trondssons are listed, the last accompanied with eight children. It seems improbable that such a prominent member of the clan as Gaute Ivarsson should have been left out of this list, and speculations have connected him to the Teiste clan, a family of equal social standing, but no evidence seems to confirm such suppositions.

[vi] The royal privilege of 1222 keeps a tight rein on the production capacity. The workforce concerned with coin production is limited to one master craftsman and one assistant. The limitations to the workforce implies limitations to the production capacity, and thus to the need for production facilities, cf. Risvaag, 2006:237, and Nordeide and Skaare, 1992:23

[vii] Following the phasing stratigraphy terminology, at the start of period 6, Phase 3

Chapter 2

[viii] The pennings that are referred to in the following pages are so-called *bracteates*. These coins are thin flans with imprint only on one of the sides, weighing between 0.06-0.12 gram and were the most commonly used coin in Norway in the 12th and 13th centuries.

[ix] All translations in Chapter 2: Jon Anders Risvaag.

[x] Ver uilium ollum monnum kunnist gera at sialfum oss till salobotar. ok riki varo. oc þegnum till gangs. oc till gifto þessa heims oc annars. hofuum ver iattat af vare hende oc þeira. er loglega verda till lanzenz kosnir æftir oss. stad hins helga Olafs konongs oc Gutthormi ærkibiskupi oc ollum er gudlega verda kosnir æftir han til ærkibiskups namfs oc vinir vilia vera konongdomsens æftir guds loghum oc manna at hafua sylfr slatto man þan sem þar kunni godan hatt a oc þionosto man med honom. huart sem ærkibiskupi syniz ser haglegra at þeir se med myntara varom oc þionosto sueinum. eda i garde sialfs sins. at sla till þyrfta stadar hins helga Olafs konongs slykt sylfer at skyrleika oc stinleika sem var vili verdr till. eda annara kononga at gange i Nidarose. hafuum ver iattat þetta firer þui at ver ætlom at her man gudi arfuusa a uera oc gagn megi af standa stad hins helga Olafs konongs. oc enguhm godom manne till vanhags. þykkiumz ver oc vist vitha at sylfer slatta su. sem ver vilium at gange i landeno varo stande þui heldr med æinord oc godum hætte er slikir guds uinir bindaz heldr vid i radom med oss (NgL I: 446).

(We proclaim for all men, for Our penitence, for the benefit and delight to Our realm and Our men, at home and elsewhere, that We, on Our own behalf and on behalf of the legally, for the government of the Realm, elected King after Us, have admitted to the Holy King Olav's bishopric and Archbishop Guttorm and all that are godly elected archbishops after him, and who will be the friend of the Kingdom, in accordance to God's and man's Law, that he shall have a moneyer, well-informed of this workmanship, and a servant with him; whether the Archbishop find it most convenient to have them with Our moneyer and servants, or at his own court, to strike, for the requirement of the Holy King Olav's bishopric, silver of such fineness and weight as We or other kings decide to circulate in Nidaros. We have admitted this because We believe to have pleased God and that it might be for the benefit of the Holy King Olav's bishopric, and inconvenience to no good man. We consider Us convinced that the coined silver We wish to circulate in Our land are better maintained and more stable when such friends of God unite with Us in this matter.)

[xi] Item concessit quod liceat domino archiepiscopo habere unum hominem in curia sua qui cudat denarios prout litera sua super hoc confecta attestabatur [footnote 12: attestatur] NgL II:460.

(Likewise the King conceded that the Lord Archbishop should be allowed one man in his service to strike coins, as it is attested in his letter, which is drawn up on this)

[xii] Item concessit quod liceat domino archiepiscopo habere unum hominem qui cudat denarios prout litera sua super hoc confecta testatur (NgL II:467–468).

(Likewise the King conceded that the Lord Archbishop should be allowed one man to strike coins, as it is attested in his letter, which is drawn up on this)

[xiii] Letters T and N refer to the inventory lists of Vitenskapsmuseet. The letter N solely refers to finds from medieval Trondheim.

[xiv] For the estimation of the bracteates place within the system of value, see Skaare 1995:62.

[xv] [...] och fframbaare Settergers breff som kallis Compositio emelle kircken och kronen och kierde sigh wdj mange maade att were ey holden, effter samme Settergerdtz lydelse men wore embitzmend giøre der altijdt emod som wore forfadre wdgiffuit hagde Bisperne och kirckerne y Norrigh Sameledis klagede the oppaa att thennom giøris hinder paa de sager som kirckens Prelater och dommere bør att dømme och ingen kongens rett y faller som er y hordome, skyldskaff, meeneeder, y ffrille leiffnit, ffadderskaff, eller kirckens eyedom met mange flere article som er y samme Compsitione huilkit wij ingeledis lijde wille her eptter meden wij, stadfesthe Bisperne Prelaterne, then hellig Kirckes alle priuilegia och ffrijheder som wore fforffædre dennom wnt och giffuit haffue och end nu medt thette wort obne breff stadfeste den dagtingen och sattmaal før war giort emelle kircken och kronen y Norrigh som kallis Settergerdt, huilken holdis skall til ewightijdt offuer alt wor rijghe Norrigh [...] (DN XIII, nr. 126; NgL 2. R. 1. halvb., s. 141–144).

([…] and professed the Letter of the Settergerd called Compositio between the Church and the Crown and claimed themselves in many ways not to be observed, according to wording of the same Settergerd. However Our officials always do in accordance to what Our forefathers have granted. The bishops and the churches and Norway together complained of hindrance made of those cases which the Church' prelates and judges ought to pass sentence, and falls to no Royal court; which are: adultery, kinship, perjury and fornication, paternity or the property of the Church and many more paragraphs being in the same Compsitione, which We by no means will accept henceforth while We confirm all the bishops', the prelates', the holy Church' privileges and liberties that Our forefathers have allowed and given them and now by this Our open letter confirmed the negotiation and agreement previously done between the Church and Crown in Norway, called Settergerdt, which shall be observed eternally all over Our realm Norway […])

[xvi] NgL 2.R. II, 1. halvb: 297–298; ST III: 363–364.

[xvii] Item haffuer ock Norges radh tijd ock offtha waret begäre[n]de myntar i landet ock wart them tijd ock offtha lofuet ock aldri til thenne tijd framkommet (NgL 2.R. II, 1. halvb., s. 301; ST III, 366).

(Likewise the Norwegian Counsel has many a time and oft been desiring coins in the country and many a time and oft it has been promised and has never to this time occurred.)

[xviii] Bethe wij ock ether kerlig, at J wele skicke oss en eller two gode myntare, ther ligger oss stor macth vppa (NgL 2.R. II, 1. halvb., s. 300; ST III, 364).

(We kindly ask of you that you will send us one or two good moneyers, which is very important to us.)

[xix] Item wele wii oc tillade effther mene raadz raad i Norge at myntes skall oc penninge slaes i Trondhiem effther Nidross domkyrkes preuilegier oc thesliges i Bergen oc Oslo effther rigens leylighet i alle thesse tre stæder jaffngod mynt wid Danske penninge (NgL 2.R. III nr. 1).

(Likewise, after the advice of Our Counsel, We will permit that there shall be coinage in Norway and coins are to be struck after the privileges of the Nidaros Cathedral, and likewise in Bergen and Oslo according to the condition of the Realm; in all these three cities par to Danish money.)

[xx] *Arn i Myntergard i Aaslo loffuet lx lod sylff fore han bygde et skyb met vdlendske penninge.* (DN XIII, 163)

(Arn in the Moneyers house (Mint) in Oslo was liable for 60 lod silver because he built a ship with foreign money)

[xxi] Most coin types of Hans and Gaute are previously published by C. I. Schive and H. H. Schou (Schive 1865, Schou 1926). Some interpretations in this paper differ from previous interpretations by Schou and Schive. Some coins/dies noted in Schou have not been available for this study and are referred to with Schou's die number and the coins collection provenance.

Chapter 3

[xxii] The 90 other specimens from the time of Gaute Ivarsson clearly identifiable to the Bergen mint have previously been described in Risvaag, 2006:368, 373–379.

[xxiii] The higher number of obverse than reverse dies indicates that in the case of the Trondheim mint the reverse die was attached to the workbench. In what concerns the Bergen hvids there has been identified 12 obverse and 15 reverse dies (Risvaag 2006:374–378), possibly indicating the obverse die being the fixed one. This leads to the question of the definition of obverse and reverse dies. Commonly one would refer to the side of the coin where the King's name, insignia or image appears as the obverse.

In Schive there is a change of classification for the types bearing the Norwegian coat of arms over long cross on one side. Schive chooses whichever side bearing the St Olav legend as obverse, making some of the coat of arms sides reverse, but the

majority obverse (Schive XIV 33–36, XVII 24–27). The same principle was followed by Schou for the Trondheim specimens. For the Bergen specimens Schou defines the side bearing the crowned monogram **h** and the Kings name as obverse and the coat of arms side as reverse (Schou 1926, n^{o}s 170, 222–225, all of the Gaute Ivarsson specimens).

Skaare, on his side, defines all sides bearing crowned monogram **h** and **O** as obverse, but chooses the coat of arms side as obverse for all other coins (NMH II, n^{o}s. 294-304 and 329). Rasmusson simply notes that sometimes the obverse and reverse have changed places (Rasmusson, 1943:283). In this work all sides bearing the Norwegian lion, Norwegian coat of arms or St Olav's axe have been defined as reverses, the reason being, as we will see in the following (table 3.1), that the development of the Trondheim coinage is closely corresponding in its iconography with the development of the royal coinage of Bergen.

Assuming that for the Trondheim coinage the reverse sides bearing the Norwegian national symbols seems to have been preferred as the ones attached to the workbench, raises one additional question. One might for the sake of the argument propose that the archbishop deliberately ranked the side of the coin with the Norwegian Lion, coat of arms and subsequently the St Olav's axe as more prominent than the side bearing the King's name and crowned monogram. This might be a subtle display of nationalism, independence or even superiority on the archbishop's behalf. However, what purpose would it serve, and who would notice such a display? At best it might have served for the Archbishop's internal gratification. It is hard to see that this would have any significance for anyone outside an inner circle. A more powerful display of the Gaute's position is rather to be found in the more predominant references to St Olav and eventually the Archbishop on the coins themselves.

Chapter 5

[xxiv] According to Saunders (2001:27), the assembly of objects connected to mint production consists of 62 % thick-walled crucibles (1018 sherds); 28 % thin-walled crucibles (459 sherds); and 10 % bone-ash cupels (174 fragments).

[xxv] For a more thorough typology of the different types of crucibles found, see Saunders (2001:27–28).