Travel Technology & Organisation in Medieval Europe

Papers of the 'Medieval Europe Brugge 1997' Conference
Volume 8

edited by
Guy De Boe & Frans Verhaeghe

I.A.P. Rapporten 8

Zellik
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Prof. Dr. Guy De Boe

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Doornveld
Industrie Asse 3 nr. 11, Bus 30
B -1731 Zellik - Asse
Tel: (02) 463.13.33 (+ 32 2 463 13 33)
Fax: (02) 463.19.51 (+ 32 2 463 19 51)

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was organized by
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wurde veranstaltet von

Karel Vlierman
Hubert De Witte

Preface

The medieval world is often perceived as a fairly closed and static society where traffic and travelling was fairly limited apart from such exceptions as the Scandinavian regions in the Viking Age and the growing international trading systems which characterize the development of the economic world particularly from the 12th century onwards. From the late Middle Ages onwards, the European world expanded aggressively both outwardly and inwardly and travelling, traffic and travelling technology and organization became increasingly complex and sophisticated.

To some extent, this picture is still valid but over the past few decades, the growing interest in travelling infrastructure and notably the rapid development of nautical archaeology has demonstrated that things may well have been more complex and diversified than has been thought hitherto. Furthermore, the continuing work on historical, archaeological and iconographical evidence has shown that after the significant technical losses and a degree of regression of mobility which occurred in parts of Europe with the collapse of the Roman Empire, the medieval period introduced quite a number of innovations. Most of these constituted essential preconditions for the further development of trade and exchange, the development of all kinds of infrastructural changes related to transport and the emergence of the complex late medieval and early modern exchange systems and expansion.

Among these innovations and/or improvements, some apparently humble ones which at first sight seem related first and foremost to comfort but had far-reaching consequences. The use of anatomically and technically more appropriate harnesses and traction systems, the stirrup, the horseshoe and others are but a few of the main examples. The same is of course also true in the case of transport over water, ships, and shipping.

The discovery and study of many ship remains particularly for the period from the 8th to 9th century onwards but also of wrecks dating from Early Modern times illustrate the point. The technological developments they reflect and which can often be identified and documented only through archaeological evidence deserve attention not only because of their significance for trade and exchange but also because they reveal new insights related to geography and certain natural laws in order to be able to sail close to the wind and to improve the operational management of speed and safety.

In addition to the actual means of transport, there is much more to be taken into account, notable where travelling infrastructure is concerned. Waterways were of course of paramount importance in the Middle Ages and Early Modern period as shown by the location of many if not most urban settlements but even more by the often complex harbour infrastructures and the significant investments that went with them. This too has been the subject of extensive archaeological documentation over the past decades. Several international conferences related to what has been called 'waterfront archaeology' illustrate the point. Related structures such as dams, quays, shored river-banks, piers, sluices and others cannot be neglected in this respect. The same goes for roads and related structures such as bridges, etc., not to forget the many buildings such as inns and others. Finally, we should not forget the many aspects of daily life when travelling and the material culture available when on the road or aboard a ship. Ship's inventories are of great importance in this respect, not in the least because of their nature of 'time capsules', offering valuable associations between objects and chronological information which is not always to come by in other circumstances.

All this indicates that travel technology and organization rightfully belong to the spheres of interest of medieval and later archaeology, not only because of the many – and occasionally fairly sensational – finds but also because of the facts that archaeology can offer

new insights as to the nature and broader meanings of many changes and developments. In addition, any approach of medieval and early modern societies has to take into account the development of travel technology and organization because these were interactive with the ways these societies and even their physical setting changed.

Therefore – and following the example set by the MEDIEVAL EUROPE 1992 conference in York – the organizers of the MEDIEVAL EUROPE BRUGGE 1997 (1st through 4th October 1997) deemed it necessary to pay attention to the subject. A special section under the heading TRAVEL TECHNOLOGY AND ORGANIZATION – TRANSPORTS ET VOYAGES – VERKEHRSTECHNOLOGIE UND REISEN – VERKEERSTECHNOLOGIE EN REIZEN was organized by Karel Vlierman (NL, Netherlands Institute for Ship- and Underwater Archaeology & R.O.B. (NISA), Dronten) and Hubert De Witte (B, Municipal Service for Archaeology of Brugge).

The present volume offers a number of pre-printed papers presented within the framework of this section. Unfortunately, a number of texts were not submitted in time to allow their inclusion in the volume and a number of speakers could not attend the conference. This explains why the general structure of the volume does not correspond in all details to the structure of the above-mentioned section of the Brugge conference. In addition, as luck would have it, only contributions related to ships, shipping, waterways and harbours were sent in time, which means that other topics such as transport over land and related technologies, equipment and structures are absent from the present volume. The papers have been grouped under four headings:

- *Ships, shipping and transport*
- *Ships: ship-construction, analysis and provenancing*
- *Ships's inventories*
- *Harbours*

The volume of course does not do justice to the many excavations and the wealth of other types of research work where travel technology and organization constitute basic issues or are of direct or indirect importance. Nor does it provide a complete overview of the results attained and knowledge acquired. Nevertheless, the 14 papers included in the present volume provide a good idea of the potential of at least part of this particular field of research, emphasizing at the same time the complexity of the subject. They also indicate that in many ways, the archaeological study of this subject cannot and should not be divorced from the many other aspects of the medieval and early modern worlds. This is one of the basic philosophies of the York 1992 and Brugge 1997 international conferences on medieval and later archaeology and the many links with papers presented in other sections and in other volumes of pre-printed papers emphasize the point. The sections and volumes related to urbanism (section 01), trade and exchange (section 03), material culture (section 07) and others sufficiently illustrate the point.

Frans Verhaeghe & Guy De Boe

Matthew Harpster

Possible Results of the Muslim Invasion on Merchant Shipping and Shipbuilding Techniques in the Mediterranean

> "*...commerce should be reserved for humble people...God had made him an emperor, not a naukleros.*"
> The Emperor Theophilus, 9th century AD.
>
> "*I prefer dying on my camel's saddle, while traveling on business, to being killed in the Holy War...*"
> The caliph 'Umar, 7th century AD.

The Byzantine empire, from its inception in the early 4th century to its final downfall in the 15th, remained a center for trade and industry in the eastern Mediterranean for approximately ten of those eleven centuries of its life. Spices, perfumes, jewels, and cotton arrived from India and Arabia, furs and slaves were exported from the Khazars and the Black Sea area (Lewis 1988, 57), and gold from the mines in Egypt and Nubia was imported for the production of Imperial bezants (Lopez 1978, 227). Constantinople was producing, and occasionally exporting, the finest silks, jewelry, mosaics, and wools, and predictably, seagoing mercantile trade practiced by the *naukleroi* was fairly active between Constantinople and its borders. But the Empire, as a result of years of unsuccessful attacks and sieges by the Goths, the Avars, and the Persians, had developed a defensive and closed foreign policy that reflected what it believed to be religious sanctity (Lewis 1988, 56).

As the Empire continued to flourish, this defensive foreign policy progressed to keep mercantile or religious contact with outside cultures to a minimum. So while the self sufficient Empire may have been producing luxurious goods, the *naukleroi* were unable to carry and trade it outside the Empire's borders (Lewis, 1988:58). In an effort to maintain its sanctity, the Byzantine empire developed very conservative attitudes to minimize risk, but as a result, merchant shipping and shipbuilding was highly regulated and controlled to maintain Christian Orthodoxy and a well balanced economy (Lewis 1988, 55, 56). Byzantine merchants were limited in their profits due to government regulation of interest rates and banking loans, and the reluctance of moneylenders to risk funding seagoing activity (Lopez 1978, 232; Lewis 1988, 57, 58). Commercial investment by the wealthy, who had the excess capital to fund risky trading ventures, was rare, and there is little evidence to suggest that they ever participated in trade (Lopez 1978, 349; Lewis 1988, 57). The wealthy classes were instead influenced in their investments by deep seated prejudice against mercantilism as a way of life, and by the Byzantine state itself, which encouraged its landowners to preserve the Empire's sanctity (Lewis 1988, 56). While there may have been mercantile activity on the part of the *naukleroi*, it was fairly noncompetitive, and it only occurred within Byzantine territorial waters for the eventual profit of the government. Essentially, the *naukleroi* played an almost passive role in seafaring trade, merely overseeing the transportation of goods from one place to another.

Shipbuilding in Byzantine territory suffered as a result of these restrictions. The Byzantine state oversaw the purchasing of raw materials, the manufacturing process, prices, marketing and final profits, and thus, local craftsmen became employees of the state working under its direction (Tierney *et al.* 1983, 89). The high taxes and government regulation, which certainly limited the shipbuilders' business, may have resulted in industrial stability, but there was little possibility for technological change (Tierney *et al.* 1983, 89, 90; Lewis 1988, 58). The same conservatism within the society that grew from the Byzantine-empire's efforts to maintain its divine existence, resulted in a high standard of living, but it sacrificed technological progress. Shipbuilders within Byzantine territories attempted to operate under this conservatism, and found themselves limited by government policies, not exposed to foreign influences that could enhance their techniques, and saw that their industry was suffering from the lack of competition between the *naukleroi*.

Along with the merchants, they too were affected by the deep seated prejudice against mercantilism as a way of life, and by the lack of demand that they

would have encountered. Merchant shipbuilding in the Byzantine empire, or almost any other culture that traded on the sea, was directly related to the activity and vitality of the merchant shippers. If there were opportunities to profit through individual mercantilism, then it follows that with an excess of merchants and competition between them, there would be a growing demand for merchant ships. If on the other hand, seagoing trade decreased or stopped altogether, then there would be a proportionate decrease in the demand for merchant ships. By the 7th century in the Byzantine empire, the wealthy were not engaging in trade, and while the *naukleroi* were gaining some notoriety in contemporary texts, they were also attempting to operate in a culture that normally shunned their activities, and limited the profits and competitive nature of mercantilism. With such limited competition between private merchants, and the government constraints, the merchant shipbuilding industry may have become stagnant, and the associated technique, mortice and tenon construction, was not progressing to more efficient methods.

The mortice and tenon technique, which was the predominant shipbuilding technique in the Mediterranean during this period, is distinctly different from shipbuilding techniques common in the Mediterranean today. When using this technique to construct a ship, essentially, the exterior hull planking is assembled first, then internal framing is added afterwards. The external planking, when constructed, is held together by a locking system of mortice and tenon joints, in which adjoining planks are secured to each other by placing a tenon into an associated slot along the edge of the plank, called a mortice. From the early examples in Kyrenia from the 4th century BC until Yasslada B in the 4th or 5th century AD, this technique was at its height, and in many cases, the seams between the planking were so close that once the ship became waterborne, the wood swelled and no caulking was required to maintain its watertightness. By the 7th century however, from an examination of the Yasslada A ship, Saint Gervais B, and Pantano Longarini, a clear degradation in both the quality and the quantity of the mortice and tenon joints in the hull had occurred. By the 10th and 11th centuries, as is clear from examining ships such as Serçe Limani built in the frame first fashion common today, the technique had disappeared.

But what brought about the disappearance of the mortice and tenon method, and the replacement by, or assimilation of the frame first technique? The most convenient starting point to begin this examination is the 7th century, and the last appearance of the technique.

In approximately the year 626, when the Yasslada A ship sank off the coast of Bodrum, the Byzantine empire was nearing the end of a Persian assault on its territory that had begun almost 17 years earlier. The invasion began when the Emperor Maurice's commander in Mesopotamia, Narses, opposed the usurper Phocas' rule, and asked the Persian king Chosores II for military aid against the new Emperor (Foss 1975, 722). Chosroes agreed, and by 610, the first year of the reign of the Emperor Heraclius, Mesopotamia had been reoccupied, northern Syria had been subdued, and the route along the northern coast of Asia Minor to Constantinople was open. Caesarea in Cappadocia was taken and destroyed by 612, in 613 the Byzantine armies had been beaten at Antioch, and the Persians began their occupation of Asia Minor and campaigns in Palestine and Egypt. After Chalcedon, across the Bosphoran strait from Constantinople, was occupied for a year in 615, Damascus and Jerusalem were taken, Alexandria and Cyprus were both occupied by 617, and the rest of Egypt was taken by 619 (Foss 1975, 723). According to the literary sources, Rhodes was captured in 622-623 (Palmer 1993, 18), the same year that the Emperor Heraclius began his campaigns to recover his territory. With his refurbished navy, he already had control of coastal cities along the Asia Minor coast, and by 627, the second Persian occupation of Chalcedon and attempt to cross the strait was a failure. Between the years 628 and 629, the Persians were defending themselves in their own territory, and by 630, Heraclius was victorious, and the last Persian troops were crossing the Euphrates on their way home (Foss 1975, 744).

Predictably, the Persian invasion compounded the effects of depopulation and ruralization that was present in Syria, Palestine, and Egypt, and in turn affected merchant shipping throughout the eastern Mediterranean. Previous to the attack, there are numerous passages in the texts of Saints' lives from the late 6th and early 7th century that reveal the presence of *naukleroi* and their activities, but after the initial stages of the invasion, there are only three apparent voyages.

Before the attack, in the Vita of St. Demetrius of Thessalonica, there is the instance of a *naukleros* bringing his load of grain to the starving population in the city, the appearance of grain ships and their owners in the harbour c.618, and finally, the story of the shipowner persuaded by the African Bishop Cyprianus to take his cargo of marble slabs to Thessalonica to redecorate the shrine of the city's saint (Abrahamse 1967, 271-273).

Theodore of Sykeon, while visiting Byzantium in the late 6th century, apparently cured a *naukleros*

also visiting the city, and the Life of St. Artemius reveals that of the six miracles performed on shippers or sailors in Byzantium, at least one was of a Rhodian *naukleros* (Abrahamse 1967, 270). The Life of St. John the Almsgiver, the Cypriot Patriarch of Alexandria, referring to events from 610 to 619, narrates the story of a *naukleros* who through the loss of almost two ships and their cargo, finds success in reaching Britain only by employing money and ships of the church (Dawes *et al.* 1948, 216). So blessed was this "swift sailer", carrying 20,000 bushels of corn, that it reportedly reached Britain from Alexandria in only 20 days (Dawes *et al.* 1948, 217).

However, unlike these and other voyages that occurred well before the Persian invasion, there are only three in the Saints' lives that occur after the initial Persian attacks, and before the Muslim invasion. The first is the appearance of the *naukleroi* in the harbour of Thessalonica c.618, and the next two are voyages in the text of the Life of St. John the Almsgiver. The first concerns the voyage of grain ships sent by St. John to Sicily to gather grain for the starving population in Alexandria, between 615 and 617 (Dawes *et al.* 1948, 223), and the voyage of the Saint himself to Cyprus, in 617 (Dawes, *et al.*, 1948: 225). The only voyages in the 7th century, recorded in historical texts, that occur after the Muslim invasion are those emigrating monks and clergy from Alexandria and Rhodes to Cyprus (Butler 1978, 358, 366), the capture of Cyprian cargo ships on the way to Constantinople by the Muslims c.649, and the route taken by the Bishop Arculf from Joppa to Sicily c.680 (MacPherson 1895).

It would seem initially then, judging by the hagiographic texts alone, that mercantile trade decreased proportionally after the Muslim invasion also, most likely for the same reasons.

The Muslims first fought the Byzantine empire at Yarmuk in 636, and after that victory, they went on to capture the rest of Syria and Palestine by 640, Egypt by 641, Cyprus by 650, and they were threatening the walls of Constantinople by 672. Their smaller naval forces had defeated the Byzantine navy off the coast of Phoenix in 655, and the 7th century Armenian historian Sebeos described their advance as thus: "'*And the fourth beast, terrible, dreadful, his teeth of iron, his claws of bronze; he ate and crunched and trampled the rest underfoot.' He is saying that this fourth kingdom, which rises from the south* [east] *is the kingdom of Ishmael* [Muhammed]." (Kaegi 1969, 146).

However, this fear of Muslim destruction or religious persecution was unjustified. The Covenant of 'Umar, which is an unspecific treaty from the mid 7th century applied to conquered to territory, states that "*We will protect you and your lawful (according to our law) property against any one, Muslim or not, who tries to wrong you, as we protect ourselves and our own property; our decisions about it will be the same as those about our own property, and ourselves.*" (Tritton 1930, 15). The Covenant also states that previously standing churches would not be razed in light of the Muslim occupation (Tritton 1930, 15), or while a church may not be built within a Muslim occupied town, it may be built outside one (Tritton 1930, 38), or for that matter, if no Muslims live within a town, churches may be built and festivals may be held (Tritton, 1930:100). Clear evidence of this practice can be found in Rihab south of Damascus, where two churches were dedicated in 635, after the provincial capital of Bostra had fallen to the Muslims, and just a year before the battle at Yarmuk (Schick 1995, 79). The Bishop Arculf, when traveling through Palestine in the last 30 years of the 7th century (MacPherson 1895, xi), encountered 19 churches along his route, none of which seem to be damaged.

Most significantly, there are numerous surviving lead seals from this period that testify to the presence of church officials and activity in cities that were clearly in Muslim hands when the seals were produced. There are three extant seals from Antioch on the Orontes from the late 7th to early 8th century, one extant seal from the island of Aradus off the Syrian coast dating from the late 7th to the early 8th century, and another from Scythopolis along the Jordan river, also from the late 7th to the early 8th century. John, the Archbishop on Cyprus, produced a seal during the late 7th century, as did the church as Kisamos in Crete in the 8th century.

In addition to the religious tolerance of Islam, there was little political or administrative upheaval involved in their military campaigns. Unlike the highly structured administration that developed in the Byzantine empire, the advancing Muslim empire was approximately ten years old by the time it conquered Egypt, and had almost no background in government on such a large scale. It had survived primarily on a tribal system until the time of Muhammed, and while the caliphate and its administration began after his death, it did not become very structured until the reign on Mu'awiyah from 641-680.

As a result of this minimal organization, the Muslims either retained Orthodox Greek officials in their positions, or appointed Monophysite Copts, who were familiar with the past administration, to take their place (Butler 1978, 450). Additionally, unlike the Chalcedonian, or Monothelite, religious elements of the society, many of the Monophysites and the common lay people did not flee from their territory, but merely retreated to a more fortified

town, or saw no reason to move and surrendered peacefully. There are examples of towns and cities accepting the Covenant of 'Umar with almost no resistance (Kennedy, 1985:147), and Hitti's translation of the Kitâb Futûh al-Buldân [The Origins of the Islamic State] by al-Balâdhuri from the 9th century, mentions the towns of Shaizar, Ma'-arrat Hims, and Fâmiyah bowing to the arriving Muslims with tambourines and singers (al-Balâdhuri 131).

So it seems from the initial Muslim occupation, that unlike the disruption expected, and that was most likely encountered during the Persian invasion, there were very little religious or political changes that occurred. The local inhabitants were able to continue their religious practices for there was no forcible conversion to Islam, and the Muslim had no need to replace the government administration they found, for they had little to replace it with. Similarly, the Muslim occupied territory was not only able to continue its mercantile practices, but it most likely benefited from the new economic policies brought by the Muslim culture.

As revealed by the statements of the emperor Theophilus and the caliph 'Umar at the beginning of this paper, it was these economic policies within each culture that was one of the most distinct differences between the Byzantine and the Muslim empires. The Byzantine policy needed and relied on merchants essentially working for the state, but it publicly shunned them, an attitude that developed from centuries of Greek and Roman prejudices against individual mercantilism. The Muslim empire on the other hand, developed from a culture based on individual mercantilism and trade as a way of life. Mecca, the home of Muhammed's tribe the *Quarysh*, was a city based around a *haram* that survived on trade. Arab society before and after Islam had a positive view towards earning and amassing capital, and even certain amounts of luxury through mercantilism (Goiten 1957, 586). The first caliph, Abu Bakr, traded cloths, the third, 'Uthman, imported cereals, and the 8th century Arab writer Shaibani regards mercantilism as a religious duty that would please God more than government service (Goiten 1957, 586-589).

Unlike the Byzantine merchants, those in the Muslim state played an active role in the economy of the society, and once territory in Syria, Palestine, Egypt, and Spain was conquered, the state and the merchants within it were able to prosper. They gained access to all of the goods previously traveling to the Byzantine empire, and luxury items such as tigers, panthers, and elephants from India, ostriches from Arabia, felts from the Barbary coast, and carpets and packsaddles from Azerbaijan (Lopez *et al.* 1955, 28).

Additionally, the caliphate often took an active role in aiding mercantile activity. Merchants from within the Muslim state, converts to Islam or not, paid lower taxes than Byzantine merchants from outside Muslim territory (Tritton 1930, 219), and until 693, the Muslim administration kept minting Byzantine Imperial gold bezants (Lewis 1951, 79), to ease economic tension between the two Empires. The caliphate even maintained the production of coinage at the Byzantine mints of Scythopolis, Damascus, Ba'albakk, Hims, Qinnasrin and other cities, producing coins that are clear copies of Byzantine counterparts. Under the Umayyad caliphate, there are approximately 77 examples of coins minted that not only retain the earlier Byzantine format, but also the Greek script and the imperial figures, simply without their titles (Walker 1956). Between the years 670 to 705, there are an additional 100 coins catalogued by Walker that do not bear a direct resemblance to a Byzantine type, but still retain definite Byzantine characteristics such as the distinctive **m** on the reverse, or instead a cross standing on three steps. Most significantly, all of these minted coins are copper, none are silver, and it was not until c.693 that the caliphate even attempted to challenge the dominance of the Byzantine bezant. Clearly, the Muslims, by minting copper coins which were the most common denomination in mercantile activity, and by maintaining Byzantine types, were attempting to keep economic tension in the marketplace to a minimum, and attempting to assimilate their policies fairly quickly.

Finally, it is clear from the evidence of extant lead seals of *commerciarioi* that mercantile activity freely continued across the Byzantine-Muslim border in Asia Minor. From the northern edge of the border, in Armenia I and IV, two seals from the late 7th and early 8th century mention George, Synetos, and Nicetas, all *genikoi commerciarioi* of *apothekai* in these provinces. In Cappadocia, just southwards, there are eight extant *commerciarioi* seals from this period, the two earliest from 659, the latest from c.692, and the position was presumably occupied well into the 8th century. Cilicia, the territory encompassing Antioch on the Orontes, Alexandretta ad Issum and Tarsus, area that was overrun by the Muslim general abu 'Ubaidah between 636 and 637 (Donner 1981, 150), was still acting as a clearinghouse or a warehouse by 668, as the first of four seals attests. Moving westwards along the coast, Isauria was the location of the *commerciarios* Peter and his *apotheke* from 676-677, Kosmas from 681-682, Thomas from 690-691, and George and Theophylactos from 691-693.

As the *commerciarioi* were mercantile agents working to acquire goods for government production,

if the caliphate wished to disrupt Byzantine industry, they could have done so fairly easily by attacking the *apothekai*, or blocking the trade routes from the East. But yet, as the *apothekai* were maintained and the *commerciarioi* apparently completed their duties, it seems that trade from the East continued to flow to Byzantium, and the presence of Byzantine officials may have been acknowledged and accepted by the caliphate. As there are separate examples of cooperation between Constantinople and the caliphate, it is certainly possible that both Empires may have been acting to retain mutual economic benefits, but unfortunately, this is not the paper to deal with those issues.

This paper instead, is examining how the new economic policies that the Muslim invasion brought to the eastern Mediterranean benefited independent merchants and shipowners, and how that directly affected the use of the mortice and tenon technique used to build merchant ships. It seems clear that under the Byzantine empire, merchants and shipbuilders may have been able to undertake their various trades, but due to the conservative and restrictive policies of the Empire, they were unable to progress to more efficient methods. As most of the territory was subdued under the Persian invasion, merchant shipping slowed or ceased, and merchants shipbuilding, as a result, had no demand for its product.

The Muslim empire, when it reached the shores of Palestine, Syria, and Egypt, found territory that had been damaged from years of war, disease, and economic instability, but that also had a great deal of mercantile potential. The Muslims quickly employed Coptic shipbuilders in Alexandria to build a new Muslim fleet that would match that found at Constantinople, and the caliph Mu'awiyah transferred workmen from Antioch, Hims, and Ba'albakk to Tyre, Acre, and other ports along the coast to reestablish the shipbuilding industry there (al-Balâdhuri 117). But the local shipbuilders most likely began to profit from more than just requisitions for military craft, for merchant shipbuilding had a direct link to economic stability and commercial possibilities.

Local merchants who wished to take advantage of the new mercantile policies and wide range of goods available to trade required ships if they wished to transport themselves and their products from one port to another. But while shipbuilders certainly may have been available at the port cities of Acre, Tyre, Alexandria, and Damietta, the technique they had been using, the mortice and tenon method, was one that did not lend itself to quick assembly to meet the growing demand for ships. Cutting mortices in the edges of planks and fashioning tenons to fit those mortices, even if in the 7th century the process had degraded a great deal in quality, still required labour, skill, time, and money. With the assimilation of Muslims and their culture's attitudes towards individual mercantilism, local merchants or those wanting to trade goods certainly had many more opportunities to earn the money to pay for the skill and time needed to build a ship in this method. But unlike the economic environment within the Byzantine empire, the Muslim culture also encouraged competition between the *naukleroi* now in Muslim territory. It was this competitive aspect, in combination with the increased access to a wide range of goods to trade, that began to eliminate the use of the mortice and tenon method. For the *naukleroi* to act and profit efficiently, they would demand a merchant ship that was efficient, inexpensive, and reliable. While a ship that was constructed in the mortice and tenon method was just as efficient and reliable as one built in the frame first method, a ship built without the mortice and tenon joints in the hull was decidedly less expensive, less time consuming to build, and was available for use much sooner.

Additionally, if shipbuilders wished to remain in business, they would have to meet the demands placed by the merchants on their product. Previously, under the Byzantine empire, they were unable to change their methods due to the strict government policies and conservatism within the culture, and there was also no demand for a change to be made. But under the caliphate, the *naukleroi* developed new demands as a result of new economic policies, and if the shipbuilders wished to take advantage of both the new economic policies and the increased demand for their product, they would have to adapt their techniques to meet the new demands. Using the mortice and tenon method however, was not the best way to do so.

While it is still relatively unclear at what the point between the 7th and the 10th centuries the mortice and tenon technique was eliminated from the Mediterranean, it is certainly clear that the Muslim invasion in the 7th century, and its continued presence in the Mediterranean to the present day, was a major factor in eliminating it from common practice.

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Matthew Harpster
Deans Court, North St.
St. Andrews, Fife
Scotland KY169QT

Paolo Squatriti

Water-Borne Transport and Communication in North Italy during the Early Middle Ages

In her excellent survey of the historical geography of western Mediterranean Europe, Delano Smith, an expert on coastal geographies, proposed that the fortunes of ports in the region were unrelated to natural or physical conditions.[1] Instead, the ports were and are wholly human artefacts whose life and death depend wholly on humans. Thus, the will and resources and skills of people first created the ports of, say, Italy, and then tenaciously defended them against undesired changes. Throughout, the history of these nodes in the communication systems of pre-industrial societies is connected to human things, to economic rhythms, to political circumstances, to social conditions. Extending this line of argument, it becomes possible to imagine the evolution over time of water-borne transport and communication as a process in which the local ecologies, the very *waters* lapping the docks and supporting the hulls of ships, are not relevant.[2] This, it seems to me, is an impoverished way to imagine past communication networks. Today I will suggest that "natural" conditions need to be taken into account and included in any persuasive model for the development of so human (and hence "cultural") a thing as transportation, trade, and communication. I will do so by sketching the history of exchanges of people and products by water in northern Italy between the fifth and tenth centuries AD, a history which must begin at the beginning, with the Roman Empire.

Transport and communication by water, mostly, but not exclusively, by sea water, were well developed in Roman Italy. We need only to think of the huge complex of port facilities on the Tyrrhenian coast around Rome, or of the network of harbours in the north Adriatic between Ravenna and Aquileia, to realize this. The dazzling variety of industrial and agricultural goods which Roman ports imported from close and faraway places is well documented. People moved by water as well. As late as the fifth century, Gaulish aristocrats like Rutilius Namantianus (in 416-7) and Sidonius Apollinaris (about 460) took advantage of the available ports and ships to reach Rome and return home.

For the post-classical period that is my focus the evidence, inevitably, is sparser. Nevertheless, late antique communications were far from being stagnant, as the extraordinary rapidity with which the plague of 542-3 spread in the Mediterranean indicates. Hence it is not very surprising that in northern Italy, and particularly in the Po valley, goods and people moved by water quite commonly in the sixth century. Byzantine armies used the north Italian waterways in their many sixth-century wars, and Cassiodorus attests to the water-borne transport of logs to Ravenna, which also received a ship carrying a 276-ton monolith to roof Theodoric's mausoleum, and was somehow able to unload it.[3] At most harbours in the area, food and other imports continued to be unloaded from ships, at slightly slackened rates, judging from the pottery evidence.

We know little about the use of water as a means of communication during the seventh century, after the traumatic settlement of the Lombards in the peninsula. Yet there was no catastrophic cessation of all inland navigation, for the Lombard law codes mention ferries. Amphorae, on the other hand, seem

[1] Delano Smith 1979, 368, whose position is the result of sophisticated analysis which does evaluate ecological factors.

[2] Several good archaeological studies, some citing Delano Smith, explicitly adopt the position that only economic or social systems matter to delineate how a given port or entire trade world evolved. See, for instance, Coccia 1993, 198 (who argues that during the early Middle Ages the Tiber delta was stable, and implies that only unstable hydrologies are relevant to ports); Rickman 1985, 105-6 and 1988, 257; Randsborg 1991, 120. Orvietani Busch 1995, rightly, in my opinion, stresses geological and hydrological processes in the study of medieval Tuscan ports, but sees them as separate from human activity.

[3] Procopius describes many instances of troop movements by river (Bognetti 1968, 545-547 considers the evidence proof of a catastrophic shortage of shipping), the most interesting being perhaps the transfer of the sea fleet's rafts from Genua to the Po, presumably on the Scrivia or Tanaro after crossing the Passo di Giovi or della Rocchetta: *BG* 2.12). Cassiodorus, *Variarum* 7.18. On the Theodorican stone and the impossibility of a ship unloading it at shallow Classe, Bonino 1991, 37. Ravenna's riverine trade is discussed by Brizzi 1978, 94.

to have stopped reaching many Italian ports, like Genua, Luni, or Classe, by about 700, though of course they may have been replaced by other sorts of containers.[4] After 715 the picture of movements grows clearer, thanks to the Lombard king Liutprand's celebrated agreement with Comacchio, based on traditions already considered ancient at the beginning of the eighth century. During the 700s it seems certain that the inland waters of the Po region carried many things, and indeed became the principal communication routes. Establishing exactly what was transported is no easy task. But in an interesting case of "continuity" with Late Antiquity, voluminous goods like timber and stone, unsuited to long movements by road, moved over the waters of the Po system in the early Middle Ages. The chroniclers record exceptional feats, but they do show how fluvial transport networks served. Charlemagne, enthused by what he saw at Ravenna and desirous of emulating such imperial splendour, shipped marble, columns, and other architectural elements north to Aachen (some part of the route was obviously by land). [5] Some 200 years later, in 967 Otto I granted the Venetians the right to continue to bring timber and resin from the Alps to the Adriatic along streams (evidently this too was an old custom).[6]

Water also carried a vital product of the coasts inland. Salt, essential condiment and preservative (the cheese industry depended on it) was the Po delta's great marketable resource. There being no rock salt in the region, sea salt, even from a Byzantine sea, had to be hauled against the Po's current to the inlanders. In 715 the Comacchians were the purveyors of this commodity to north Italy, by appointment to his majesty the Lombard king, and despite heavy taxation their ships took deltaic salt at least as far west as Piacenza. They also bore salt up several of the great river's tributaries, both Alpine and Apenninic.[7] Within two-hundred years the Comacchians had been replaced by Venetians and other traders, like those of Cremona, who began their riverine operations with salt.

The Comacchians also had garum, the notorious fish sauce, and pepper and oil on board. In other words their cargoes mixed luxury foods, some imported from overseas, with their staple. Waterways now supported complex cargo movements, and by the 800s highly prized and expensive textiles were included in these cargoes. Hagiographical and other sources show Venetians and other traders avidly involved in the transfer of these cloths to likely purchasers, by boat.[8] The Venetians certainly participated in other, local exchange networks, but from the mid-ninth century took the lucrative and specialized position of suppliers of east Mediterranean goods of all sorts to north Italy and Europe.[9] Early on they learned that slaves, too, could be handily transferred by water, and many seem to have reached the Venetian lagoon, a stepping stone to Islamic markets, by way of the Alpine rivers.[10] Along with manpower, Venetian ships took timber and metals (as well as pottery) to Dar al-Islam.[11] These products could reach the lagoon most easily on rivers, like the Piave, or Brenta. Some metals probably reached the lagoon by the Adige, and old ore route.[12]

Unlike the unfortunate slaves, pilgrims tended to move by road. But other early medieval people travelled on the inland waters. Kings, for instance,

[4] On Ravenna, see Claude 1985, 129, 239; on Luni and Genua, see Gardini & Murialdo 1994, 164. Containers are treated, for the later Middle Ages, by Pini 1981, 173-182. At a fortified site near Como, in the 5-6th century, food was stored in wicker baskets, infrangible and ideal for transportation (Schede 1991, *Archeologia Medievale* 19, 1992, 600). In the Byzantine south, amphorae were produced and exported in the 7th c (Arthur *et al.* 1992). The catastrophist portrait of 7th c. trade and communications of Bognetti 1968 is correcetd by more moderate, archaeologically informed surveys, like Christie 1995, 140-142.

[5] *Codex carolinus* 89 (but the details of Charles' shipment are garbled, as Agnellus and Einhard and perhaps some imprecise poetry of Ermoldus Nigellus do not agree in their descriptions). In the eleventh century relatively puny rivers were used by Montecassino to import architectural elements from Rome (Leighton 1972, 37). Waterways were the only way for such bulky transports.

[6] Rösch 1982, 10. The Sile and the area of Treviso seems to have concerned Venice most.

[7] For the treaty, see Hartmann 1904, 122-123. The payments required suggested to Fasoli 1977, 589, that Comacchio's vessels carried about 8 tons of salt, but it is not always clear whether the payments apply to each ship or to entire convoys (Bognetti 1968, 552). Scholars have long puzzled over the absence of Pavia from the treaty. There is an environmental aspect to this, namely the fact that as ships moved upstream their progress became more difficult on account of the current.

[8] Notker Balbulus and the *Vita* of St Gerald of Aurillac indicate that luxury items were important to Venice. On silk, see Bettelli Bergamaschi 1992.

[9] Verhulst 1993, 27 connects this new role for Venice with the decline of west Mediterranean trade. See also Claude 1985, 142-143. Excavations on an island in the lagoon of Venice (see Fersouc *et al.* 1989, 71-96) show an eighth and ninth century settlement thriving on regional and international exchanges, and from manufacture: Venice did not live from the international luxury trade alone (indeed, some Venetians were landowners).

[10] The river was thus used already in Antiquity (Brizzi 1978, 88). On the medieval situation, see Rösch 1982, 29-37; but Verhulst 1993, 507 thinks the Chur road more important for slavers.

[11] See Ortalli 1993, 106 on the tenth-century exemption from a Byzantine anti-Islamic embargo of some Venetian shippers with pots, pans, and wood, "on account of poverty".

[12] Brizzi 1978, 92.

had a navigating pavilion at Pavia by the tenth century. Royal emissaries of that time, like the bishop of Cremona who represented Otto I to Byzantium, also travelled by water (Liutprand reached Venice from Pavia in only 3 days).[13] Saints too, dead and alive, rode the waters. Relic theft via the rivers was not unknown, and Einhard, who carried off bones of two Roman martyrs, was only the most distinguished of the thieves.[14]

Other things were afloat, then, alongside eastern luxuries and salt, in the early Middle Ages. Less glamorous but more economically significant exchanges involved agricultural products. Manorial lords shipped wine, grain, and olive oil from places of production to those of consumption, or, taking advantage of toll-exemptions, sometimes to market. Though we know most about a few monastic interregional economies because of the vagaries of record keeping (and archaeology has been unable to cast much light on such exchanges, given the perishable nature of the goods), it is likely that on north Italian waters the surplus of large secular estates on the way to consumption was the commonest cargo.[15]

Having discussed, in broad terms, what north Italy's inland waters transported, I should next engage the question of how shipping was organized and transports occurred. Unsurprisingly, in the course of the roughly 500 years which concern us here, the infrastructures, techniques, and the machines related to fluvial communications changed considerably. In Late Antiquity many large ports clung to the coasts of the peninsula, usually where a river reached the sea. These transformed themselves in the early Middle Ages, suffering the dilapidation of their harbour works. Aquileia in the north-east witnessed the destruction of its port on the Natisone in the fifth century, which was built of stone and had overhanging docks to ease loading operations, and ceased to play a role as the hub to Adriatic and Alpine trade thereafter.[16] Luni, on the coast of Liguria, likewise saw its harbour facilities decline, especially when imperial demand for white marble from the nearby quarries dried up.[17] At Genua the ancient docking facilities, strategic for Byzantium and economically tied to the Po system, appear to have ceased functioning in the 600s, when the last imported pottery arrived.[18] Slightly further north the Byzantine port of Varigotti was stifled in 641.[19] On the Adriatic coast, Pescara's harbour, restored in the mid-500s, was severely degraded after that, according to recent archaeological investigations.[20] The best known harbor of all, archaeologically speaking, is Ravenna's Classe, where the restriction of use of warehouses and moles is well attested, despite some sixth-century Byzantine efforts to revitalize the docks, supply water for ships, develop local industries (glass and pottery), improve roads, and facilitate loading and unloading operations.[21] By AD 700 Classe was no longer an active site.

It is significant that at the Tiber estuary, further south than the area under consideration, the grandest harbour in the Mediterranean fared little better than these north Italian coastal ports. Ostia's (or Portus') inhabited section shrank and its warehouses ceased to function in the sixth century. More than half the quays were excluded by the newly necessary walls and the artificial basin which had offered shelter to ancient ships was abandoned. Although Tyrrhenian spices, wine, and fish sauce continued to be unloaded in amphorae until the late eighth century, this was a faltering port whose structures received minimal upkeep after the fourth century. In fact, Ostia was being replaced by a series of landings and unloading facilities upstream, inside Rome. There was no longer much need by 589 for the huge *horrea* that stored the Empire's grain and other products in Ostia for Rome's consumption.[22] Rome was being supplied from places upstream, like the Sabine hills, and used harbours within the Aurelianic walls.[23]

Rome's port shifted from a coastal-estuarine set of facilities to a riverine set. This is perhaps the best model for early medieval developments in north Italy too. During the Empire's palmy days, the inland

[13] On the kings and messengers, Fasoli 1977, 575.

[14] *Vita Appiani* in *AS* Mar. 1 (Antwerp 1668), 323; *Vita Corbiniani* 16: *Translatio Beati Marcellini et Petri.* Carolingian rulers tried to eradicate the relic trade (*Capitularia* 1, 72: 163 (AD 811)). Zug Tucci 1993, 51-79 has engaging things to say about Venetian involvement with relics.

[15] Toubert 1983, has the fullest coverage.

[16] Aquileia was excavated during the Fascist period. It was the goal of several fresh- and sea-water routes and of several Alpine routes into the late Empire (Diocletian's *Edict* seems to contemplate it as a roadway station: Randsborg 1991, 122): Brizzi 1978, 88-93.

[17] On Luni, A. FROVA, *Scavi di Luni*, 2 vols ; Ward-Perkins *et. al.* 1986, 81-146; Orvietani Busch 1995, 163-165.

[18] Gardini & Murialdo 1994, 164. By way of the Via Postumia and the Scrivia river (which reached the Po upstream of the Ticino) Genova was the outlet of the western Po plain (Rougé 1977, 93).

[19] Lamboglia 1976, 129-130.

[20] Staffa 1991, esp. 211-96.

[21] Along with Bermond Montanari 1983 and Maioli 1991, 223-47, see Nepoti 1982, 1985, 1986.

[22] Important archaeological work has been done on Ostia: Coccia 1993, 177-200 summarizes it. See also Rougé 1977, 74-88 on the late antique situation. 589 is the date of a famous Tiber flood whose waters drowned much grain stored, by then, inside the city and not at Portus.

[23] Hubert 1990, 100-103 records the vitality of the urban harbours around 1000 (unlike Rome's, most early medieval ports in the Po valley lay outside city walls). Not all were reachable from

waters of Italy were not as intensively used as were, say, those of Gaul, but they were used nevertheless. As the Empire's sun sank forlornly, coastal cities and ports shrank and their docks fell apart, but during the early Middle Ages numerous harbours on the Po and its many Alpine and Apenninic tributaries appear to have flourished. For instance at Brescia archaeologists discovered the orderly marble quays which were built on the small river Mella in postclassical times.[24] These were built from spolia, the carved and engraved stone from older funerary and other monuments. Brescia's port is unique in the archaeological record, but starting in 715 there is ample written testimony of riverine docks and landing sites for ships, usually called "portus." Royal donations and more ordinary contracts indicate that the rivers and streams of the Lombard plain and foothills, as well as the Alpine lakes, had many ports on them. The tenth century saw the apogee of such installations.[25]

Probably none of them had the stone solidity of Brescia's port. Much postclassical construction in the Lombard plain was done with wood, and if, as seems logical, these early medieval docks were mostly wooden, their archaeological traces will be elusive. Since they lay in vulnerable, inherently unstable locations, on the banks of mutable water courses quite likely to overwhelm them from time to time, their life spans were probably short too. Associated structures to store goods, repair equipment, and protect people will have had similar brief and transient fates.[26]

Indeed, the earliest document to reveal something of these riverine ports (of 715, but referring to "ancient custom") suggests that ports were little more than poles driven into the riverbanks on which it was possible, and legal, for ships to tie themselves, for a fee. Insofar as this document allows us to see, unloading meant either transferring goods onto another smaller craft or pulling up onto the the banks and then moving the cargo onto the damp ground. In the tenth century Venice managed several rudimentary fortified docks where goods were trans-shipped from riverine to sea-going vessels, all at lowland sites on the rivers. Though important to Venice's fortunes, these entrepots appear to have been small and minimally equipped.[27] Such simple harbours were far easier to maintain than the imperial sea ports, and thus better suited to the possibilities of the authorities which managed many of them.[28]

Thus, as the important harbours of north Italy moved inland from the coast they simplified their facilities. Ships too appear to have become smaller and simpler, exempted in this way from imperial requisitioning while also being more attuned to their new functions, to short-range movements, than the lumbering galleys of the Empire. Yet it is difficult to be precise, partly because archaeological investigation of post-classical ships is underdeveloped in Italy, and partly because so much shipping took place on inland waters where wrecks were more easily recovered after sinking.[29] Nevertheless, the ships which *are* known were flat-bottomed, high-prowed, and seldom longer than 25 meters. They sometimes lacked sails, being propelled by poles, oars, or hauling when the current was unfavourable. Their hulls tended to be made skeletally, saving time and labour, when indeed they were not dugouts.[30] All such vessels had limited cargo capacities, at most the 8500 kilos of the Pomposa wreck.

This is rational enough, since they traversed shallow waters and berthed at rudimentary ports with limited or even non-existent storage facilities. What made their operation feasible was the fact that their

the sea due to the shallows at the Tiber island. Leighton 1972, 127 points out that the river's navigation season (winter) did not match the sea's (summer), which made Ostia a good place to store materials until the Tiber became more pliable.

[24] Possibly late antique: Mirabella Roberti 1963, 273. See also Brogiolo 1993 and Panazza 1988, 26 (and note 81, with bibliography).

[25] For a catalogue, see Bocchi 1993, 174-175.

[26] After 1000 elegant, spacious finger docks were built of masonry in the area (Genua: Cabona 1984; Schede1984, *AM* 12 (1985), 549 and Poleggi 1993) and vast stone hangars for maintenace of ships (Pisa, which also had a lighthouse (Singer 1956, 523: Schede 1993-4, *AM* 21, 1994, 413-414). But it is notable that the best evidence is from the sea ports. Fluvial archaeology deals with a far more mercurial water-land edge, and is hence underdeveloped (though now a "Archeologia fluviale in Lombardia" project is underway, under the Lombard region's superintendency).

[27] Rösch 1982, 33 thinks these harbours existed "seit alters her."

[28] So Singer 1956, 521. Actually early medieval Byzantine, Lombard, and Carolingian rulers were willing and able to carry out large scale hydraulic engineering projects (a sure sign of the importance of navigability to them): A Byzantine canal was excavated c. 650 at Eraclea Veneta (M. Harari & P. Tozzi, *Eraclea Veneta*); at Cittanova (near Modena), for unknown purposes, king Liutprand's workers dug a canal (Schede 1985, *AM* 13, 1986, 476; altogether exceptional is the "aqueductus...ad navigia deducenda" of 852 (Elmhauser 1991).

[29] Old ships were "recycled" (Fasoli 1977, 577; Mannoni 1983, 22) and sunken ships were recovered (e.g. Bonino 1978b, 13).

[30] The recently discovered dugouts in the Oglio, about 7.5 meters long, are fairly typical (Schede 1993-4, *AM* 21, 1994, 435). The main larger wrecks are from Cervia (5th c), S. Giuseppe di Comacchio (7th c), Pomposa and Pontelagoscuro (early 11th c). Po river shipping retained some "archaic" qualities (like sewing of hulls) longer than some other areas. On the techniques of construction, see Bonino 1978a, 47 and 1967, 209-217; Bragadin 1977, 389-407. Bass & Van Doorninck 1982, 312 and Unger 1980, 41-42 make the point about labour-saving building techniques. See also Kreutz 1976, 79-82.

small cargoes had high values or, more often, that their operators did not mind much about market principles. After all, both late antique and Carolingian ecclesiastical lords managed big fleets whose primary purpose was to bring the owners' agricultural produce from far-flung estates to the central places where the clergy and their dependents could consume them. En route some of them could even use their own private docking structures. Rome, Ravenna (sixth-seventh centuries), and Grado and Bobbio (ninth centuries) had such shipping concerns.[31] Professional merchants who had to watch the "bottom line" more assiduously tended not to specialize in agricultural goods but in more precious wares. The famous "milites" of Comacchio who brought salt upstream to several ports along the Po in the eighth century, and returned to their deltaic settlement laden with grain, represent a special category of ship manager. Their boats, whose bulky cargo had to be protected from humidity, may have been different and larger than other ones.

At the end of this brief overview of the movement of goods and people in the corner of Italy between Alps and Apennines, it seems safe to say that the articulated net of rivers and streams which flowed into the Po created, by the eighth century, an integrated system of communication. The waterways could be, and were, employed to carry diverse things. Much of the movement was local or regional, but since some regions, on account of their climate, or hydrology, or soils, were adapted to producing special things (the delta had salt, lake Garda and the Romagna had oil, the mountains had big trees, etc.), inter-regional trade of specific rare and desirable goods was worth the effort. The highly dissimilar environments of the coastal lagoons, the *bassa* of the Po, the Apennine foothills, and the Alpine lakes encouraged the exchange of goods and services.[32] Water bound regions together, but also opened them to international horizons, so that Constantinopolitan products were available in north Italian markets like Pavia. For archaeologists, this documentary truth is driven home by numismatic finds, in the absence of the actual silks and brocades and peppercorns or pottery of the Levant. A recently found late eighth-century hoard from the Reno river, near Bologna, contained a mix of Beneventan, Islamic, and Byzantine coins, certainly an indication of contact with an international exchange mechanism.[33] In the end it was the inland water courses that made the whole system possible, that allowed the monastery of Bobbio, near Genua, to maintain property in Comacchio, confident that the products of this remote possession would reach the storage bins of the monks in Liguria, and secure in the knowledge that this outpost placed the monastery in contact with a bigger world.[34]

The history of the technical infrastructures and machines used in north Italy during the post-imperial centuries, like the history of the economic exchanges that justified these structures, was powerfully affected by a series of human factors. The economic transformations brought by slower transmarine exchanges and greater regional introspection brought different types of technology to transports. The withering of the Roman state mattered too: the *cursus publicus* which vanished in the 600s is one example of how, and Luni's demise when no emperor needed Carrara marble any more is another. The political rift which, at least in theory, divided many coastal areas from the Po valley, also played some role. Comacchio, or Grado and later Venice, prospered by occupying a political edge, a frontier area between Byzantine and Lombard (later Carolingian) spheres of influence. In effect the successful settlements ferried people and goods between the two spheres. Of course not everyone was so advantageously located, and in the ninth and tenth centuries the unlucky location of some ports exposed them to Saracen (and Viking) naval raids. In general, then, ports and ships responded to these new political and economic circumstances by changing themselves, altering the locations where transactions occurred and the ways in which they were organized.

Yet these very "cultural" explanations for the evolution of communication by water present only a partial picture. A more satisfactory description of what happened to water transportation between the late Roman Empire and the second millennium should include "natural" explanations as well. For environmental shifts in Late Antiquity and the early Middle Ages certainly contributed to this evolution. Floods, which appear to have characterized the sixth century, occupied late antique levels in several sites on the Po river, particularly its western end.[35] Siltation of valley bottoms and deltas, erosion of river

[31] Claude 1985, 131-132, 238-9; Ortalli 1993, 101. On such ships the number of sailors (often dependents) and the size of the cargo mattered less. Marketed surplus generated income regardless.

[32] Settia 1993, 201-202 suggests that exchanges of a classically Braudellian type took place between mountains and plains.

[33] Hodges 1994, 124. The rapid adoption of Carolingian coinage in north Italy, another sign of the area's participation in inter-regional exchanges, would make a fine topic for further study.

[34] In 888. See Hartmann 1904, 46.

[35] Floods at S. Michele in Trino (near Vercelli) have been extensively described by Negri Ponzi Mancini (e.g. 1992, 195,

beds and the erratic water flow which contributed to both, heavily influenced the late antique ports of north Italy's coasts. Luni, Aquileia, and Classe are excellent examples of harbours whose capacity to receive ships was impaired by natural processes, principally by siltation, the inevitable result of human manipulation of ground cover upstream and up-valley.[36] Though the ships were smaller and rode higher than the Roman galleys for which these ports were built (loaded galleys could require 3 meters of water to float), they still found these harbours unreachable. In these circumstances water regimes directly shaped how and where and even whether people and goods moved on the waterways. In the same way, the incredible navigability of the Lombard region's inland waterways, proved by the capillary distribution of its freshwater ports, suggests that in the early medieval period the area's hydrology was healthily copious. In the 700s the sailors of Comacchio, and by 840 the Venetians, took ships on Apenninic streams whose parsimonious and erratic water regimes today would make such sailing far from smooth. This most likely is due to thicker forest and other ground cover than had prevailed in Roman times (or was to prevail later), which influenced the hydrology.[37]

How water flowed encouraged some settlements and routes and discouraged others. This was only one way the waters affected transports. Seasonal use of the more meagre water courses will have affected the rhythms of trade and communication. The foggy and stormy (and in the higher reaches of the Alpine rivers, icy) months were easier to confront on inland waterways than in the Mediterranean, but were discouraging anyway Such unpleasant periods of the year were also the times of most abundant water flow, especially for the Apennine streams which benefited less from snow melting in the spring, but which were as vital as the Alpine arteries to Venice in 840. Yet these wet periods did not correspond to the times when eastern luxuries crossed the seas most easily nor to the moment when the grain harvests were available and stocks from the previous year were thinnest. Transportation systems had to circumvent these seasonal hazards, and confront the difficulties of storage which seasonal variations dictated. A successful journey depended on the ability to anticipate the weather patterns and rates of flow, and to know how to adjust schedules and equipment to match them.

There is also an ecological dimension to the use of another vital raw material of these transportation systems. The progressive disappearance of earthenware containers from cargoes and the increased use of wood barrels, which has considerable impact on the archaeological visibility of trade, can also be connected to environmental factors. The denser and bigger woodlands of the early medieval landscape were extensively used by early medieval people, for whom wooden containers were more sensible than pottery.[38] The timber for ships, often oak, now made with fewer protections from decay than in Roman times, was more easily available.[39] In other terms, the builders expected their submerged woods to rot but also expected it to be feasible to replace the ships. Environmental conditions (abundant timber from the bigger forests) were related to techniques of ship building (the "disposable" ships of the early Middle Ages).

These are, of course, only some of the many possible illustrations of how ecological conditions in early medieval Italy could affect communications. In brief, Mother Nature mattered. So, of course, did absent emperors, demographic slumps, economic regionalization, manorialism, Saracen incursions, technological know-how, and a host of other human concerns. The historical development of water transport and communication in northern Italy during the post-classical centuries must be understood as *both* a natural and a cultural product. Indeed, the promiscuous and indissoluble dialectic between human agency, in its manifold incarnations, and the environment within which such agency occurs, which is not a passive backdrop, but an active protagonist, is the key to how post-classical Italian societies' communication systems worked. To seek purely cultural

198); on Brunasco (near Turin), see S. Nepoti, Schede 1980-1, *AM* 8, 1981, 578; for Mantua, Gelichi 1994, 592.

[36] Orvietani Busch 1995, 164-167 discusses Luni's silting and Pisa's. On Aquileia, Schmiedt 1977, 236-238; on Classe, see Bermond Montanari 1983. Ostia, whose choking he dates to after the 700s, is treated by Coccia 1993, 168, 197.

[37] The surprising number of "ports" on streams today considered non-navigable has given rise to varied explanations. I find Fasoli's "ecological" one (1977, 566 on better water regimens) most persuasive. For Settia 1993, 206 it must be that "ports" were not real places of exchange. For Eckholdt 1984, 3-9, water levels were as they are now, but ships were tiny and shallow, navigation was seasonal, and river beds better maintained.

[38] Leighton 1972, 35 and Gille 1986, 452 replicate the myth that Italy's inland waters are "naturally" unsuited to navigation. On the effects of vegetation cover, see Delano Smith 1996. On woods see Wickham 1990. On the change to less fragile, more space-efficient (hence better for small boats) barrels, Unger 1980, 51-52, 96, and Pini 1981, 180.

[39] Roman galleys were often covered with lead to protect their hulls. Early medieval ships were not, and their years of service were probably many fewer in consequence (see Unger 1980, 36-40).

causes and effects even in this most human of domains, communication systems, is misguided. For people, in the early medieval Po valley or elsewhere, cannot be separated from the environmental context in which they live.

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Paolo Squatriti
Department of History
University of Michigan
343 Mulholland
Ann Arbor Mi 48103
USA

Dirk J. de Vries

Transportation and Trade of Timber, Stone and Tiles in the Low Countries related to Building Practice in the Late Middle Ages

In connection with building practices, my study on late medieval town architecture starts with building materials, their origins, transportation, treatment and use[1]. As a supplement to what is immediately visible in buildings, numerous old accounts provided information on the places of origin of the materials and manners of building. Accounts and deeds also include data on producers, traders, commissioners and builders, as well as on their contacts and the manner of payment. Thus an image of mobility, both of materials and of people, emerges behind the static and solid buildings. This necessary mobility was greater in towns than in the country and increased depending on the size of the projects.

Already during the late Middle Ages, The Netherlands largely depended on neighbouring countries for the supply of natural stone, timber, wrought iron and limestone. Commissioners and builders availed themselves of possibilities offered by the then known market- and production places by going there themselves or by buying goods from travelling traders. The relation between the area of production and the building site was determined by rivers and to a lesser extent by country roads. This flow of materials resulted in the unity of building and territorial coherence in the aspect of late medieval architecture. However, a closer study of buildings and accounts also reveals nuances and changes. In Zwolle, the 15th-century shift from purchasing timber in Hasselt instead of in Deventer is not immediately visible in the material itself. Accounts of the building activities in towns reveal these gradual changes. A similar and clearly recognizable change took place in the trade in natural stone. For instance, the supply of trachyte and basalt lava by way of the river Rhine and Deventer on the bank of the IJssel was superseded by that of Bentheim sandstone after 1440. The latter material came via the river Vecht and was hardly taxed contrary to the numerous taxes raised by the noblemen along the river Rhine. In 1488, however, the trade in Bentheim sandstone came to a standstill in favour of the use of Namur stone, as a result of a conflict with the Count of Bentheim over the toll rates. Only a threat of war made the Count reconfirm the old rights in 1490. In the early 17th century, large-scale wartime conditions caused a shift from trade in German oak wood in favour of North-European pinewood, and due to the blockade of the river Scheldt, the trade in white Belgian stone came to a stop.

The use of flat tiles in Arnhem, a town where over- and under-tiles prevailed, was possibly the result of employing a master tilemaker from Utrecht, a town where flat tiles were customary. The occasional presence of over- and under-tiles in the 'flat-tile towns' Amersfoort and Haarlem may have been due to their being supplied by shipmasters/traders from the Eastern and Northern Netherlands. These transactions took place apart from the relation between citizens and their town tilework. The surplus from the production areas was available for exportation.

Wood and timber

Throughout The Netherlands, Wesel oak wood was well-known and probably also an indication of quality. The products from the timber markets in Dordrecht, Deventer and Hasselt were comparable. They were usually so-called rough timber. In the Eastern towns of Hasselt and Zwolle, the influence of the surrounding countryside of Twente and Bentheim is clearly noticeable. On the other hand, the Deventer accounts state names of timber suppliers from the Lower Rhine and Westphalia regions (fig. 1). Several important buyers of timber were members of the town councils of Deventer and Hasselt. In accordance with the town regulations of Deventer and Hasselt, trade there was tied to particular places, times and holidays and subject to municipal supervi-

[1] This tekst is a summary of the dissertation *Bouwen in de late middeleeuwen. Stedelijke architectuur in het voormalige Over- en Nedersticht*, Utrecht, 1994 (Building in the Late Middle Ages. Town Architecture in the former Over- and Nedersticht).

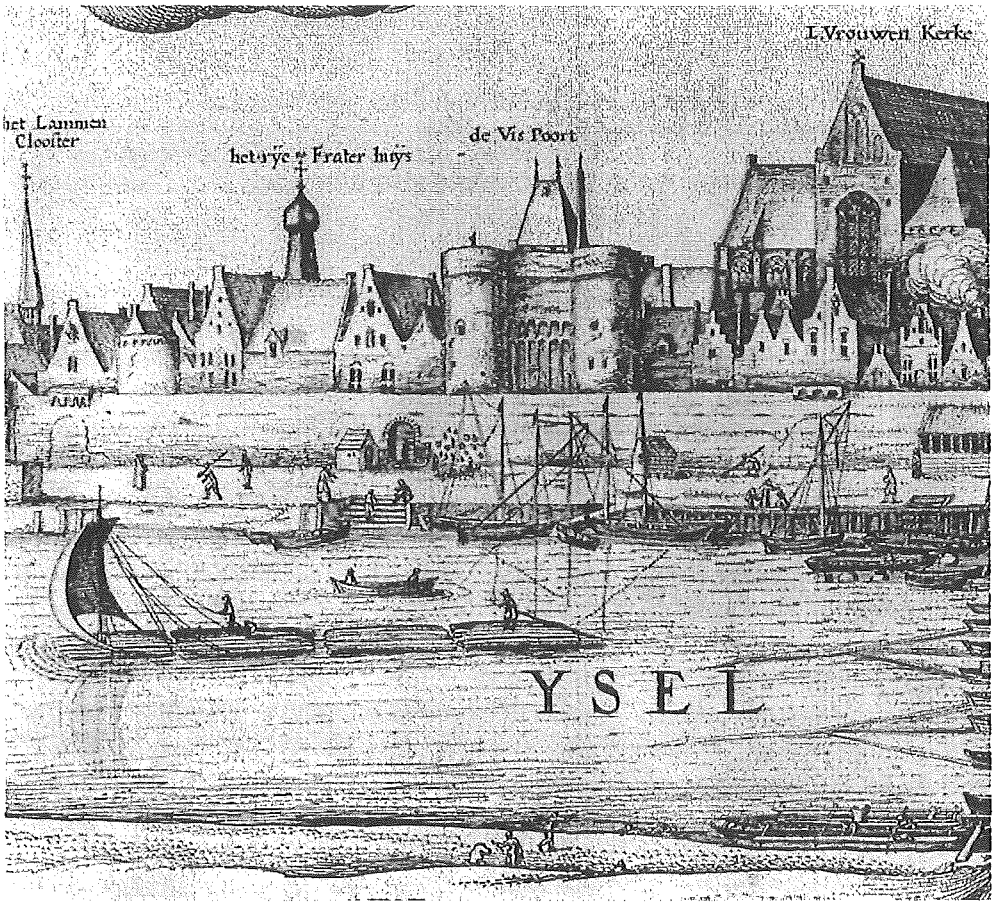


Fig. 1. - *The town of Deventer and the river IJssel by Claes Janszoon Visscher 1615.*

sion (Deventer). In the larger towns, a timber trade existed with exchanges to all points of the compass. Along the western coastal area, timber from Dordrecht was used; 59 % of the total amount traded there was rough timber. To the Eastern as well as to the Western Netherlands, Amsterdam was of major importance as a market for sawn products. To a lesser yet similar degree, this also applied to Kampen, which was just like Amsterdam a town with international contacts and a shipbuilding industry entail-

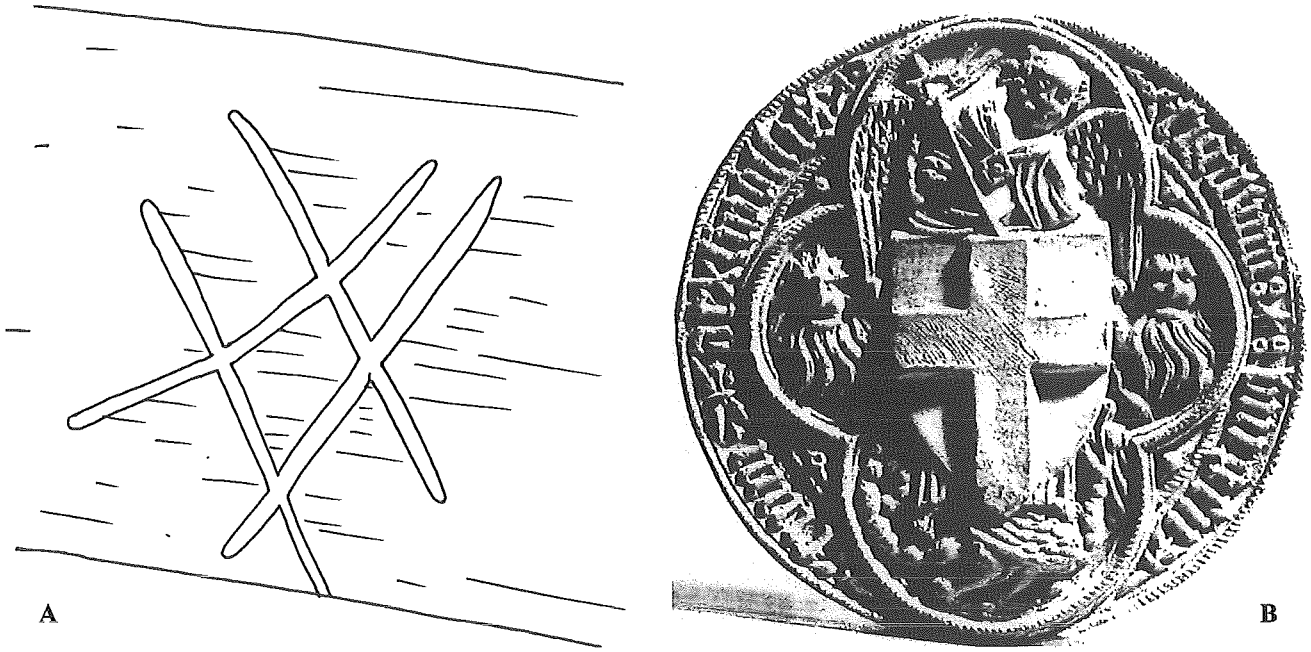


Fig. 2. - *Town property-mark on wood: A. derived from the town arms of Zwolle; B. found in the town hall (1447) and meat hall (1469).*

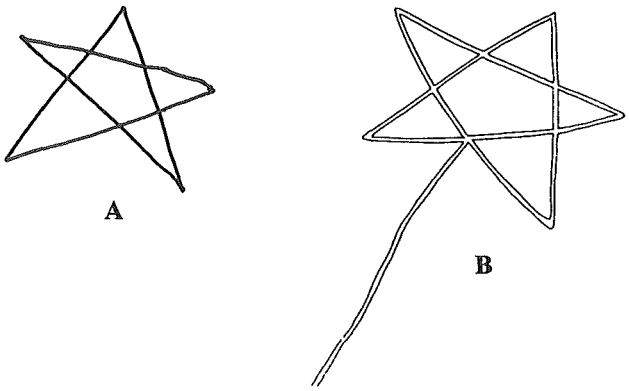


Fig. 3. - *Property marks on wood in star shape: A. Maastricht, a town with a star as arms, here in the choirs of the Dominican and Franciscan churches (1277 and 1305); B. Zwolle, choir of Saint Mary's Church 1417.*

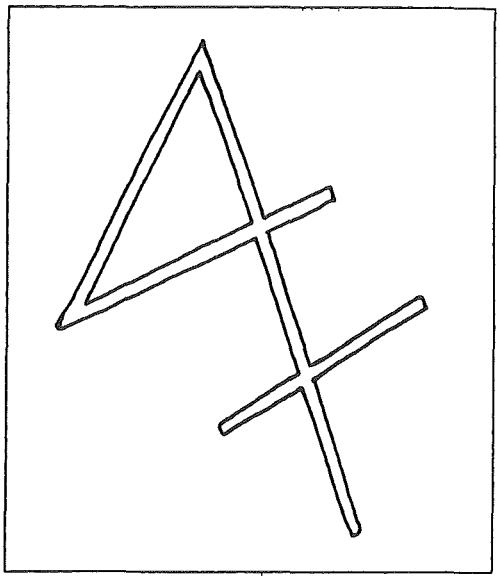
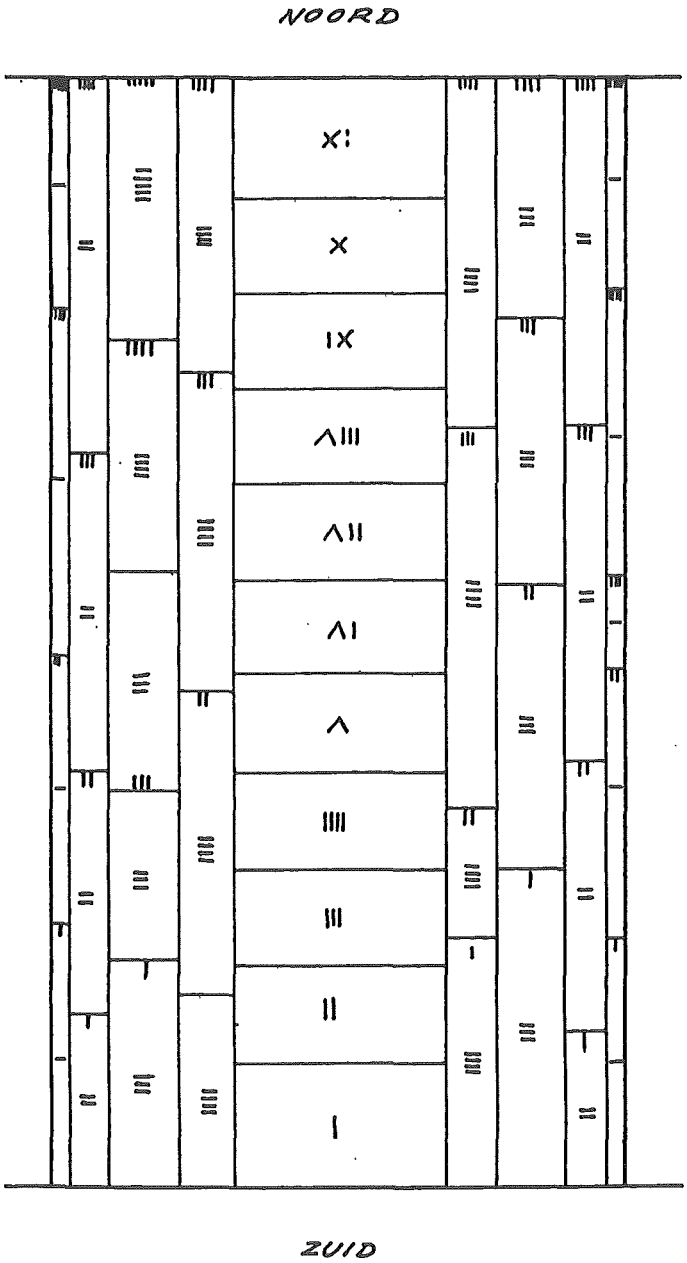


Fig. 4. - *Mark of the Le Prince family in Ecaussinnes (B), XVIA (H. Janse, RDMZ)*

Fig. 5. - *Projection of the vaulting of a Bentheim sandstone bridge at Nijbroek (XVII) with position numbers.*



ing an extra demand for sawn products. The late-medieval exportation to other towns reveals the types of products and their relative importance. From Kampen came 68 % of wainscot, 15 % of the rafters and 17 % of the other wood; Amsterdam provided 30 % of rafters, 23 % of planks, 21 % of wainscot, 6 % of joists and posts, 4 % of secondary beams and 16 % of other material. Wainscot was a typical exponent of intensive and precise sawing. The Hansa towns on the river IJssel exclusively purchased these kinds of sawn products in Amsterdam and during the 16th century also more and more pinewood. Conversely, for its rough oak wood Amsterdam depended on transports through towns such as Deventer and Hasselt and possibly the North Sea and Baltic Sea areas; in this respect, the relation with Dordrecht is unknown. Comparing the 15th to the 16th century, the part of pinewood bought in Amsterdam increased from 11 tot 38 %, an indication for the total change in favour of pinewood at the time of the peace from 1609 to 1621.

Ready-made products such as beams, joists, rafters and wainscot were supplied with more or less standard measurements. Oak beams, however, had square cross-sections and beams made of pinewood rectangular ones. Around 1300, some towns used pinewood as well as oak beams and rafters. In that period, oak beams and rafters frequently had rectangular cross-sections as well. Whereas floor joists already had square cross-sections in the 14th century, oak rafters kept their rectangular cross-sections until the early 15th century, after which time they acquired square measurements of approximately 10 cm all over The Netherlands.

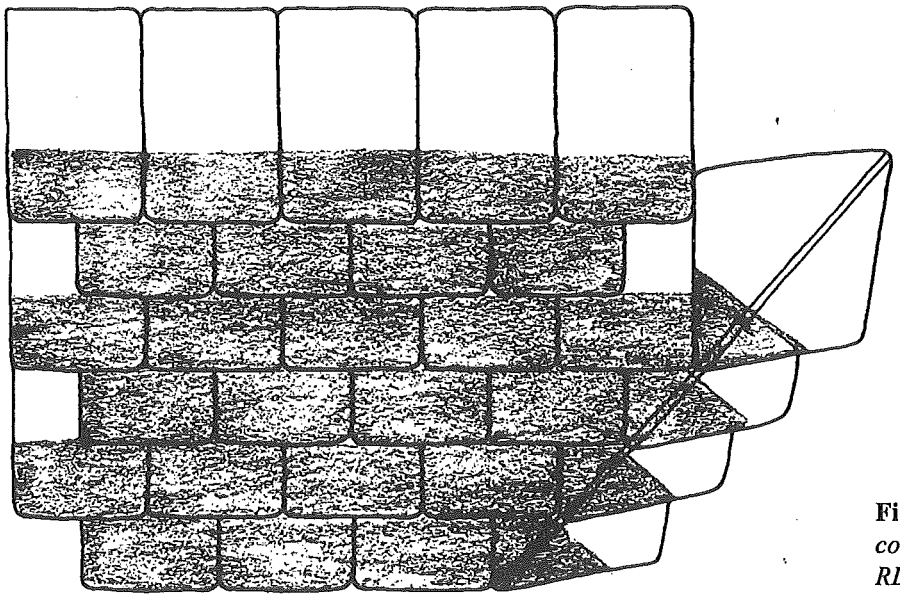
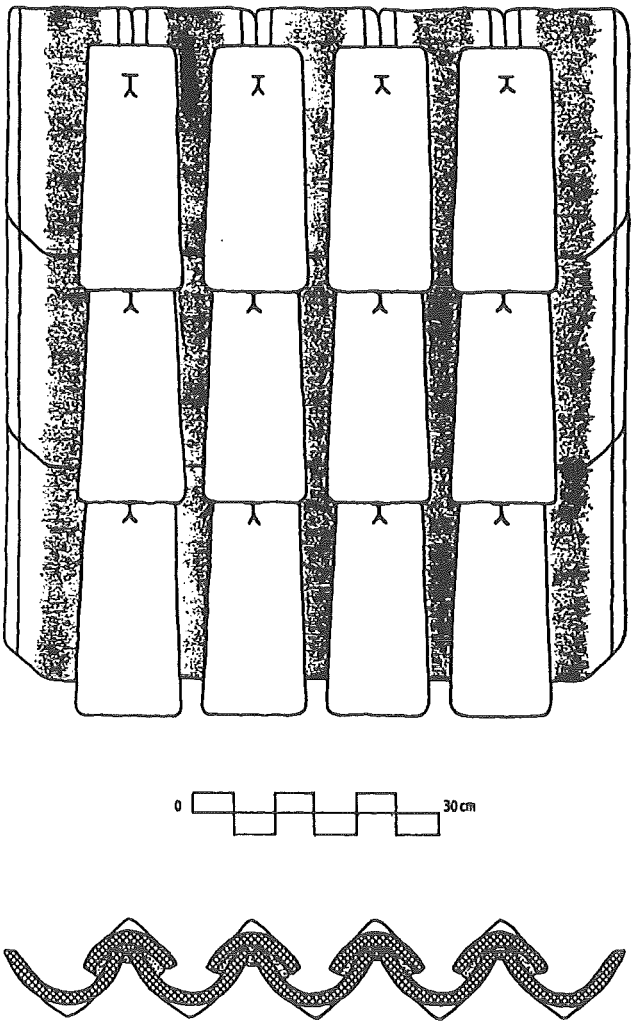


Fig. 6. - *Flat tiles with special inner-corner tiles (drawing A. Hazelaar, RDMZ 1985).*

Fig. 7. - *Over- and under-pannen (tiles) as found in the IJssel area (drawing A. Hazelaar RDMZ 1985).*



Archive texts from Kampen and Zwolle led to the rejection of the existing vision on hand marks on timber as signs of the professional pride of carpenters. Applying marks on timber was comparable to what was customary for loads of cloth, beer, grain or butter. Property marks in the form of abstract hand marks were found on larger pieces of oak wood during the period from the 14th through the 17th century. Property marks on coniferous wood, which is mostly of a more recent date, are often composed of initials. Applying property marks had to do with trade and transport of timber and mainly occurred in the case of sales at a distance. It is likely that property marks were therefore often carpenters' hand marks, since in the event of contract work, the carpenter himself often supplied the timber required. Accounts and contract documents show that commissioners and craftsmen, as well as transporters were responsible for the purchase of building materials. Shipmasters and traders bought building timber without having found a buyer in advance and provided it with their own mark in order to make identification possible after a shipwreck or loss. When more marks are found on one piece of wood, this may mean that two or more persons, e.g. a company, bought the piece of wood in question. A larger number of marks may also illustrate that the timber belonged to several buyers/owners in succession or it might be a proof of quality or of right measures as assured by the town or its controller. Attributing property marks on parts of wood constructions or masons' marks on natural stone to particular persons is not a simple matter. The chance of linking up marks with persons is small and differs for each archive.

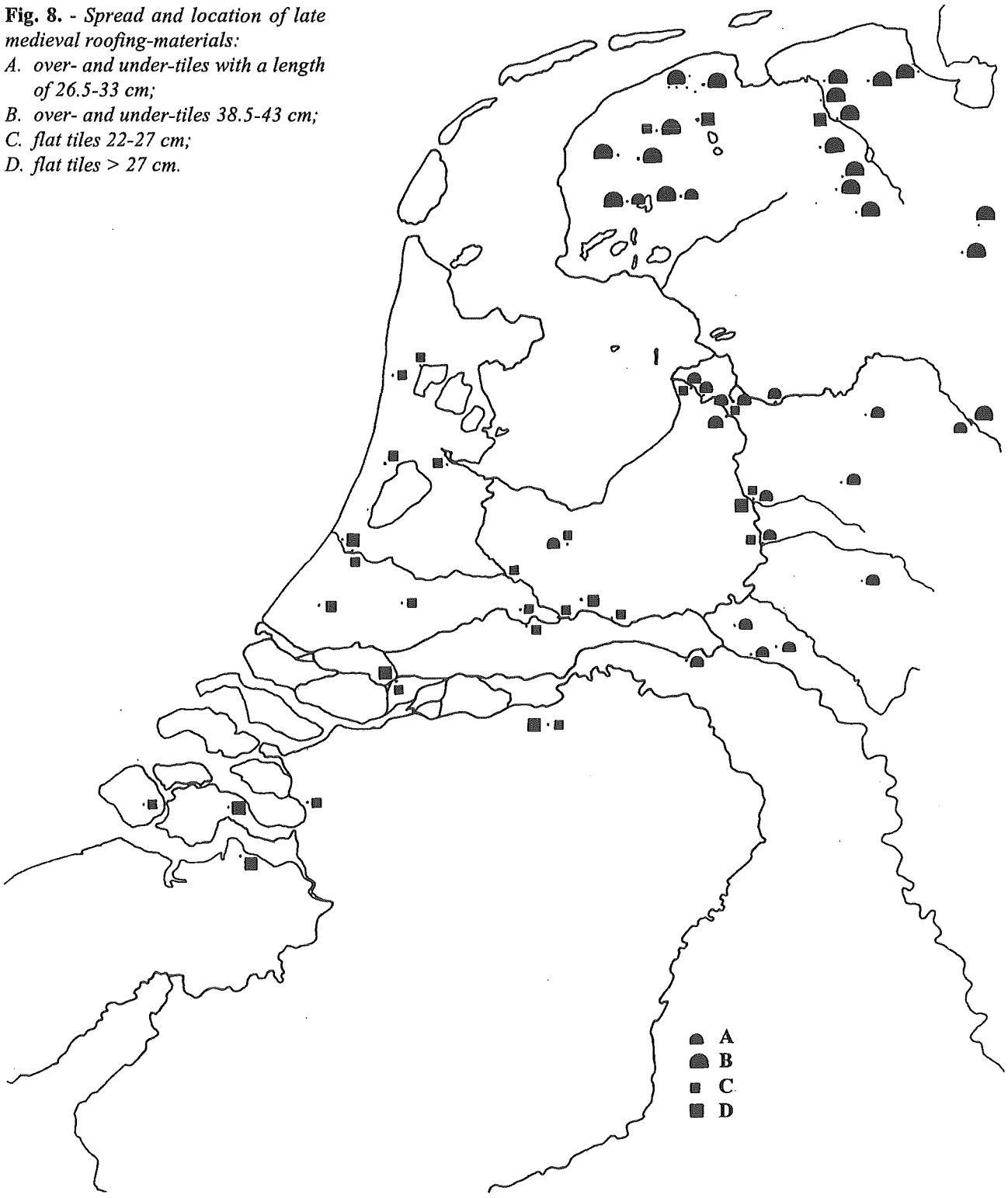


Fig. 8. - *Spread and location of late medieval roofing-materials:*
A. over- and under-tiles with a length of 26.5-33 cm;
B. over- and under-tiles 38.5-43 cm;
C. flat tiles 22-27 cm;
D. flat tiles > 27 cm.

Town marks derived from town arms, found on wood constructions of town buildings, form a special category (fig. 2). They are an abstraction of more complicated, mostly painted forms. Other institutions, like churches, might have a comparable property mark, like for instance a star in relation to Saint Mary (fig. 3).

Natural stone

With respect to the use of Bentheim stone, there was no strict distinction between the trade of supplier of stone and that of mason. Both masters and journeymen supplied per linear foot or got paid by the day, 4 to 8 *stuvers* (a five-cent piece). Both stone cutting and bricklaying were practised by the same

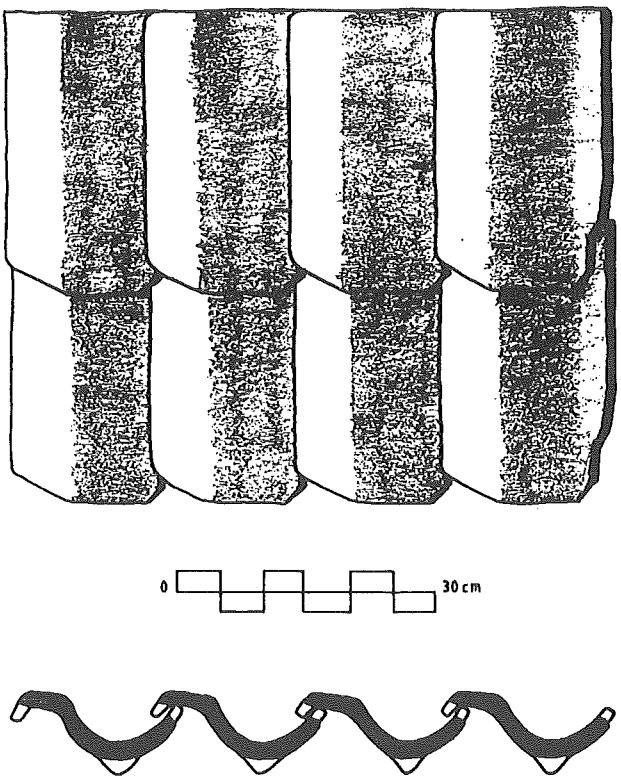


Fig. 9. - *So called 'quackpan' found in Deventer and Zwolle, XVB (drawing A. Hazelaar, RDMZ 1985).*

persons, masters and journeymen. There was no difference in payment between stone cutting and bricklaying. Only rarely did we come across bricklayers earning half a *stuver* less than other bricklayers, possibly because they had no command of stone cutting. Mutual differences in payment rather seem to have been determined by season and age. A town architect mastered both bricklaying and stone cutting, although he was always referred to as town *messeler* (bricklayer). Detailed building accounts show that invariably construction started with the cutting of large quantities of natural stone, and the laying of these blocks of stone and bricks took place later.

In the 15th and 16th centuries, we also come across persons/families who were exclusively recorded as suppliers of large quantities of natural stone, such as Ruyger and Campherbeeck at Zwolle for Bentheim sandstone. The rough blocks the supplied supported the building of large churches like the Utrecht Cathedral. To a certain degree, ready-made products such as lintels and parts of windows were directly made in or near the pits. This was allowed by the guilds who were active mainly in towns, but they feared the competition of foreign craftsmen. So the stone cutting activities mainly took place in lodges on the building site, using rough blocks.

A different way of preparing building parts occurs with works in dark, Belgian limestone. Here, a greater influence of the stone cutters in the pits is reflected by the correspondence that is left. Big parts like pillars or windows were made in Ecaussinnes and supplied with a family mark like that of Le Prince (fig. 4).

During the second quarter and middle of the 16th century the new architectonic forms were mainly executed in marl and Baumberg stone. These soft types of stone could be carved by '*cleynstekers*' (freemasons) freehand without using moulds or templates.

Judging from the total of masons' marks known on natural stone, it was not customary during the late Middle Ages to make a distinction between marks of masters and those of journeymen. Both types of marks were personal marks to control and identify a piece work for its right measurements and quality. Only occasionally, a coat of arms comprising a mark allows us to deduce that this was the master's mark. In the 16th century, masons began to apply more striking marks on the building concerned, sometimes including their initials. When there is no coat of arms, the master's mark may be traced on the most important stones of the building, for instance those used over the main entrance or on one of the crowning parts. Apart from these marks, other marks like numbers can be distinguished and served to indicate the position or layer (height) of the blocks (fig. 5).

Tiles

From approximately 1300, roof constructions appear to comply with the higher requirements set by baked, 'bricklaid' roofing-materials in order to guarantee stability and carrying capacity. A rough reconstruction of medieval roof-covering in The Netherlands is to be sketched, mainly on the basis of archaeological evidence. In the Western, South-Western and Middle Netherlands, flat tiles were used (fig. 6). In the Eastern and Northern Netherlands over- and under-tiles prevailed (fig. 7 and 8), although Hildesheim tiles were also known. The over- and under-tiles from the IJssel region were approximately ten centimetres shorter than the ones from the North, where the under-tiles were not glazed. In the IJssel region, there was great uniformity in size and appearance of the over- and under-tiles, although within this region the northern and southern parts used different terms. The 'prototype' of the pantile – in fact an adapted under-tile – came from the Eastern Netherlands and was known in Zwolle as '*quackpan*' since 1466 (fig. 9). In the early

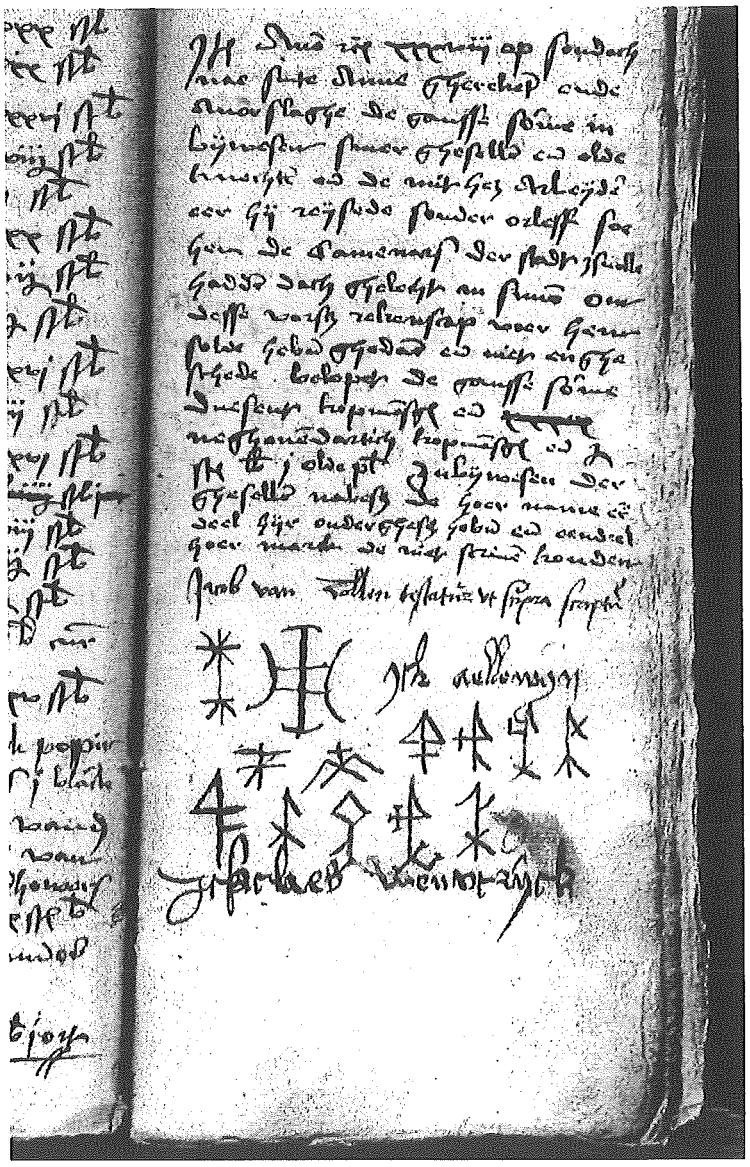


Fig. 10. - *Account of the re-start building the lantern on Saint Mary's Tower in Zwolle, 28th of July 1538, after the Antwerp master Simon Penet let the site and the town-treasurers listed the situation with the remaining 16 masons of whom 3 could write and 13 signed with their mark, 'unable to write' (G.A. Zwolle, KA012).*

16th century, pantiles were already known in the IJssel region and in Groningen; by the middle of that century, the Middle and Western Netherlands followed. The introduction of the pantile and in connection with it the lighter roof construction caused the disappearance of medieval roofing-materials. '*Hollandse pannen*' (Dutch pantiles) became an export product on world scale during the 17th century.

From the 13th and 14th centuries onwards, citizens all over Europe took over the practical management of the parish churches from the clergy. The office of church master was comparable to the office of '*schepen*' (alderman); it invariably concerned the same persons: the church masters were 'deputees' of the town council. The interference of commissioners, the leading citizens of the town, was always noticeable. In most cases the commissioners did not only buy the building materials themselves, they also recruited the builders, accompanied them in search of building materials and architectonic examples, described the desired form and specifications of a building, kept the town tilework going, kept the books and accounts of the building, sometimes made calculations and symbolically started construction themselves by laying the first stone (fig. 10). All this does not imply a denial of the responsibility, the autonomous insight, and the experience of the builders. Commissioners were thoroughly aware of their dependence on these people and sometimes took great pains to hold on to a master. However, the more recently arisen image of the brilliant master, who was thought to act both as designer and as works foreman, requires some adjustment in favour of the commissioner.

Dr. Dirk J. de Vries
Rijksdienst voor de Monumentenzorg
Postbus 1001
3700 BA Zeist
The Netherlands

Mark Redknap & Nigel Nayling

Coastal transport in 13th-century Wales, with special reference to the Magor Pill boat: a preliminary statement

Historical evidence

From the twelfth century, an increasing volume of everyday records such as financial accounts, inventories, legal cases and administrative records illustrate aspects of coastal transport and of goods traded in medieval Europe. Maritime supply were of particular significance to the balance of power in the wars against the English crown in thirteenth-century Wales. To take but one example, during 1256 an Anglo-Irish fleet of twenty ships docked at Milford, carrying 600 horses from Waterford, probably cavalry intended to reinforce an English force destined for Ystrad Tywi, and in 1257 Henry III directed a reinforcements from Drogheda to West Wales through the port of Cardigan (Lloyd Gruffydd 1987, 34-5). Matthew Paris recorded that ' The Welsh, forewarned, had galleys and a corporation with piratical arms and foodstuffs in order to meet the Irish hostiley and powerfully on the sea' (*Matthaei Parisiensis Chronica Majora* (1880), v, 633).

Thirteenth-century records of shipwreck around the Welsh coast provide an interesting but limited perspective on contemporary ships and their characteristics. Three of Henry III's military supply ships were lost off the Great Orme in 1245 (see Fig. 1 for location of this and other sites mentioned in the text). A large part of the subsidy collected in Ireland and entrusted to a ship belonging to one Simon of Faversham was lost in the sinking of the ship during a storm on 1 November 1295 in Porth Eilian on Anglesey, drowning Simon and his three sons – the money, ship's tackle and Simon's own property valued at sixty marks, came into the hands of various local men, and the king wanted to recover the money and called for an investigation (Carr 1982, 117). A small ship was wrecked in Cemlyn in 1302-3, worth 1 pound (*ibid*, 117); in the case of the wreck in the mouth of the Clwyd (Bircloyt, Aberclwyd) on 19 January 1309, the crew managed to unload four tuns and two pipes of red wine and sundry casks of herring before the crippled ship was carried helplessly out to sea. Most of the planking and ship's timbers ended up in domestic fires; ropes, anchors, hatch covers and other tackle were taken away by persons unknown (Pratt n.d.).

In 1313 the Abbot of Margam appealed to the lords officers taking possession of a wreck on the shore of Abbey land, and in 1333 a wreck at Burrows near Margam in which seven people drowned, comprised a boat, three bales of wool, small coffer and cask (Rees 1957, 178). In 1331 a ship called 'la Mariote of Hook' freighted by the Bristol merchant Robert Gyen at Bordeaux with wine and other goods, was stranded at Goldcliff, on the north side of the Severn not far from Magor, whence part of the cargo was washed ashore at various parts along the coast, and carried away as wreckage by a number of people, including the Prior of Goldcliff (Penn 1986, 184); casks of wine cast up on the shore were a constant temptation, as they were for the communities of Trefdraeth Wastrodion and Trefdraeth Ddisteiniaid on Anglesey in North Wales who were presented at the Malltraeth tourn (court) on 12 March 1321 for helping themselves to items from a vessel wrecked at Abermalltraeth (Carr 1982, 117; P.R.O.SC2/215/5, m.1).

Welsh shipwrights are less well recorded than their English counterparts, and English shipwrights are known to have been employed in Wales – when a small ship was built in Conwy in 1301, the shipwright was English, and Welshmen were only employed to fell trees. In 1302, the clinker-built Menai ferry at Llanfaes on Anglesey was repaired by two Welshmen, Iorwerth the carpenter and his mate Madog (Carr 1982, 123; Friel 1995, 43).

Miniature pictorial depictions of thirteenth-century boats can be found on contemporary seals of the port towns in Wales and the West (as on those of coastal towns from the Baltic to the Bay of Biscay), such as the first Common Seal of Bristol, which shows a single masted ship steered by a mariner holding a rudder, and the First Common Seal of Monmouth (with figureheads on stem and stern), both reflecting the importance attached to shipping by such ports. The Common Seal of Haverfordwest,

dating to 1291, shows a warship with embattled fore, top and after castles lashed down within a clinker-built hull. This seal is notable for its fine detail, particularly of the hull, which shares a number of basic characteristics recorded on the Magor Pill boat (see below) such as short outer plank lengths and double-ended hull form.

For understanding the past technology available for travel and transport of commodities, archaeology has provided a new chapter. Earlier boats in local tradition from Britain are represented by the finds from Sutton Hoo and Graveney; for the thirteenth century, discussion has hitherto relied largely on fragments of boat reused within waterfront structures or dredged up from the seabed, such as the timbers from Penner Wharf, Bristol (dated later than 1240), planks from Hartlepool (dated before 1212/13), and timbers from Lincoln, London and Dublin. The Kingsteignton boat from a clay pit in the river Teign in Devon may be fourteenth century (Goodburn 1993). Comparable boat remains from Wales include fragments of tenth- or eleventh-century planking from a boat discovered in alluvium near the mouth of the river Usk at Newport (radiocarbon date HAR-3203 of 1000 + 80 bp) – in all probability a fragment of hull re-used within a waterfront structure (Hutchinson 1984, 27 ff.).

The Magor Pill boat

The Magor Pill boat was discovered in August 1994 by Mr Derek Upton, an amateur archaeologist who has been reporting and recording ancient remains of the Severn Levels for many years. The intertidal mudflats of the Bristol Channel and Severn Estuary form a remarkable environment of great archaeological potential, one which continues to face a number of threats to its survival from development to increasing erosion by natural agencies. In late 1985, the Severn Estuary Levels Research Committee was established in recognition of the area's importance, in order to co-ordinate efforts to record and preserve this resource.

From the outset the Glamorgan-Gwent Archaeological Trust Ltd. (GGAT), Cadw: Welsh Historic Monuments, the National Museums & Galleries of Wales (NMGW) and Newport Museum were involved in constructive discussions about the way forward. It was recognised that no single organisation could tackle such a project alone. The archaeological investigation, lifting, conservation and display of the boat has been made possible through the co-operation of three archaeological organisations, each on their own unable to undertake the project, in what could be described as a voluntary partnership between bodies who have the interests of archaeological inquiry at heart.

The initial archaeological assessment of the find was by GGAT under the direction of Nigel Nayling, funded by Cadw. Following site visits by members of the Department of Archaeology and Numismatics (NMGW) and the normal reporting procedures required by the Receiver of Wreck, the boat was generously donated to the National Museums & Galleries of Wales in July 1995 by his Grace the Duke of Beaufort.

Excavation and recovery

Fieldwork at the site, located in the intertidal zone about 500m seaward of the present sea wall, was limited in time to approximately two hours each side of low tide. Partial excavation in May 1995 confirmed the survival of up to eight metres of a clinker-built vessel which appeared to have been truncated and disturbed, possibly by fluvial action following its deposition. Complete excavation followed in July, requiring the stratigraphic excavation of overlying palaeochannel sediments and gravel, the in situ recording of the vessel by photogrammetry, and the removal of the remains of a cargo of iron ore. While the excavations were in progress, wide-ranging consultation with maritime archaeologists sought to identify a suitable method of recovering the remains. The hostility of the intertidal environment and the difficult terrain between the site and the nearest road encouraged recovery of the remains as a single object, rather than the more usual approach of controlled dismantling in the field. An approach for assistance made to Laing-GTM, the consortium constructing a second road bridge over the River Severn, elicited a positive response, and discussions led to a detailed design for a lifting cradle. During the last week in August, a collaborative team comprising Laing-GTM staff and support ships and plant, and a joint GGAT/NMGW field team worked every available tide leading to the successful recovery of the boat and its transport to storage in dedicated facilities in Cardiff.

Further recording of the vessel was carried out whilst she was supported on her cradle in a custom-built holding tank, prior to controlled dismantling of the vessel into her constituent timbers. The individual timbers were recorded by photography, scale drawing and 1:1 tracing (Fig. 2). Post-excavation analysis is on-going: interim results of specialist studies are included below in a provisional description of the vessel.

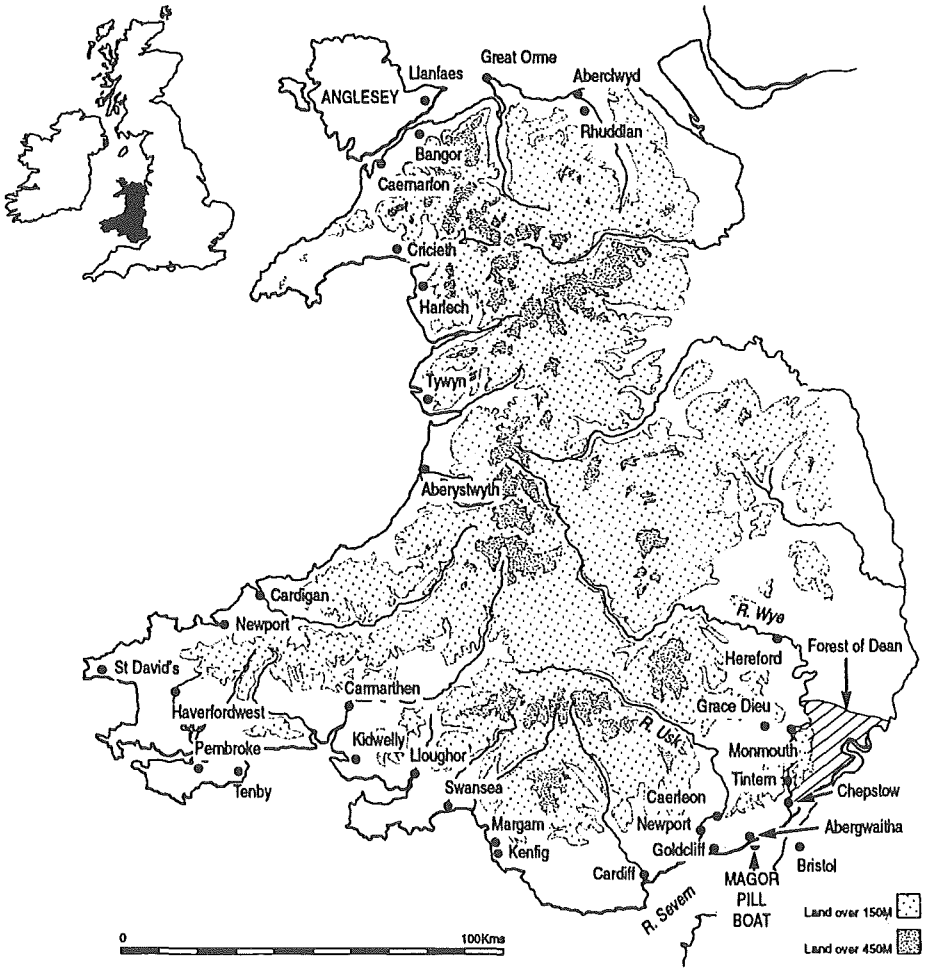


Fig. 1. - *Coastal Wales in the thirteenth century, showing main places mentioned in the paper. (Drawing: National Museums & Galleries of Wales)*

The boat structure (Fig. 2)

The vessel as found comprised the incomplete forward section of a clinker-built vessel. The surviving section measured about seven metres in length and up to 3.3 m in width, and appeared to have undergone selective salvage and subsequent collapse and erosion. Unless otherwise stated, all the timbers are oak (Quercus Spp.). A rabbeted keel was incomplete and survived from the midships area to the bow end, where it was attached to an eroded and incomplete stempost by a modified through-splayed scarf secured horizontally with iron nails. The rabbet on the keel was carried forward onto the stempost to receive the hull planking. Six clinkered strakes of radially split planks survived on the starboard side, while on the port side up to ten strakes survived. Five floor timbers and fragmentary remains of side-frames were secured with wooden treenails. Ceiling planking survived in a restricted area where an overlying remnant of a cargo of iron ore, placed on a laid hurdle, had prevented its removal by either salvage or erosion.

The stratigraphic context of the vessel has been investigated in the restricted area where excavation was necessary for recovery of the remains, and in a subsequent transect of test pits immediately to the east. She appeared to rest on the south-south-west edge (near the right bank) of a palaeochannel running from east-north-east to west-south-west. This offers a partial explanation for the differential survival of structural elements of the boat. The bow and port side may have become partially embedded in the soft river bed/ bank near its southern edge, leaving the stern and starboard side more exposed nearer to the centre of the channel which promoted the break up and loss of the latter elements. The base of the vessel's keel lay at about 2.1 m below Ordnance Datum and the stempost survived to a height of 1.2 m below Ordnance Datum, with the erosive interface of the palaeochannel defined by a spread of fine grade ore washed out from the wreck.

Structural elements are described in approximate construction sequence and, in order to allow comparison with broadly contemporary boat finds, are considered in terms of attributes used to characterise the substantial set of boat timbers excavated in medieval Dublin (McGrail 1993).

Keel

The keel, with an incomplete length of 4.56m, was hewn from either a whole oak log or a boxed-heart baulk of timber. The upper surface was worked to a convex cross-section and rabbets were cut along both sides with moderately sharp deadrise angles of about 45-55° to receive the garboard strakes. At the approximate midships position, its overall depth (214 mm) and width (215 mm) are more substantial than might normally be anticipated in a vessel of this size (cf. McGrail 1993, 35). The moulded (126 mm) and sided (158 mm) dimensions of that part of the cross-section protruding below the garboards, give a ratio of 0.8 which is comparable with keels from Dublin and Scandinavia (cf. McGrail 1993, tables 5 and 6). At the forward end, the keel was attached to the incomplete stempost with a modified vertical through-splayed vertical scarf (angle 24°) secured with iron nails. Approximately 0.4 m behind the scarf, a sub-rectangular hole had been augered and cut through the keel below the rabbets, and subsequently sealed with an oak plug. The hole was presumably cut to assist hauling out of the vessel onto the foreshore/ beach, and wear on its forward face supports this interpretation. The sternmost surviving portion of the keel is damaged and incomplete, although there is some thickening in the midships area. As yet, it is unclear whether this damage is the result of the vessel having broken her back when she foundered, the result of salvage attempts or the result of post-depositional erosion by later palaeochannel action.

Stempost

The wedge-form stempost is incomplete at only 525 mm in length, 275 mm of which forms the linking scarf to the keel. Shallow rebates for the garboards only, including their forward ends, continue the rabbets from the keel. Although curvature in the surviving portion is slight, the scantling reduces from astern (475 mm moulded, 300 mm sided) to forward (420 mm, 210 mm). To judge from the growth pattern of the surviving timber, the stem was probably made in two or more sections, scarphed together.

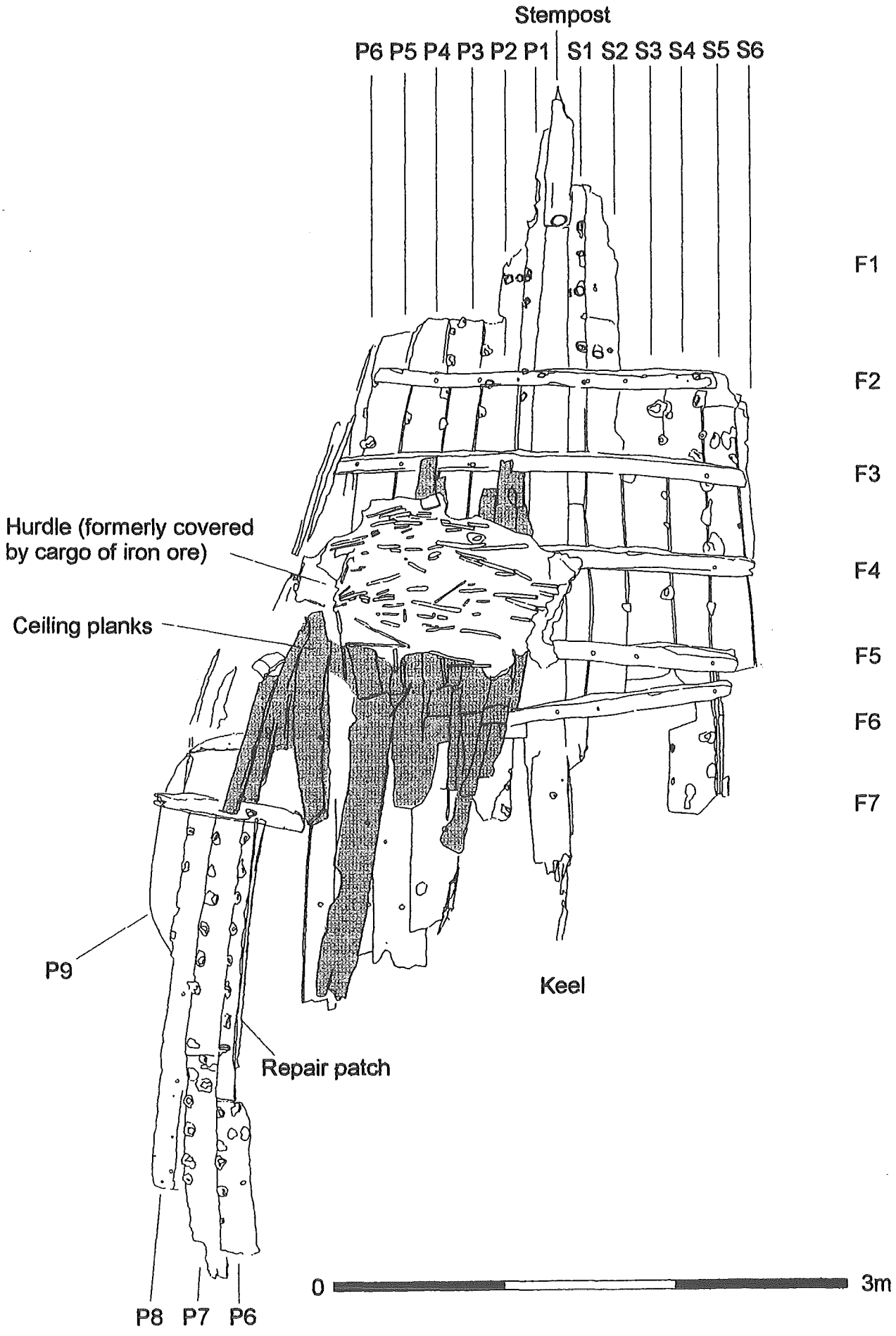
Planking

The hull planks were hewn from radially split oak trunks of straight grained mature trees. Dendrochronological analysis indicates that at least twenty-two of the planks were derived from only two trees, 147 and at least 154 years old at felling. The uniformity of the timbers could be taken to imply direct supply of wood from woodland to shipbuilder in contrast with the diversity of source for wood seen in other broadly contemporary structures, including boats (e.g. reused hull planks from Penner Wharf, Bristol; Groves & Hillam 1987), suggestive of more complex methods of wood supply involving large wood yards in urban contexts.

The garboard strake planks forming S1 and P1 (three of which survived on each side) were 180-220 mm wide and approximately 20 mm thick, hewn from radially converted timbers. They had been worked on their outboard faces to continue the curved cross-section of the keel giving something of a 'wine-glass' transverse section to the vessel. The inboard faces were hewn to an angled cross-section to allow the strakes to fit closely in the keel rabbet and define the angle between the faying surfaces of the garboard strakes and the floor timbers. The planks which make up the garboard strakes were secured in the keel rabbet and stempost with round-headed nails (26 mm diameter head) driven through the planks from outboard into the keel at intervals of 120-200 mm. Planks along the same strake were scarfed to one another with feathered ends secured with round-headed nails (normally two per scarf) turned over roves on the inboard face ('through-splayed on edge, face-nailed', McGrail & Denford 1982, 35).

Subsequent planking was overlapped and attached by nails driven from outboard through an inboard rove and then clenched. Organic residue in the keel rabbet and between overlapped planks contained wool, the remains of caulking (Ryder, pers comm). The starboard strakes, beyond the first, garboard strake (S1), comprised two feathered planks and associated fragments at S2, a single plank at S3, a single plank at S4, two feathered planks at S5 and fragments of two planks at S6. The arrangement of planking on the port side was less clear because of collapse and displacement, especially of planking beyond the position of floor timbers. Single planks survived at P2 and P3, two feathered planks at P4, the same at P5, and at three at P6. The upper port side had collapsed along the line of a longitudinal split in P6 which had been repaired in antiquity (see below), and the original location of these timbers was not immediately apparent. Three planks survived at P7 and single planks at P8 and P9. During excavations prior to recovery of the vessel, a detached plank fragment uncovered just to south of P9, may be the only remains of the tenth and possibly last port strake. The planks were generally 250-300 mm wide and 15-30 mm thick. The overlaps between planks from adjacent strakes, usually 40-50 mm wide, are often marked with distinct scores, interpreted as intentional marks used to define the extent of overlap. Bevels cut along the overlaps ensured a close fit between planks and defined the profile of the vessel. Planks along the same strake were scarfed in the same manner as the garboard strakes, and fastened to one another with

Fig. 2. - *Plan of boat as excavated. (Drawing: Glamorgan-Gwent Archaeological Trust Ltd)*



round headed nails driven from outboard and clenched over roves at spacings of 150-200 mm.

Frame groups

The presence of floor timbers/side-frames, treenail holes in planking (with diameters of 20-30 mm) and intentional marks defining the faying surface of the frames on the hull planking provide evidence for nine frame groups. Four floor timbers (F2-F5) were still in position, spaced between 0.5 m - 0.55 m apart (measured between centrelines), while the floor at F6 was displaced, especially on the starboard side. Floor timbers were joggled to match the underlying planks and attached with treenails to the hull planking, but not the keel. No timbers survived at F1: only treenail holes through P2 and S2 indicated the former location of framing timbers. The floor timber at F6 exhibits two redundant auger holes on the upper surface and a slight waist which suggests a seating for a mast-step or keelson. The floor timbers appear to have been hewn from slightly curving main trunks, or branch wood, the boatbuilder having often exploited branching timbers ('natural crucks') for optimum strength. Although some of the floor timbers have notched limber holes on their underside to allow free movement of water in the bilges, no limber holes are present at F2 and F3 as the timbers here were not in continuous contact with the keel and hull planks. They were secured to the shell of hull planks with willow treenails driven through augered holes from outboard and secured on the inboard end with oak wedges. Surviving bark surfaces on some of these timbers have enabled dendrochronological dating of the felling season to AD 1239/40 (Nayling 1996).

Side-frames, often incomplete and displaced, survived along the port side at frame groups F4-F8 inclusive. These appear to have been seated over the port end of the floor timbers and extended the framing to P10. As with the floor timbers, these had been joggled to meet the clinkered hull planking and secured with treenails, driven through both hull planks and side-frames, and secured with oak wedges.

Ceiling planks

Approximately twenty ceiling planks survived, nailed to the underlying floor timbers. These were best preserved where covered by the cargo: the presence of poorly preserved remains of iron nails on the upper faces of floor timbers suggest that originally the ceiling planking was more extensive. The majority of the ceiling planks comprised radially split beech (Fagus sylvatica). Dating of these, with the last surviving ring dated to the summer of AD 1240 provides an insight into vessel's building timetable, and reflects a major advance in the construction of an absolutely dated beech chronology from Britain (Tyers 1997). The majority of the analysed beech ceiling planks probably derived from just two trees, one over 330 years old.

Repair

A longitudinal split along the sixth port strake had been patched with two laths of oak secured with nails which had been driven through both of these patches and hull planks before being turned over on the inboard face of the hull planks. Sadly, these patches have not been dated by dendrochronology. In order to gain access to the inboard faces of the sixth port strake, the overlying ceiling planks must have been removed. This may explain why the majority of ceiling planks, to the port side of the third port strake, comprised often reused oak timbers. Four of these have been dated by dendrochronology. One substantial plank, probably felled between AD 1214 and 1248, correlates especially well with tree-ring masters from medieval Dublin, suggesting reuse of a hull plank from an Irish vessel. A second, smaller plank, derived from one of the two oak trees which produced most of the original hull planks, may indicate reuse of a hull plank implying repairs to the hull elsewhere on the vessel. Two further fragments of thin radially split oak, with no clear signs of reuse, are dated to AD1235-1256 and AD1197-1242. Further structural analysis is required before the full implications of this dating evidence can be assessed.

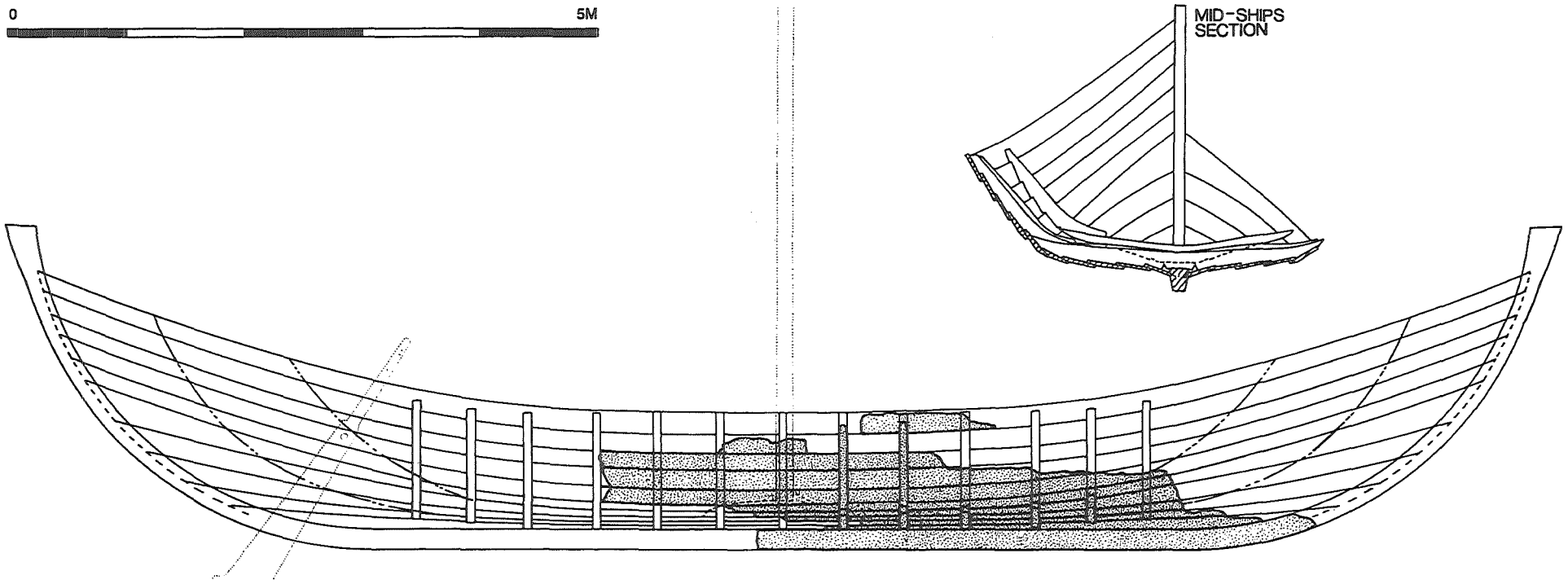
Parallels

The floor timbers share characteristics such as limber holes, profiles, dimensions, with examples from the Wood Quay excavations at Dublin (McGrail 1993, Fig. 66; T55, dated c. AD 1200-25). Parallels have also been found in Dublin for the scarf joint between keel and stem post (McGrail 1993, Fig. 67: T56, a part keel from a ship, dated c. AD 1200-25). Some characteristics, such as the spacing of the frames, the absence of evidence for transverse beams (Bitte), the nature of the change from the bottom to side of the vessel (hard bilges) and details of construction process suggest that the Magor Pill boat represents a regional variation within the 'Northern European' tradition of shipbuilding, operating predominantly in the West of Britain.

Reconstruction

In order to establish the original form of the vessel and the curvature of the surviving planks prior to their conservation, NMGW decided to commission a full-size model of the surviving hull structure. The

Fig. 3. - *Preliminary reconstruction of the Magor Pill hull based on life-size model of the surviving structure (sheer view and midships section of model, looking towards bow). Shading denotes extent of original timbers. (Drawing: National Museums & Galleries of Wales, based on line drawing by E Gifford)*



future display of the boat will present the remains as they may originally have appeared, supported by a metal cradle which will 'ghost' the original shape of the vessel. Consequently the model needed to achieve a number of objectives: i. to model accurately in three dimensions the structural lay-out and shapes of all the surviving timbers (but not original woodworking techniques); ii. to provide a means of assessing the original curvature of the hull planking, and original form of the hull; iii. to fulfil a need to interpret the original boat timbers; iv. to aid the design of a display system for the original boat. Large scale model building has previously been undertaken in Britain of the Saxon ships from Sutton Hoo (seventh-century) and Graveney (tenth-century), where sufficient information was available for quarter-scale models to be made, from which plank shapes could be taken (Gifford 1995). For the Museum's immediate purposes, a model of the surviving hull only was required, based strictly on the 1:1 acetates and numerous cross-sections of each individual timber. The archaeological documentation was prepared by NMGW in conjunction with GGAT; the construction of the model was undertaken by E.W.H.Gifford and craftsmen at Griffon Hovercraft Ltd., Southampton.

The usual method of shell-first construction could not be used in the case of the Magor Pill boat, as this requires complete runs of planking to create the shape. There were several problems to resolve:

- the shape and size of the stem had to be derived from the forefoot fragment which fortunately was just of sufficient size to give a probable curve (radius of 3 m), but not the height.
- the midships point of the vessel had to be established (from the blind treenail fastenings from the (missing) mast-step and the curvature of the hull planking.
- the original shapes of the frames, some of which may have been slightly deformed, had to be established.

The construction strategy was to start with a preliminary lines drawing at 1:10 scale to fair the frames, then to set up the stem, keel and alternate frames on trestles so that adjustment could be made, if necessary, when the planks were offered up. The correspondence of nail holes was to be the essential check on the shape of the hull. The line drawing was progressively revised to help shape the new planking needed to bridge the gap between the planks as found and the new stem and produce a sheer line compatible with the evidence from other finds and contemporary iconography. Figure 3 shows the hull form of the 1:1 model as built, but graphically extended about the estimated midpoint to provide a complete vessel profile. The outer planking is also depicted as if viewed from the inside. Extensive 'gap-filling' has been needed between surviving structure and projected stem, and other sheer lines can be projected with 'flatter' midships sections and steeper sheer at both ends, reflecting the curvature recorded on some of the groups of planking from Dublin (e.g. DST297-304; DST312-29; McGrail 1993, 133-4. 138-9). It has been assumed, on the basis of the surviving section of stempost, that the outer planking would have been bevelled at the end of each strake, possibly with a curved lower edge to provide a broad landing on the post to which it would have been nailed.

The planks, of green larch, were cut and drilled according to paper patterns printed from the 1:1 acetate tracings of the original timbers, and shaped to the bevels and cross-section thicknesses of the planks. Existing scarfs were bolted, but those needed in the new planking were also glued. Keel and frames were of seasoned pine and the stem was laminated from plywood. The positions of the ends of the original planking were marked with black paint lines and the hull was painted with one coat of linseed oil/ white spirit in equal parts.

The original craft would have been double-ended, and was well-shaped with a flat floor and firm bilges to give good stability and load-carrying, as shown by the buttock lines and the diagonal.

Boat peformance and function

Performance is as yet untried, but at this stage of analysis a number of general points can be made for future testing. The Magor Pill boat probably had a single, square-sail rig, and wuld have been capable of coastal and interestuarine, short sea voyages under sail. The fine ends would have allowed a speed of about six to seven knots in a moderate breeze, and there is sufficient depth of hull and keel to provide a good windward capability (Gifford, in litt.). The upswept bow and stern would be suitable for beach landing, and it is evident from the wear on the hole in the keel near the stem that the vessel had been frequently hauled out. Such a fastening point will have been of benefit in securing the boat on a falling tide, in an area where the tidal range is great (12.3 m at Avonmouth) and mudflat gradients steep. The ship appears to have been well suited to sail the Severn Estuary, and with a strong crew she could work in Force 6 and probably survive Force 7. A preliminary estimate of her shallow draft at about 0.6 m, and her flat floors and firm bilges would have provided good stability and load-carrying.

The boat contained iron ore lying upon a wattle hurdle, and appears to have conveyed bulk commod-

ities (amongst other lost components of cargo) during the last stage of her life. The preliminary results of the scientific analysis of the ore (in progress) indicate a possible source within the Forest of Dean (T. Young, pers.comm.), and the final results will be important for our understanding of iron smelting in the thirteenth-century.

The shipwreck

Common sense suggests a number of possible causes for the sinking of the boat. She may have collided with other vessels in the tributary mouth, or been brought in damaged to sink at anchor or while trying to beach; her cargo may have shifted, bringing water over her sides; driven by prevailing winds and strong currents, she may have hit the channel mouth in a heavy swell, the force of grounding splitting the hull with its heavy point loading of iron ore; longitudinal stress on the keel may have snapped her near midships, the heavier cargo pinning the bow portion to the channel edge, and preventing economic salvage (for which limited evidence exists). Further work by GGAT around the boat's findspot has confirmed that the boat came to rest on the western edge of the former channel of a minor tributory of the Severn, though it is not certain how wide this was in the thirteenth century. Some 350 m ENE of the boat and 350 m seaward of MHWM was a fishing structure dated dendrochronologically to c. AD 1120, suggesting with other evidence that the thirteenth-century coastline lay perhaps 400-500 m seaward of the present MHWM. The boat appears to have one weakness, which could have proved her undoing. The sideframes were fastened to the floors with only two treenails. All those found were broken, and there is no evidence of permanent cross-bracing with deck- or through-beams or permanent thwarts. It may be that the shock of a steep wave and/or a grounding forced the gunwales apart by breaking the treenails, thus transferring the whole of the longitudinal bending moment onto the keel, which then snapped near amidships. The concentrated weight of the iron ore cargo could have contributed to this.

Discussion

The Magor Pill boat is the most complete medieval 'keel' to be found in Welsh waters, belonging to the Northern European tradition of boat building tradition. That the Welsh used boats of this type in the eleventh century is indicated by the Anglo-Saxon Chronicle's account of earl Harold's march on Rhuddlan and references to Gruffudd ap Llywelyn's ships, their sails and the figure head of his ship – in other words, ships similar to those operating out of Dublin in the 1060s.

The wreck was found close to the presumed site of the minor port of Abergwaitha (river mouth, works), which may have been attached to Tinter Abbey"s Lower Grange (Moor). The port is first recorded in 1245, when the keeper of the mill there assumed responsibility for maintaining the watercourse in Whitewall. A reference of 1327 describes Abergwaitha as 'now wholly deserted', but sporadic references indicate some form of activity until at least the sixteenth-century, when in 1561 the pill was called 'a great landing for boats with butter, cheese and other kyndes of vittalles to ships' (Robinson 1970).

Any visitor to the area today will be aware of the distance between the opposite shores of the Severn (one mile at the Severn Bridge to twenty between Worms Head and Ilfracombe). This struck Leland writing in the 16th century – the connection betweeen the two shores of what he described as the Severn Sea. The thirteenth century saw a rise in seaborne trade: Welsh hides, leather, wool and fish from the West to Bristol, timber iron and coal from the forest of Dean. Tenby, for example, granted its charter in 1290, was noted in the Middle Ages for the importation of wine, and export of cloth and hide (Griffiths 1984, 78). In addition, the coastal distribution of 13th-century pottery such as Vale, Ham Green, Bristol and North Wiltshire wares point clearly to the movement of pottery by ship. During the campaigns of Edward I in the 1270s, Severnside military, maritime and commercial resources were put to effective use, soldiers and tradesmen from Bristol Channel ports frequently being drawn to assembly points in South Wales. The Magor Pill boat represents the type of craft engaged in such activities, at a period when Newport, Caerleon and Chepstow were all seaports, and the River Wye was navigable as far as Hereford. The postulated handling characteristics of the boat as reconstructed would have allowed her to ply the Bristol Channel, and operate along the south Wales coast, possibly as far as Ireland in fair conditions. Her shallow draught certainly made her admirably suited for travelling up main rivers to ports such as Monmouth and Caerleon (Fig. 1). The type of timber used to make the boat is consistent with construction on the shore of the Severn Estuary or its tributaries.

The tradition of iron making away from the ore-bearing formations has been noted as a feature of the Forest of Dean in the later Roman period (Fulford & Allen 1992, 205); if final analysis establishes that the Magor Pill ore came from the Forest of Dean, this will confirm that the River Severn (and Wye) also

played an axial rôle in the distribution of high grade ore (and also finished products) during the 13th century. The rise at this period in the exploitation of Forest of Dean iron ore, which had the advantage of being a low phosphorus haematite ore of high quality, coincided with an increased use of the seaways to service the new towns and castles of Wales during the period of Anglo-Welsh wars. It is possible that the rich ores exported from Dean may have been blended with leaner ores from sources closer to the iron-making settlements, as has been suggested for the area during the Roman period, when many sites appear to have supplemented a farming economy with ironworking (Allen & Fulford 1987, 279-81). The association of free-miners of the forest community had privileges recognized in royal prescripts under Henry III which contrasted to the regulations governing ordinary forest dwellers elsewhere. Members of the free miners controlled not only extraction but also its export to the region along the Severn; carriers paid dues to the miners on penalty of having their boats confiscated (Hindley 1990, 93). At medieval towns such as Monmouth and Trellech, seasonal smelting is recorded, smiths being licensed for parts of the year, and such towns have produced evidence for bloomery activity along stream or river banks, and masses of medieval slag have been uncovered by excavation. The rôle of seigneurial initiative in establishing boroughs as centres of specialisation and exchange was an important factor, for at many towns iron making formed one part (though not the only basis) of the economy (Davies 1987). The Cistercians, who had a grange at Moor on the coast at Abergwaitha (Magor Pill) and owned ships to transport their agricultural produce, were also engaged in mining for ore and smelting, and obtained iron ore from mines in the Forest of Dean (where Tintern Abbey had two forges; Williams 1965, 12). Tintern's boats could ply as far as Bristol, and in 1268 one was seized and plundered by men of Bristol on the Wye (Williams 1984, 316). Grace Dieu Abbey also obtained ore from the Forest of Dean, having been allowed to mine 'as much ore as necessary' for its two forges at Penyard (Herefordshire) by Henry III (Williams 1984, 328).

Who may have owned her? Apart from the king, institutions and merchants could own ships, though the latter often employed others to man them and handle the goods. The miners of the Forest of Dean were required to include the lord of the soil, whether king or private landowner, as one of the partners (verns) with a share in the proceeds (Hindley 1990, 94). As previously mentioned, the Cistercians owned ships and were engaged in smelting, and obtained iron ore from mines in the Forest of Dean. In 1234 Margam Abbey owned a ship, and in 1235 Neath Abbey was licensed to trade with England using its ship, called hulc. A succession of boat ownership was also common, and it is no easy matter attributing nationality to a particular craft: for example, an unnamed Cardiff vessel was seized by English officials at Pembroke in 1216 carrying wine and chattels to Dublin and men from Drogheda (Ireland). In May of that year King John gave the ship to William Marshall, Earl of Pembroke. By February 1218, Marshall had sold the ship to Peter Blunt, a Drogheda merchant: in other words, the boat was Welsh, English and Irish within a few years (by seizure, gift and sale: Friel 1995, 28-29).

We may never know the precise circumstance of the loss, but the present research programme will shed further light on her last voyage: whether its cargo shifted leading to capsize, whether the boat was swamped after springing a leak, or whether it broke its back in a raging sea. The final story of the Magor Pill boat will form a centrepiece within an exciting display in Cardiff: a 'time capsule' of medieval seafaring off the Welsh coast from the time of Henry III and Llywelyn ap Gruffudd. The boat provides an opportunity to contrast our perception of thirteenth-century coastal transport through the medium of contemporary sources with the reality of a well-preserved hull and her cargo.

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The excavation, raising and current programme of conservation will be covered by Diane, Senior Conservator in the Dept.

For ships in Welsh waters, there is the interesting story of a large ship, notable for its size and furniture, becalmed in the mouth of the Avon in 1275 (year after Evesham) and being offered safe passage by cives to the port of Bristol. On board were Almeric de Montfort, and his sister Alianor (daughter of Simon de Montfort), on way to Wales to marry Llewellyn ap Gruffudd. They were imprisoned in the castle. Eventually she married him in 1278.

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Mark Redknap
Department of Archaeology & Numismatics
National Museum & Gallery Cardiff
Cathays Park
Cardiff CF1 3NP
Wales

Nigel Nayling
Glamorgan-Gwent Archaeological Trust Ltd.
Ferryside Warehouse
Bath Lane
Swansea,
Glamorgan, SA1 1RD
Wales

Karel Vlierman

A caulking method used as an aid to dating shipwrecks from the Hanseatic period

Introduction

Besides vessels dating from the 17th, 18th and 19th centuries, quite a large number of late medieval ships have been found in the province of Flevoland (land reclaimed from the former Zuyder Zee; Fig.1). The oldest of these is a cog (*kogge*), sunk at the end of the 13th century. By means of combining data, it is often possible to determine precisely the moment of sinking for each of the 435 wrecks known to date (Vlierman 1983, 1). This provides a unique possibility to date objects that are otherwise usually difficult to date.

Almost all of the medieval vessels investigated to date have been caulked in a very characteristic way. In the case of both clinker and carvel secured planks, more or less V-shaped grooves are made along the seams and these are filled with moss. The moss is pressed into the seams using thin, narrow laths of wood and is held in position with iron cramps, each cramp having two peripheral lugs (the so-called *'sintels'*). These *'sintels'* are hammered into the wood on either side of the seam (Fig. 2).

There are various shapes of *'sintels'* known. A relationship has been established between the shape of the *'sintels'* and the date of the ship within which they are found. The different shapes can be divided into three categories comprising six types (Vlierman & Van Dijk, 1980; Fig. 3), based on fifteen finds. More than eighty Dutch and foreign finds are now known. The number of variations in *'sintel'* shape has therefore increased somewhat, although the number of categories and types remains the same.

The data on *'sintels'*, collected over a period of more than fifteen years, have been carefully checked against historical sources dating back to the medieval period. This supplies information on both the different materials used for caulking (oakum, in Dutch *'werk'*), and on the medieval terminology. Changes in *'sintel'* shape that had previously been established can now be dated more accurately. The results of the research have been published recently (Vlierman 1996A) under the title of *'... Van Zintelen, van Zintelroeden ende Mossen...'*, an enumeration of materials used and the charges paid by the city of Antwerp for the maintenance of a *'Baardze'*, a kind of war ship, dated 1401 AD (Verwijs & Verdam 1885, VII 1165). A surprising result of the research has been the association of *'gesinteld mosbreeuwsel'* (the newly introduced Dutch name for this caulking method) with the Hanseatic period.

With the typological dating, account is taken of the age of the ship on sinking or the chronological deviation of the *'sintels'* compared to the context in which they are found. The general dating of these time-spans is determined by the number of repairs, the quality of the ship's hull (young or old, 25 to 50 years) and, in a few cases, the results of tree-ring or radiocarbon dating where these are known. Table I (Fig. 4) lists the types and variants known until 1994 and their associated dating. Recent *'sintel'* and *'sintelnagel'* finds will allow for a more precise and accurate dating of the different transitional types in the near future.

Archaeological and historical sources

Archaeological sources indicate that, in general, *'gesinteld mosbreeuwsel'* was in use in regions to the north of the Alps from c. 900 AD (Duisburg, from the end of the 9th century; ship's fragment from 'Bull' Wharf London, 956 to 985 AD). The oldest example from the Netherlands (until mid-1996) dates from the early 11th century (the barge from Utrecht, Waterstraat, 1004 AD $\pm$ 6 years: De Vries, 1983; or even earlier, 1198 $\pm$ 23 BP = 780 to 890 AD: Van der Plicht/ Lanting 1994, written communication). Ship's fragments of river barges (*'aken'*) with *'gesinteld mosbreeuwsel'*, discovered during recent excavations at Tiel, have a dendrochronological (fell) date of 986 AD + approx. 5 years = c. 991 AD (Hanraets 1996, written communication). The method was not used in the construction of new ships in the Netherlands after c. 1550 AD.

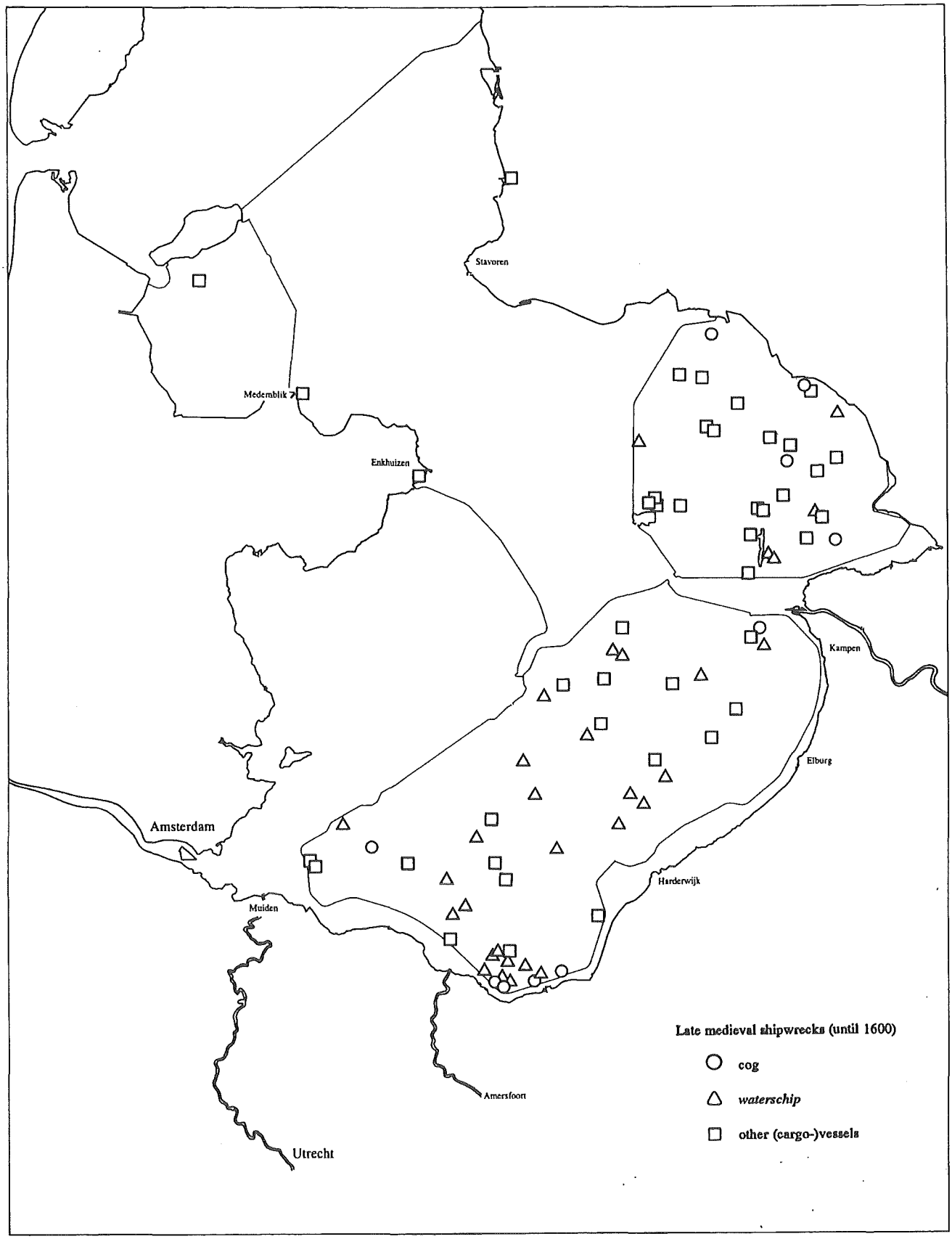

Fig. 1. - *Late medieval shipwreck sites in the Netherlands Zuiderzee region (Province of Flevoland, Vlierman 1993).*

The use of *'sintels'* is mentioned in historical sources of the 14th to 16th centuries. After the 16th century the method was no longer mentioned by well-known maritime authors such as Witsen 1671 and 1690, Van Yk 1697, Van Lennep 1857, Mossel 1859, and Schokker 1861. The method and names of the materials used, with the exception of moss, are not found within the modern Dutch language in this

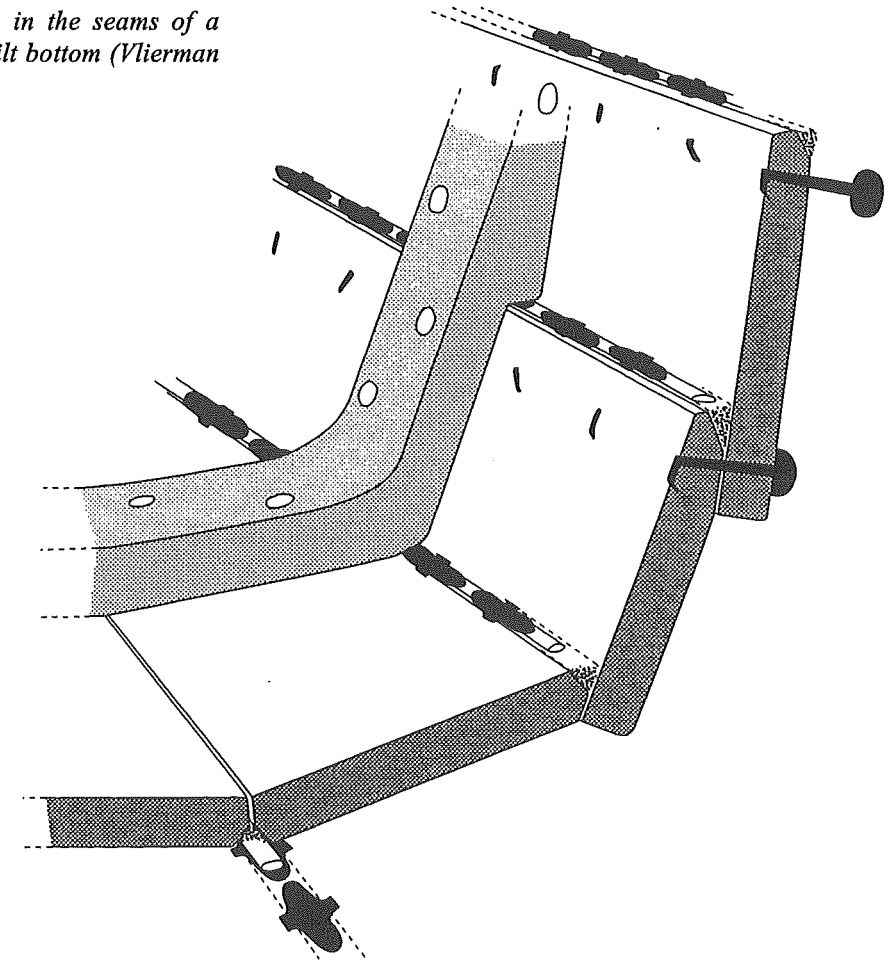

Fig. 2. - 'Gesinteld mosbreeuwsel' *in the seams of a clinker-built vessel with a carvel-built bottom (Vlierman 1996A).*

context, but were probably used locally by ship's carpenters in isolated areas with their own ship-building traditions until the beginning of the 20th century.

In Middle Dutch and Middle Low Germanic sources (mainly accounts for the maintenance and construction of vessels), we regularly come across a list of the materials used and described by their medieval names. The word *'sintel'* (Verwijs & Verdam 1885, VII 1165 and Lübben & Walther 1965, 349) is used to describe an iron cramp with two peripheral lugs; the amalgamation to make the word *'sintelnagel'* is used to describe a small iron clamp with the same function, the earliest form of the *'sintel'*; *'sintelroede'* stands for the lath which is used to press the moss into the caulking seam. The word *'naghelhout'*, as well as meaning wood from which nails or pegs can be made, can also be a description for *'sintelroede'* in eastern Dutch/Low German, a meaning which has gone out of use in the course of time (referring to Van Dalen-Oskam 1994, written communication).

These originally medieval words have been reintroduced in the report. The term *'gesinteld mosbreeuwsel'* is introduced to describe the method, hitherto described as *'gesinteld werk'* (Sopers 1974, 33). *'Werk'* (oakum) is actually the term used for old twined hemp rope, the material that, according to the above-mentioned maritime authors, has been preferred for use in caulking since the end of the 17th century. However, this material has not been found in the more than 200 wrecks investigated so far in the

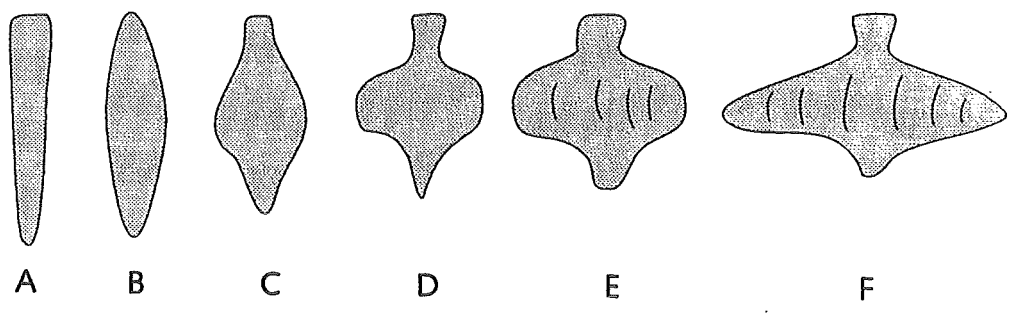

Fig. 3. - *Developments in the shape of* 'sintelnagel' *(type A) to* 'sintel' *(type F, Vlierman 1996A).*

province of Flevoland. In the (later) Middle Ages, only moss was used in combination with *'sintels'* and *'sintelroeden'*, with the exception, of course, of the ships built according to Scandinavian ship-building traditions in which essentially (cow) hair was used.

From the recorded archaeological finds of *'gesinteld mosbreeuwsel'*, it can be concluded that the earliest type of *'sintelnagel'* (A) maintains the same form from at least the end of the 9th century until well into the second half of the 11th century. Around c. 1150 AD, the elongated trapezium shape developed into an elongated rectangle with either pointed or rounded ends. Between c. 1150 and 1225 AD, the form changed very quickly (although probably not at the same rate in all areas) from a laurel leaf shape (type B and C) into a true *'sintel'* (type D). This was the case in the area lying between southern Scandinavia, i.e. Denmark and north-west Russia in the north and Flanders and the Lower Rhine area in the south. A relief from the Sainte-Chapelle in Paris (built between 1245 and 1247 AD) indicates that the *'gesinteld mosbreeuwsel'* (as a 'foreign' caulking method) was also known in the region of the Seine basin. The further development to the last type (F) in the 15th and 16th centuries in fact took place in this area of north-western Europe. This area, as well as the period concerned, coincide with the rise of Hanseatic league prosperity. This is confirmed by the fact that the names *'sintelnagel'*, *'sintel'* and *'sintelroede'* appear in both Middle Dutch and Middle Low German.

Sintel(nagel) types

In the 19th and 20th centuries, types A (1) and B (category 1) are found in the region of the Upper Danube basin (down to Hungary), southern Bavaria, the whole of the Swiss plateau, the north of Savoy and the Saône basin.On the basis of a comparative study of the caulking methods used on boats from Bevaix and Yverdon (where the *'sintelroeden'* were secured using nails instead of cramps or *'sintels'*), Arnold (1977, 293-297; 1992, II, 87-94) concludes that the method evolved locally and remained in use in the above-mentioned areas in and directly to the north, west and east of the Alps. No actual archaeological evidence has, however, been found from these areas for the period c. 200 to 1800 AD.

The types A and B do not appear to evolve within the above-mentioned areas (basin areas of the Danube and Rhine up to Karlsruhe) from the early 13th century onwards, but remain in use until the 20th century. This may also have been the case for these as well as some later types in a few localized areas of eastern France and north-eastern Europe. Type E appears to remain in use in the most southern Lower Rhine and Moselle region into the 19th/20th century. In the bordering Meuse region this was also the case until the 17th century. This may explain the difference between the typological date of the *'sintels'* and the results of radiocarbon analysis for the Kessel barge (Vlierman 1996B, 1.2). There are indications that *'sintels'* were also used in the bottoms of ferries and horse barges in the Netherlands until the 20th century (locally, along the larger rivers). What remains uncertain, however, is the shape of the *'sintels'* used in such instances.

Type D, in use around 1250 AD, is a cramp with a hammered out middle section. From this type on, the name *'sintelnagel'* (used for types A-C) should be replaced by the name *'sintel'*. In order to make the different types, the medieval smith probably used the same or a similar semi-finished product for his basis material as that which he would have used to make nails: a more or less square-shaped iron rod, approx. 5 x 5 mm in section, that tapers at one end and is cut from a longer rod after each *'sintelnagel'* is forged. In the case of nails, the cut off end was shaped into a head using a nail iron. Figure 5 shows the transitional type D2/E in a boat from Oosterhout.

Type E came into use at the end of the 14th century; a *'sintel'* that demanded more smithing skills, which therefore resulted in numerous variations in the shape and size, and which further evolved into an elongated shape forged from two pieces of basis material. These were possibly described in the *'kameraarsrekening'* (Chamberlain's account) from Deventer dating from 1428 *'... 1900 sintelen mit langen sterten...'* (1900 *'sintels'* with long shafts). The last type (F) was made around 1450-1460 at the earliest, according to finds to date.

The *'gesinteld mosbreeuwsel'* was applied to clinker-built constructions before the frames were put in place and should therefore be seen as a part of the 'shell first' construction technique. For cogs, this is only done on the sides and the fore and aft of the bilge (Fig. 6). The caulked seams on the underside of the carvel-built part of the bottom were sealed at a later stage.

Caulking seams and *'sintelroeden'*

Apart from the changing shape of the *'sintels'*, there is also a change in the caulking seams themselves. In general, it can be established that completely open, straight to trapezoidal seams are to be seen on the oldest (10th to 12th century) river vessels. These are completely filled with moss and are finished on one or both sides with *'sintelroeden'* and

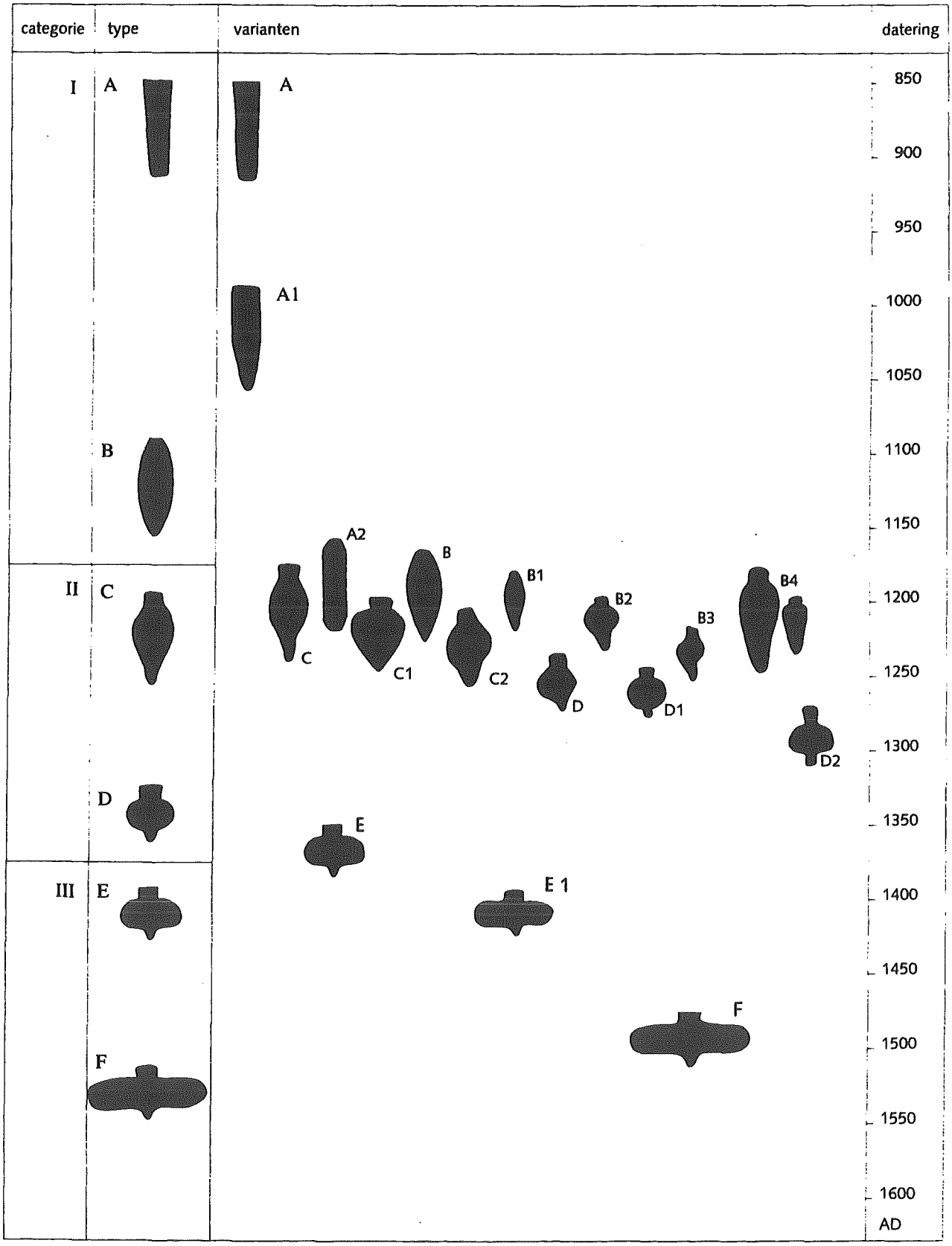

Fig. 4. - *Overview* 'sintel(nagel)' *types (end 1994, Vlierman 1996A).*

'sintelnagels' or in combination with nailed-on covering laths. At a later date, the seam becomes V-shaped in carvel-fitted bottom planks. The partly chamfered bottom seams, forming a more or less triangular-shaped caulking seam are first encountered on the mid-12th century Kollerup cog and, in the Netherlands, on the early 13th century small boat Meinerswijk II. After this point, the shape remains

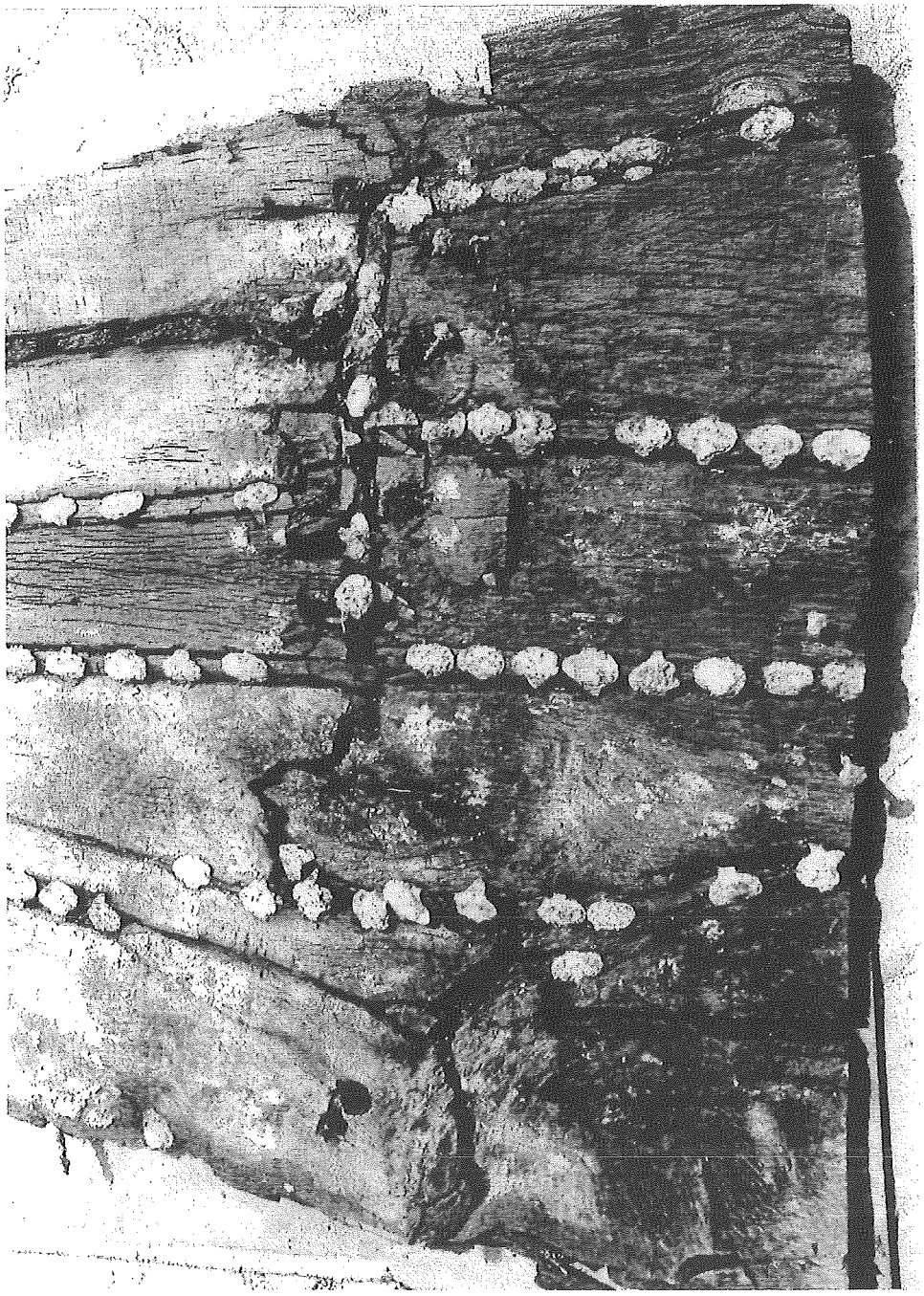

Fig. 5. - *Transitional* 'sintel' *type D2/E in the bottom seams in a late-14th-/ early-15th-century boat from Oosterhout.*

the same. The latest example of *'gesinteld mosbreeuwsel'* is encountered on a fishing vessel (*waterschip* W10 O.Fl.) that was built around the middle of the 16th century. In this case it could have been used to repair or maintain leaking seams within the carvel-built *bundeken* (well deck).

The recent finds (1996) of *'gesinteld mosbreeuwsel'* on the 10th-century ship's fragments from Tiel bore out the statement (Vlierman 1996A, 22) that (the 10th to 12th century) *'sintelroeden'* were made of split (willow) twigs. The same applies to a 16th century cargo vessel of a medieval hull design on lot L 89 in Flevoland, a N.I.S.A. excavation in 1996 by a team of students from Texas A&M University (see: Maria Jacobson & Robert Neyland: *A 16th century ship from the IJsselmeer Polders: technological continuity and change*). A remarkable and first find in the Zuyder Zee area of this 'old-fashioned' use of twigs in 15th/16th century ships.

Subsidiary function of the cramps and other iron construction elements.

Richter (1980, 48) describes the subsidiary function of the *Klammern* (cramps) as being connecting elements for securing planks together on the traditional (smaller?) boats of the Upper Danube. Gritsch

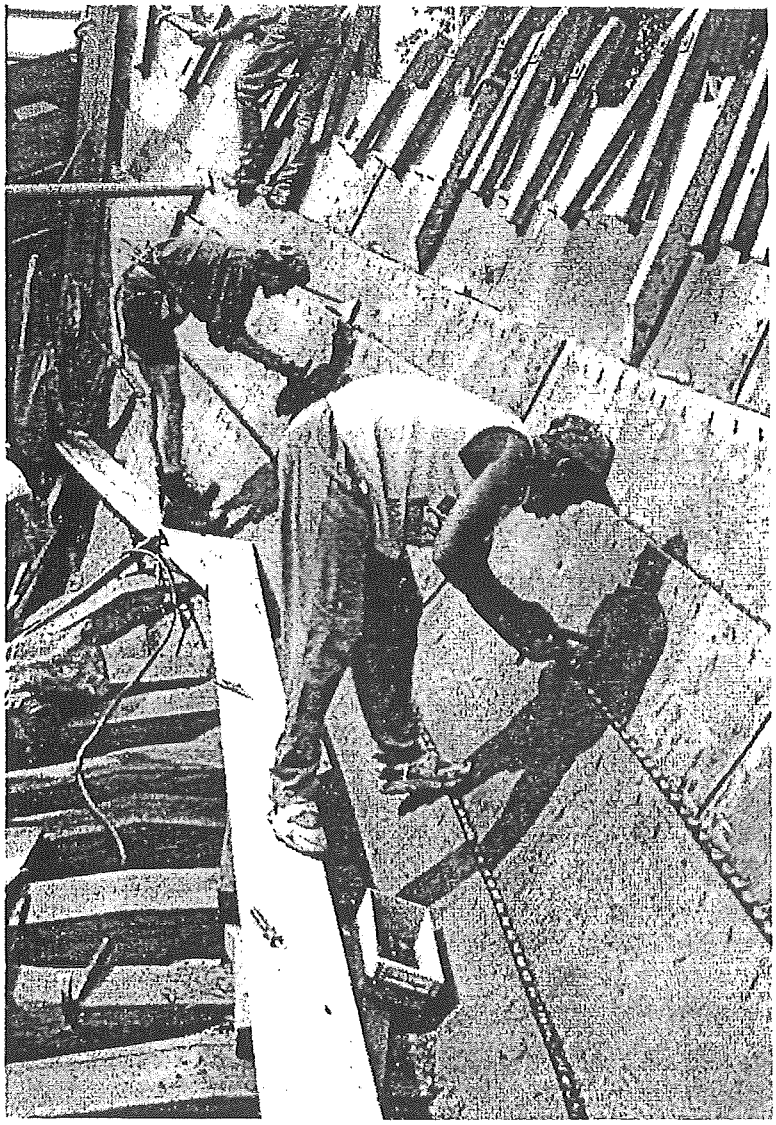

Fig. 6. - *Caulking* ('sintelen') *of the seams on the innersite of the replica (scale 1:1) of the early-14th-century cog from lot Oz 36 Zuidelijk Flevoland, which was build in the old Hanseatic city of Kampen by De Boer & Sars.*

(1987, 49) describes the same for the vessels of the rivers Etsch and Inn in Austria. This shows many similarities to the '*kusedüre*' (sewing or seam work) on the 20th-century Gondola from Lake Como and the Burchielle from Lake Maggiore as described by Bonino (1985, 97). On the basis of linguistic and historical evidence, Bonino believes that this building technique dates back to the Byzantine period, at least on the lakes of northern Italy, and probably originated from Roman traditions.

Within the provincial Roman tradition there are many iron elements and even some iron cramp joins used in (riverine) ship construction (Zwammerdam boat 2: De Weerd 1988, 103, afb. 59), and even more in the Mainzer galleys (Dr J.-M.A.W. Morel, pers. comm. 1995). In boat 4 from Zwammerdam, the nails in the bottom plank timbers and floors were hammered in alternatively from outside to inside and from inside to outside. The nails were then clenched and (mostly) hammered back into the timber. In essence, this is almost an example of iron sewing or seam work (Vlierman 1996A, 54). In the post-Roman period, the use of iron (in western and central Europe?) sharply declined and appears to have come back into use in ship-building on a large scale only in the 11th century.

Conclusion: thoughts and hypothesis

The development of the *'sintelnagel'* into a *'sintel'* and the use of *'gesinteld mosbreeuwsel'* within the cog-building tradition probably took place in the Lower Rhine area and, somewhat later, in northern Germany. The origin of the *'sintelnagel'* is probably to be found in the Celto-Roman riverine ship-building tradition in and directly to the north and south of the Alps (*ibid.*).

This statement has been based on thoughts and hypotheses concerning the archaeological evidence

of 10th- to 13th-century river vessels and the earliest (mid-13th-century) cogs. In other words: where on earth has the Hanseatic cog sprung from?

At this point, I would like to present some of these thoughts and hypotheses, drawn from my investigations on *'sintels'*, 'small' medieval boats and ship's fragments and the cog (Vlierman 1996A, 1996B & in press), and sum up what some other authors have to say concerning the origin of the cog.

As Professor de Boer mentioned in his key-note lecture: this conference should not (only) be the place to present completed research, but more a kind of stock-taking of the various subjects in terms of, for instance, what do we now know about these subjects in a historical and archaeological way. Is it comparable to what has been published, or – put otherwise – which information has been in use at the universities? Is it possible to arrive at new starting points? If so, what are the questions we would like to answer? And in which directions do we have to look for a better, more up-to-date and realistic picture of the subjects of interest?

It appears from written sources that particularly tall German vessels appeared on the sea in the second half of the 12th century. Heinsius (1956, 247-248) drew the following conclusion: '*Offenbar handelte es sich um Fahrzeuge eines neuen Typs*'.

Practically at the same time, the name *'Kokke'*, in the meaning of a tall sea-ship, appears in South-Germanic, particularly in Southwest-Germanic sources.

Charters of 1206 and 1210 AD mention the type name is in the North Sea area, while there is written evidence that the cog sailed the Baltic in the same period. Heinsius *(ibid.* 248) also mentioned a source which presented the information that the cog was in use along the whole of the Germanic coasts and was widely known well into the inland areas of South-west-Germany. A first written indication about four tall sea-worthy Crusader ships from Cologne dates from 1188 AD. Heinsius (*ibid.*) writes: *'Es liegt der Gedanke nahe, dass es sich bei diesen Fahrzeugen bereits um Schiffe des eben jener zeit zuerst genannten Koggentyps handelt'*.

The strengthening of the ship's hull by cross-beams, pierced through the sides, is known from 13th/14th century seals from the Hanseatic area, England and France, which depict the 'cog' as well as the Atlantic 'nef'. The origins of these methods of construction have to be situated in the Mediterranean area (*ibid.*, 38; Zimmermann 1982, 40), where the post-rudder was also known in the same period (Heinsius 1956, 38).

On the basis of historical information, several investigators came to the conclusion that the origin of the cog has to be situated in northern Germany, Frisia or the Zuyder Zee region.

Hagedorn (1914, 16) concludes that the word *'Kogge'* originated from the Frisian language and was mentioned for the first time in the 9th century.

The wrongly interpreted sharp underwater-ship of the cog supposed by Hagedorn makes it improbable that this type of ship originated along the Frisian coast, but he solved this problem by suggesting that the origin of the cog might be found along the French coast. The type of ship in use there, the *'nef'*, might have been constructed with the Frisian post-rudder at some time. Luns (1985, 17) properly observed that this thesis of Hagedorn raises many queries. Another thesis of Hagedorn (1914, 26) is that the tall sea-worthiness and efficiency of the German cogs have had their effect and ultimately became prominent in the southern merchant fleets: *'Innerhalb weniger Jahre waren die Kastenartigen Ungetüme verschwanden. Die Italiener habe der Koggen als bald nach ihren Bedürfnissen ausgestaltet'*.

On the basis of written sources mentioned earlier, Heinsius (1956, 117) supposed that the cog had been developed in Germany along the Baltic coast and built on the basis of a house-building method. Heinsius concludes the summary of his book with: *'Wir werden ferner noch zu klären haben, in welchen Masse die verschiedenen abendländischen Seefahrervölker zu der von den Niederdeutschen eingeleiteten Entwickelung der Grosssegelschiffe beigetragen haben. Doch eines steht fest: Die Bedeutung der Koggen für die abendländische Wirtschafts- und Schiffahrtsgeschichte is nicht mehr zu unterschätzen'* (*ibid.*, 254).

Ellmers (1972, 58-59) looked for the origin of the cog with the Frisians, basing his ideas on several 9th to 13th century sources. Ellmers follows Hagedorn in the idea that the cog, as the prototype of north-western European ships, was increasingly mentioned in the Mediterranean area in the 13th century.

Crumlin-Pedersen (1983, 17) recognizes particular Nordic elements in the ship-building methods adopted by the Hanseatic ship-builders and adapted where necessary. The result (compared with the Viking ships) of this was a vessel made from sawn planks and more simple frames, the cheaper cog which was also more suitable for a larger cargo.

A few of the investigators mention the Mediterranean area as the region of origin of particular construction elements, such as pierced cross-beams and post-rudder, known from Arab vessels.

As mentioned earlier, Heinsius wonders cautiously to what measure the Mediterranean seafarer could have contributed to the evolution of the cog.

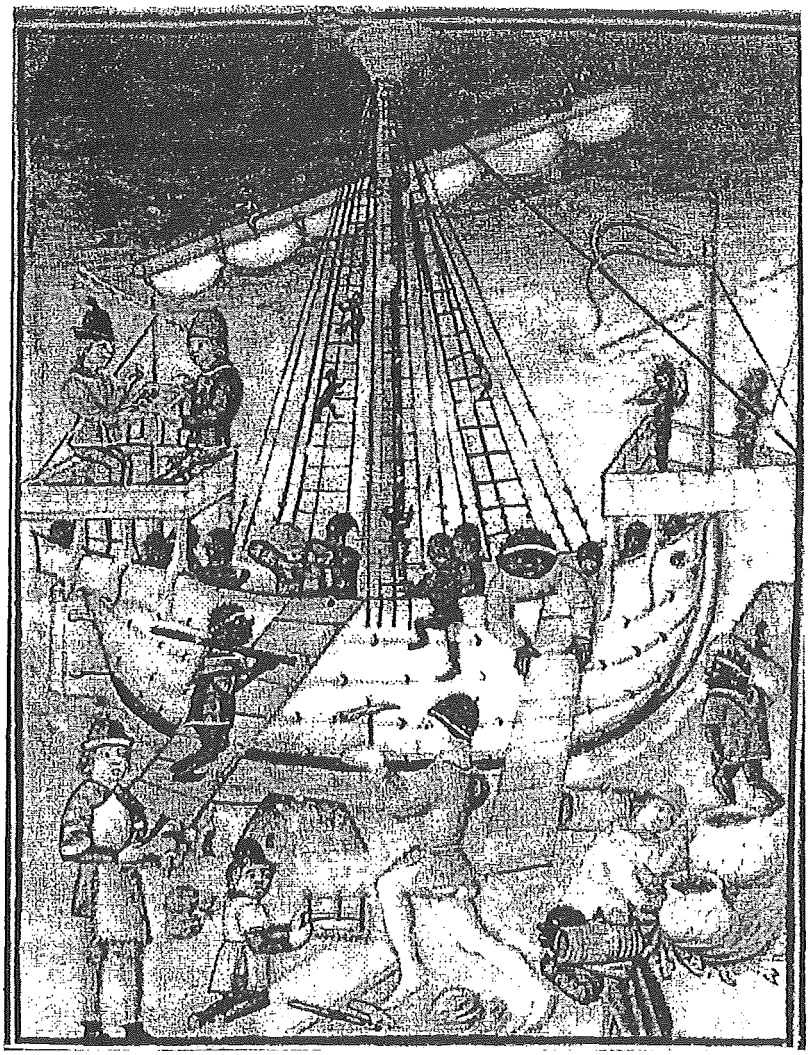

Fig. 7. - *Illustration in the* 'Histoire Ancienne jusqu'à César', *probably showing the caulking of a cog (possibly of an early type) with* 'gesinteld mosbreeuwsel' *(Vol. 31r of MS Douce 353, Bodleian Library University of Oxford).*

One of the conclusions of my investigation on 11th- and 12th-century vessels from the area in which the Hanseatic League operated in later years is: they do not provide any indication that the cog developed from one of these older types of inland river vessels.

On the other hand, we can clearly see from the oldest, mid-13th-century cog finds that there was undoubtedly a well-considered building technology. This building has to have been based on knowledge and craftsmanship which had existed for a long time. That is to say, absolutely no prototype, but examples of a fully developed ship type (Vlierman in print).

Illustrative in this case is also the shape development of the *'sintels'*. As mentioned before, the oldest type (A) does not change between the 9th and mid-12th century and then it changed completely in the Hanseatic area within a period of 50-75 years, while the shape (as of around 1200 AD) seems to have stayed the same for a longer period in the surrounding areas. Besides that, the application of iron construction elements increased tenfold (in the Hanseatic area) during the same period (*ibid.* 1996, 54).

These data, based on archaeological finds, form a indication of a supposedly stormy development of ship-building in this area of north-western Europe during the second half of the 12th and the beginning of the 13th century, an era in which it is more than conceivable - to my mind (*ibid.* in print) – that the following considerations led to further development of the cog.

The development of shipping and the need for greater dead-weight capacities keeps pace with the social and economic development in the German Empire north of the Alps in the second half of the 12th century.

The ship-building technology to achieve that capacity is not available in the Empire at that time, neither in the barge-like river vessels, nor in the Viking tradition. I base this hypothesis on two points.

In the first place, the ship-building tradition of the Vikings belongs in a completely different area: Scandinavia and Denmark. In the second place, this tradition was gone by the time ship-building began to develop in other countries of north-western Europe.

The Viking, or perhaps more accurately the Nordic ship-building tradition had lost its leading importance for the greater part by that time, but it still existed and was developed further in Scandinavia, Denmark, the Baltic states and England. Presumably this development also took place in Normandy/ Brittany and the other areas the Norsemen settled after the 9th century, such as for instance the southern part of Italy in the early 11th century. As masters in ship-building, seamanship and navigation, the Norsemen had been the best seamen on the Nordic seas for about 300 years (McGrail 1981, 63). It is therefore hard to believe that they did not take this knowledge to their south-Italian kingdom or that this knowledge did not have any influence on ship-building in the Mediterranean and particularly in northern (or north-western) Italy.

In the 12th-century Mediterranean, there was already a centuries-old tradition of intensive shipping with a lot of cargo space on what originally were probably Arab vessels. There is evidence that in the period of the first Crusade (1096-1099) the Italians, temporarily at least, were in the forefront with the dimensions of their ships and the application of technical capabilities (Pryor 1992, 30). The big maritime towns of Genoa and Pisa went through some tremendous developments in the 12th century and had large (merchant) fleets at their disposal in the middle of that century (Erbstösser 1976, 173-174).

The northern half of Italy was already part of the Roman-Germanic kingdom (an empire after 1155) and assumed a growing economic importance for the empire after the Roncalic Resolutions of 1159. For instance, the total monetary value upon which the Emperor asserted his rights stands at approx. 30,000 Talenten in annual income, or 116 million DM in present-day calculation (Wijsenbeek pers. comm.), which was about 4½ times as much as the rates the German cities had to pay (Wahl 1959, 90-92, 95).

The experience gained during the second Crusade (1147-1149), during which large transports of troops already took place across the sea, and the regular and emphatic presence of Emperor Frederic I (Barbarossa) and his armies in this part of Italy in the third quarter of the 12th century, probably contributed to the penetration of Mediterranean ship-building technology in the part of the empire north of the Alps and the building of Crusader ships (the first *'heer kogge'* [host cog?]) for the third Crusade (1189-1192).

The visual similarities between the shape of the hull of the cog as seen on seals and known from archaeological finds in north-western Europe, and the illustration of an Arab vessel from 1237, an Arab *'dhow'* recently reconstructed on the basis of 8th/9th century information (Mudi 1984, 47-51), the tall *'kaïki's'* of the Aegean Sea and the construction details, like the post-rudder and pierced cross-beams, do suggest a clear relationship between the technological developments in ship-building in Europe north of the Alps and the existing traditions in the Mediterranean.

In my opinion, this 'taking over' of Mediterranean ship-building technology took place in the third/ fourth quarter of the 12th century and started in the Lower Rhine area with Cologne and its surroundings as a centre.

A good possibility could be that the first Crusader ships were built or rebuilt there by, or with the know-how of, ship-builders from the Italian part of the Empire. The ecclesiastical and political power of the considerable Bishopric of Cologne, the influence from the neighbouring historical imperial residence of Aachen and of Barbarossa himself, would all have been interested by and might have contributed to the further developing of this centre (of transport) of, for instance, the metal-working (Schildhauer 1988, 17) and the stoneware industries.

Duisburg with its royal court, being well situated on the river Rhine, was also an important trading centre from the end of the 9th century and particularly during the temporal power of the Staufer (Krause 1992, 3).

Cologne has an excellent location with regard to both the overland routes and waterways through Europe, such as the important north/south trade route via the Upper Rhine as far as Basel, from there through the Jura as far as Geneva, and further south via Avignon towards Genoa (Koelner 1954, 13). It was also easily accessible for sea vessels and in that particular period one of the biggest trading metropolises in north-western Europe. Cologne had been carrying on trade with Britain since the 9th century (Böcking 1980, 79). The English, and especially the Flemish merchants readily made use of the *'Königstrassen'* through the Rhineland and Schwäben, constructed at the end of the fifth decade of the 12th century, and travelled by the increasingly important route via Ulm and the Brenner to Italy (Wahl 1959, 295).

Almost in the same period, this 'new' cog-building technology was introduced along the Germanic Baltic coast. Henry the Lion, the Saxon nephew of Barbarossa, had at his disposal several privileges obtained as reward for taking part in the coronation journey of the Emperor. He had great power in the North-Germanic coastal area, where the Emperor had little influence. In the Baltic states and in Scandinavia, the people where scarcely informed concerning either Emperor or Empire (Wahl 1959, 191, 194).

The majority of *'sintelnagel' and 'sintel'* forms can, at the moment, be dated to within a 50-75 year period. In some cases, it is possible to give an even closer date range. Future finds will hopefully help to make a more precise dating possible. One can, however, already speak of new archaeological dating possibilities for ships in north-western Europe during the medieval period.

With the result of the research on *'sintels'* in mind, and referring to the thoughts and hypotheses mentioned before, it will be of great importance to increase our knowledge concerning the origins and evolution of the cog. Therefore it is necessary to pay more and new attention to archaeological and historical information on medieval, and in particular to 9th- to 13th-century ships in Italy. Art historians should also pay more attention to medieval illustrations of ships. Thus for instance, to the one in Fig. 7, an illustration of the 'Histoire Ancienne jusqu'à César', which probably shows the caulking of a cog (possibly of an early type) with *'gesinteld mosbreeuwsel'*.

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Karel Vlierman
Centrum voor Scheepsarcheologie (ROB)
Vossenmeerdijk 21
8251 PM Dronten
The Netherlands

Niels Bonde

Dendroprovenancing: Count the rings, map the journey
A new branch of tree-ring studies

During the last 25 years dendrochronology has established itself as a main scientific dating method in archaeology. It solves the most important question that arises when an archaeologist is investigating a wooden object: how old is it? Now, as a new feature, dendrochronology also offers information about origin. It can tell us where the trees which supplied the timber for the object grew – that is to say it can determine provenance.

This is of extreme importance when doing research on non-static object types such as barrels, paintings, furniture, altars, chests, shipwrecks etc. For example, it is unlikely that the place where a large seagoing ship is found as a wreck and excavated will be the same as where it was built.

Tree-ring dating is based on the study of the variations in the annual growth rings of trees. Growth is dependent, among other things, on climate, and this makes it possible to work out, for a geographical region, master-chronologies of year-ring variations extending back several thousands of years. In order to determine the place of origin of the wood, the dendrochronologist has to establish an extensive network of master-chronologies covering all the possible regions from where he may receive material. The next step is to compare the ring patterns from an object with the range of tree-ring chronologies at hand. The resulting values of cross-dating are then evaluated; the highest correlation value represents the most likely place of origin.

Over the years, the dendro labs in Copenhagen (DK), Lund (S), Warsaw (PL), Göttingen (D), Cologne (D), Hamburg (D), Belfast and Sheffield have established very close contacts and have exchanged chronologies produced in the respective labs. During the 1980s all the master-chronologies for oak in NW Europe have been expanded to cover the last 15 centuries and the chances of carrying out successful research on historical shipwrecks etc. have improved considerably. Especially in the last couple of years some remarkable results have been produced.

Tree-rings from 'Skuldelev 2', a 30-metre clinker built "longship", part of the famous Skuldelev find near Roskilde in Denmark, was investigated in the end of the 1980s. The tree-ring sequences form a chronology spanning a period of 248 years and we can estimate the building of the ship to around 1060-1070 AD.

The amazing feature of this research is that the chronology for the ship does not cross-date with the master-chronologies from Southern Scandinavia and the regions around the Baltic Sea. It caused great frustration in the lab when months of work did not produce any results, but during the subsequent discussions it was pointed out, that there are details on the ship that correspond to shipwrecks found around England. We then started to look for reference chronologies from England, and achieved a remarkable result with the big master-chronology for England produced in the Belfast lab (t-value 7,71. See figure). The question was then: was the ship really built with oakwood from England? To answer this question, we entered more reference chronologies from England, Scotland and Ireland in to the computer. As it turned out, we produced extremely spectacular results with the reference chronologies from around the Irish Sea. In particular, the correlation value for the Dublin chronology is astonishing (t=12,24).

Based on these results we can conclude that 'Skuldelev 2' was built of oak from the region around the Irish Sea – most likely from the Dublin area. The fact that a supposed 'Viking ship' was built in Ireland and ended its days in Denmark is completely new information. Now we need to figure out how it happened.

The finding of the wreck of a medieval cog off Vejby Strand on the coast of North Zealand in Denmark in 1976 greatly increased our knowledge of this ship-type. The wreck was of a smallish cog, originally about 16-18 metres in length and 5-6 metres in breadth. An interesting feature was that the wreck, among other things, included a large hoard of coins, mainly English gold nobles. The preliminary evaluation of the find revealed that the ship's last voyage probably was from Flanders to the Baltic region and that the ship met its fate 'after 1369 AD'.

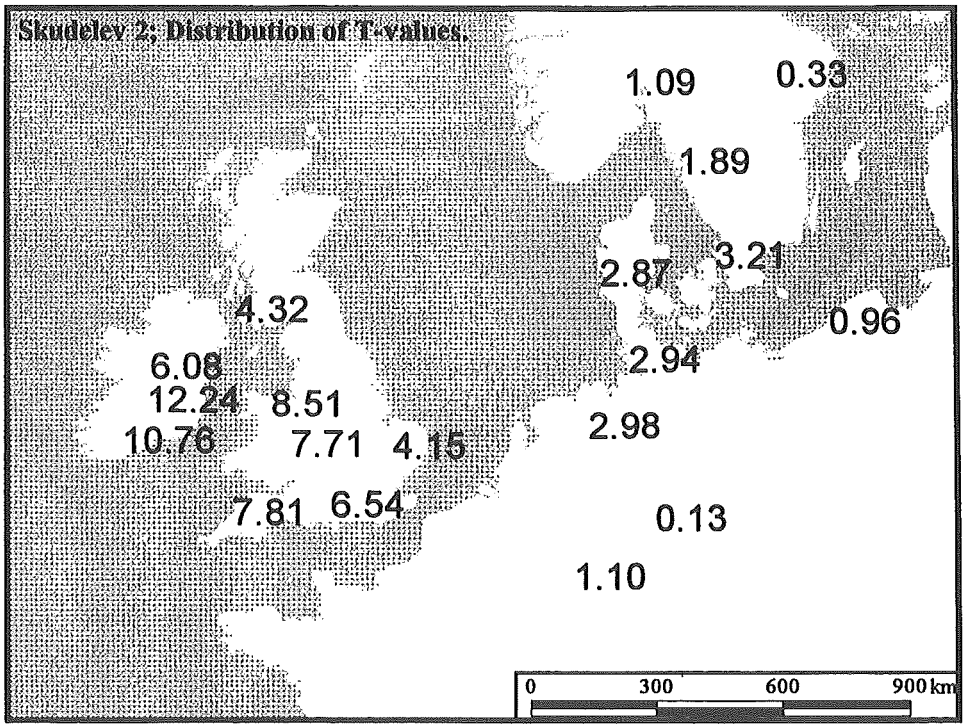
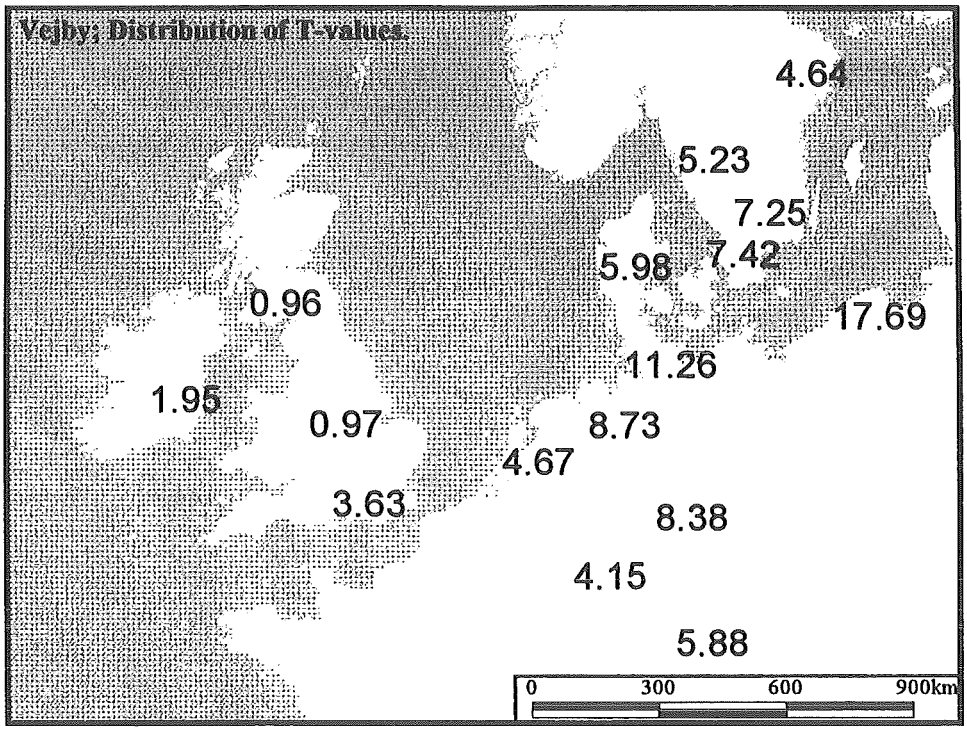


Fig. 1. - *Maps of Northern Europe giving the correlation values (t-values) for the cross-dating of the chronologies from Skuldelev 2 (top) and the Vejby ship (below) respectively, and the series of master-chronologies for oak trees from Northern Europe. t-values are a measure of similarity between two chronologies at a particular relative position. Values greater than 3.5 are regarded as significant indicators of a likely match. Note that all the values greater than 3.5 in the map for the Skuldelev 2 are concentrated in Ireland, England, Wales and Scotland while the reverse situation applies to the Vejby ship.*



Tree-rings in 28 samples of oak from various ship components were examined and all the samples have been cross-dated and the conclusion was reached that the ship had been built in 1372 AD. The chronology for the ship cross-dates with most of the master-chronologies from Northern Europe except those from England and Ireland. By far the best match, however, is found with the chronology for the coastal region of Poland (t=17,69). This strongly suggests that the trees that supplied the timber for the Vejby-ship grew in that region and that the ship was built there, most likely in the Gdansk area.

These two examples from Denmark only give a hint of the results already accomplished. For example, the dendro labs in Belfast and Sheffield have been working for years with the problem of the origin of the timber used in panel paintings in the 16th and 17th centuries and now have a solution. In the future the ability to achieve new results through tree-ring studies will be enhanced as the grid of site chronologies increases in density.

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Niels Bonde
National Museum of Denmark
Natural Science Research Unit
Frederiksholms Kanal 12
1220 Copenhagen K.
Denmark

Karel Vlierman

A 'reference book' for late medieval and post-medieval shipwrecks and artefactual ship's inventories *

Introduction

Over 50 % percent of the Netherlands is situated below sea level. Since the 10th century, this low-lying land has been gradually isolated from the influences of low and high tide by a relentless process of dike building and land reclamation, a chapter in Dutch history known as 'the eternal battle against the sea'. 1932 was an important year for the security of the *Zuiderzee*. In its northern part, a 32 km-long dike was built connecting the provinces of *Noord-Holland* and *Friesland*, thereby sealing off the heart of the Netherlands from the North Sea. After 1932, the *Zuiderzee* was renamed the *IJsselmeer*. The *Wieringermeerpolder* was the first polder to be drained, followed by the *Noordoostpolder, Oostelijk Flevoland* and *Zuidelijk Flevoland*. A total of 166,0-00 ha of new land was reclaimed (Fig. 1), and on this former sea bed, covered by thick layers of sediments, hundreds of shipwrecks have been found.

The *Netherlands Institute for Ship- and underwater Archaeology* (*[N.I.S.A.]*, until 12th April 1995 the *Centrum voor ScheepsArcheologie [C.S.A.]* of the *Rijksdienst voor het Oudheidkundig Bodemonderzoek [R.O.B.]*, the National Archaeological Service) has been excavating these shipwrecks since 1942. At the time of writing the present paper, the remains of 435 ships dating from the 13th to the end of the 19th century have been registered.

A large number of these wrecks still contained their artefactual inventory. Many can be dated to within twenty-five years or less, and on occasions to the exact date of sinking (Vlierman 1983, 1). These 'time capsules' contain information on the daily life and work not only of a skipper, but often also of his family or mate.

An important characteristic of the shipwrecks is that they provide information about ordinary people in circumstances for which almost no written sources are available. All the ships and their artefacts represent a form of 'reference book' for late and post-medieval shipbuilding techniques, and utensils and equipment used over a period of more than seven hundred years.

At the N.I.S.A., we try to publish the information about ship and its equipment/inventory as an indivisible whole. This paper presents not only information about the nature of the artefacts, but also outlines the ship types and their methods of construction.

As only a small number of the ship finds have been thoroughly investigated and published at this stage, comparison between individual inventories is barely possible. The excavation reports published so far have been mainly descriptive.

Discovery, investigation and storage of the shipwrecks

At the time of writing 350 of the 435 registered shipwrecks have been excavated and recorded. Fifteen well-preserved ships have been protected *in situ*, to reserve them for future investigation. Seven excavated and recorded medieval ships have been reburied at a different location. Three exceptional ships have been conserved. Two of these, a mid-17th-century merchantman and a so-called *ventjager* wrecked in c.1700 are currently shown in the *Rijksmuseum for Ship Archaeology* at *Ketelhaven*. The third vessel, an early 17th-century *beurtschip* (Fig. 2), will be exhibited at the new location in Lelystad. Two Roman logboats found beyond the *Zuiderzee* region at Zwammerdam are also on display.

Methodology

In the polders, most of the shipwrecks were found during the first years after draining the land (while

* This text is derived from a paper presented at the N.A.S./S.P.M.A. Conference 'Artefacts from Wrecks. The archaeology of material culture from shipwrecks of the late middle ages to the industrial revolution' in the National Museum of Wales, Cardiff September 1994.

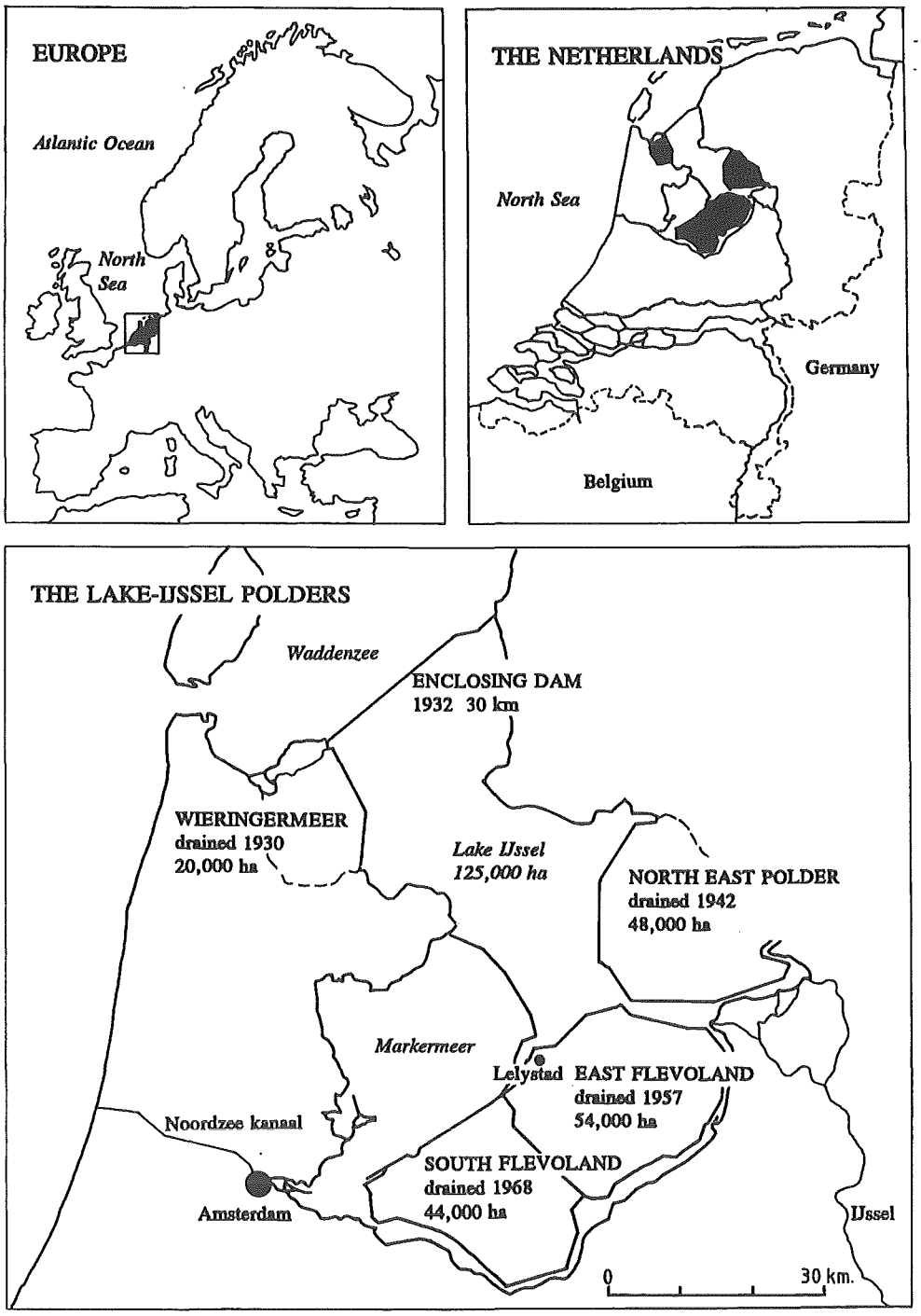


Fig. 1. - *The Zuider Zee water management and land reclamation project.*

digging canals and ditches for example) and later in the course of building activities, or while ploughing. Several new wrecks are still being reported each year.

Since 1975, the emphasis of research has shifted away from 'excavate whenever feasible' to 'excavation only if essential'. As a result, more effort is now spent on conserving the wrecks *in situ*. Wooden remains come under threat if the soil settles or if the water-table sinks: major dangers are fungus growth and damage by farming machinery.

Conservation in the field

A method has been developed to conserve shipwrecks *in situ* (De Roo *et al.* 1978): if the vessel has settled in a dense body of clay, damage to the wood may be prevented. A vertical screen of plastic foil is installed around the wreck to prevent lateral drainage. Vertical drainage is prevented by the clay. A layer of soil is deposited on top of the wreck, and covered with plastic membrane to prevent evaporation. Either a small funnel-shaped opening is left immediately above the ship, or holes are made in the membrane to admit rain. The effect on the water-

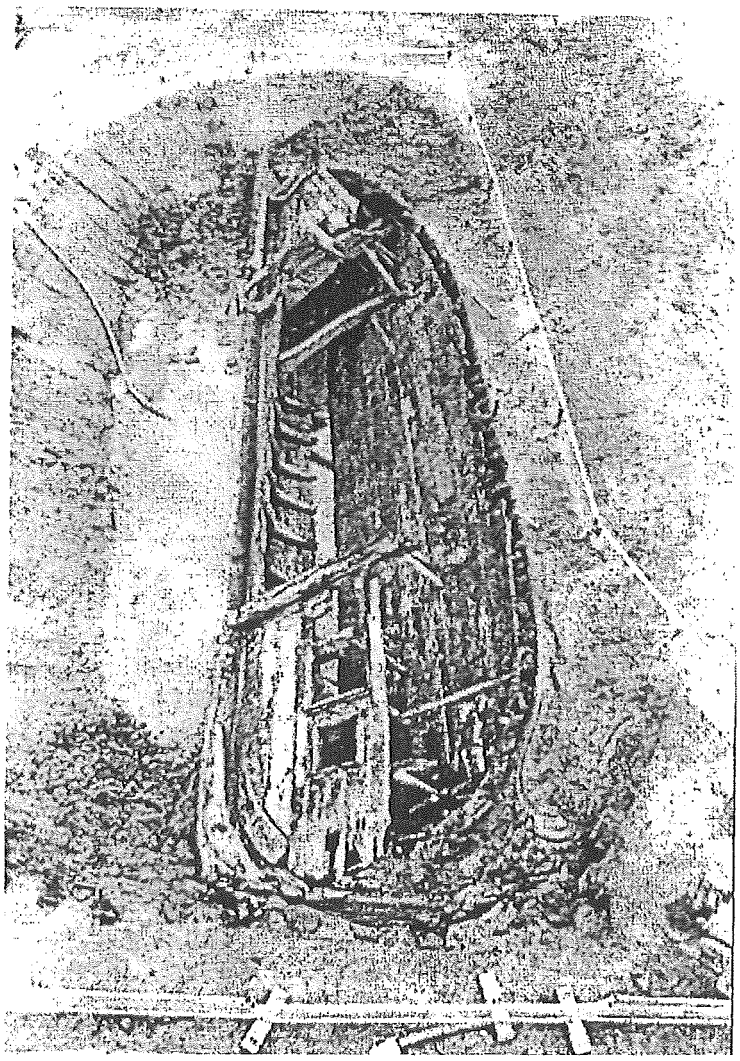
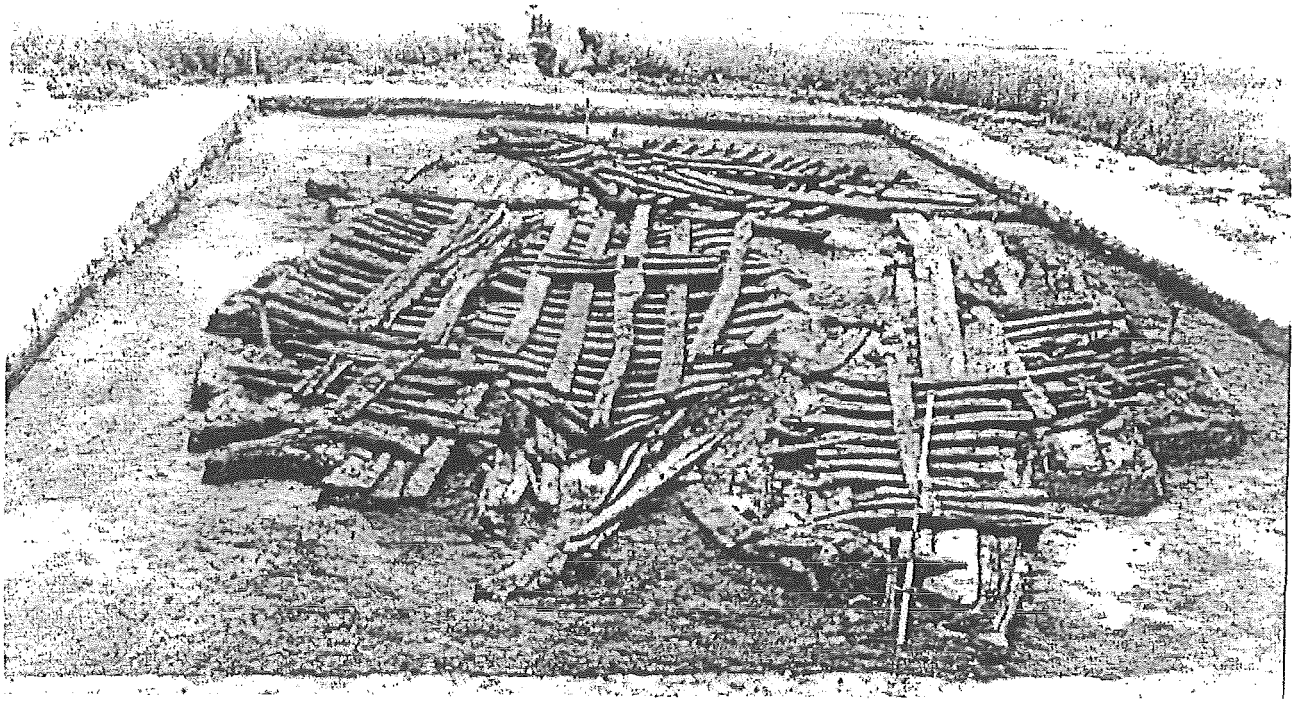


Fig. 2. - *The 18.5 m long early 17th century* beurtschip *on lot B 71 Oostelijk Flevoland* in situ, *1980.*

Fig. 3. - *The uncovered wreck of a late 13th-/early 14th-century cog on lot Oz 36 Zuidelijk Flevoland, 1983.*



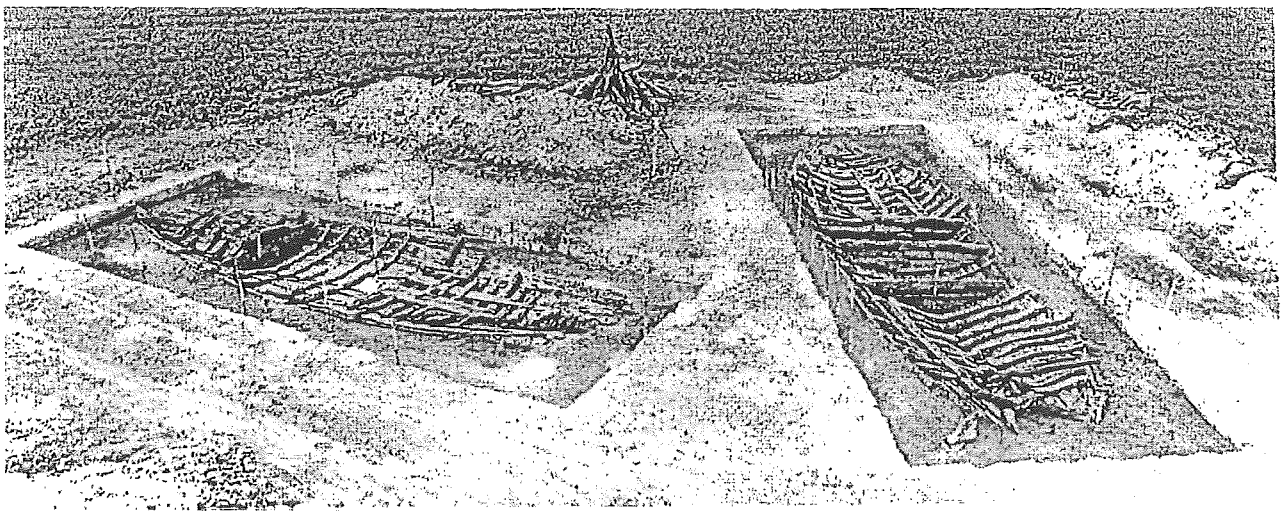


Fig. 4. - *Two early 16th-century clinker-built* waterschepen *(length 16 m) during the excavation on lot Nz 74 Zuidelijk Flevoland, 1978.*

table can be considerable: the artificial rise above that of the surrounding field may be up to over a metre.

If soil conditions preclude conservation in the field, the risk of damage by farm machinery may be reduced by applying an extra quantity of soil, though this will not prevent fungal attack.

Shipwrecks destined for full conservation and museum display are provisionally stored below the water-table. If reburial near the site of discovery is not feasible, then the wreck can be buried in a two-hectare central depot in *Zuidelijk Flevoland*. This currently holds eight shipwrecks found in the *polder*.

Excavation and recording

During excavation, the first step is the partial exposure of the outside of the wreck. The interior is then excavated as far as possible without removing any fixed parts.

Until the late 1970s, the various stages of excavation were drawn on one or more plans, with a longitudinal section and number of cross sections. To do this, a datum line was strung from bow to stern (overall length) and, where necessary, transverse tapes were affixed. Since the early 1980s, drawings have been prepared of all elements of a ship, preferably on a scale 1:10. Several views are recorded, with details such as dowel/treenail holes and repair work accurately drawn in. Such drawings are referred to as *plankuitslagen*.

In recent years, measuring tapes and plumb-lines have been replaced by the pantograph. Initially, a two-dimensional field pantograph was used, but more recently a three-dimensional pantograph has been developed, which can also produce plane projections of upright elements (Koehler 1994, 103-104).

A study of the remains of the ship, as recorded in photographs and drawings, may indicate the degree of completeness of the discovery. Materials and techniques used provide an insight into the methods of construction. In all cases, an attempt is made to reconstruct the wreck as a scale model. The strakes of the vessel's elements are used to reconstruct the shape of the hull. First a mock-up is made from strake shapes, transferred to special cardboard, and affixed to mock-up frames. Once this cardboard model is found satisfactory, a 'definitive' wooden model is constructed.

Ship types

Although having sailed the former *Zuiderzee*, most of the shipwrecks can be characterized as being inland ships. Of course, until the beginning of the 19th century, many large sea-going ships would have crossed the up to 20 feet deep *Zuiderzee*, especially on the route to and from Amsterdam. However, very few of these larger vessels sank along the main route.

The smaller, inland water vessels excavated so far represent several types. The period up to about 1500 is represented by the remains of ten Hanseatic cogs and several small cargo vessels of various sizes which were mainly used for short coastal and river journeys. One such is the late 13th-/early 14th-century cog excavated in 1983 (Fig. 3; Vlierman 1996A, table I). A full-size replica of the vessel is now under construction in the old Hanseatic city of *Kampen*. Such cogs were clinker-built, usually with flat, carvel-built bottoms, and were most commonly up to 16 m in length (except for the largest cogs and hulks which are between about 20 and 30 m long).

Many changes in shipbuilding techniques occurred from the second half of the 15th century onwards,

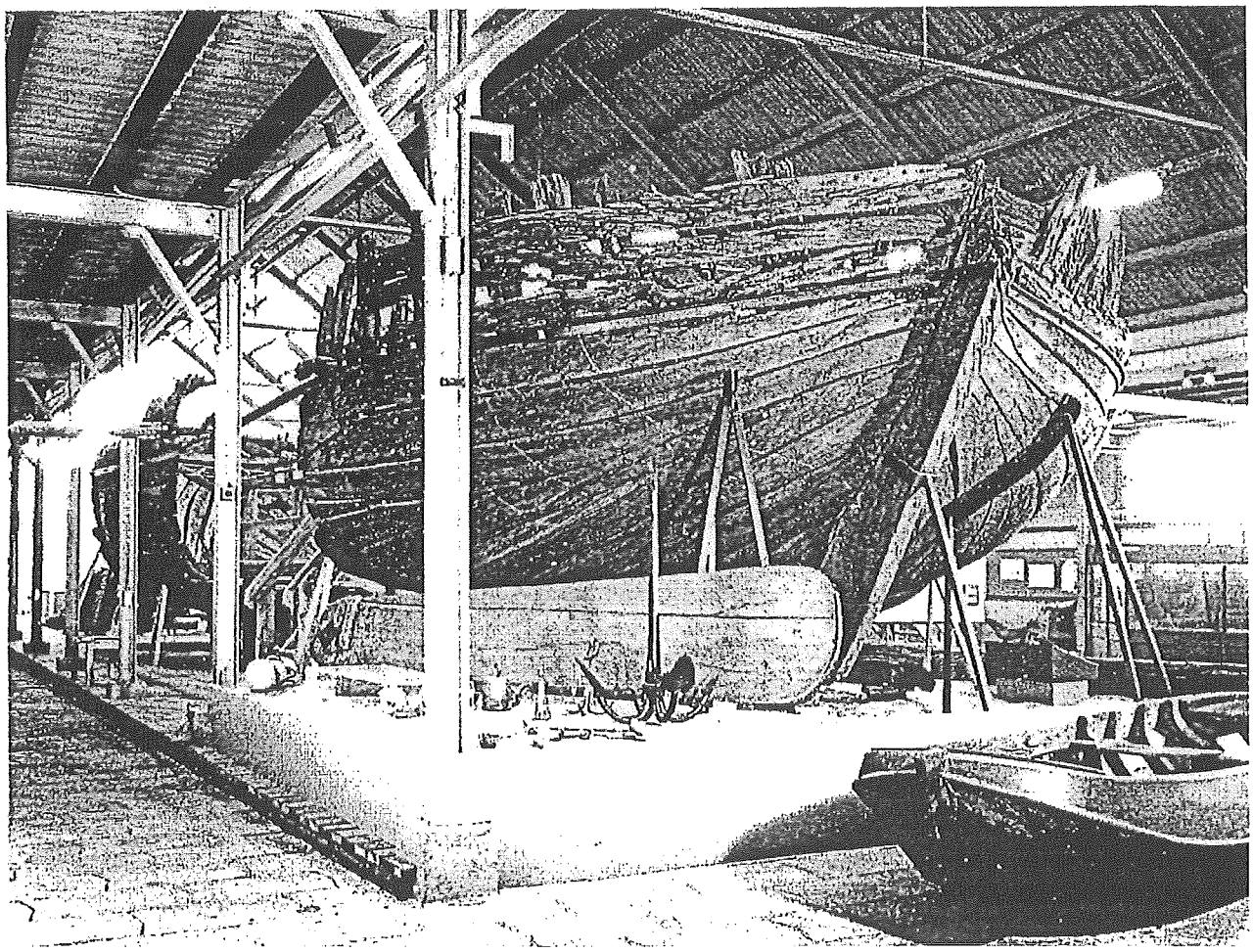


Fig. 5. - *The mid-17th-century merchantman from lot E 81 Noordoostpolder in the Rijksmuseum for Ship Archaeology at Ketelhaven.*

stimulated by the very fast-growing population in Europe and the search for new sources of food and other goods. Shipbuilders had to look for, and found, new ways to increase ship capacity, equipping them with more masts and sails to permit the transportation of more extensive cargoes. Not only shipbuilding techniques changed. Contacts with different cultures and countries resulted in a demand for new goods, such as spices, Chinese porcelain, tropical wood etc.

The vessel most characteristic of the *Zuiderzee*, the so-called *waterschip*, is a particularly good example illustrating changes in building techniques. The ship type is mentioned in written sources dating from 1339. It was 16 m long and clinker-built with a broad-bottomed front part and a sharp stern (Fig. 4).

From the mid-16th-century up to the 19th century, it appears that the shape, construction and accommodation plan hardly changed, the main developments being an increase in length in the sixteenth century to 20 m, and a change to carvel construction. In the 17th century 'new look' ship types were established, and then slowly evolved during the eighteenth and nineteenth centuries.

The most common ship types to have been excavated so far are the small and medium sized cargo vessels with a length of up to c. 20 m. These types are known by the Dutch terms as: *tjalk*, *praam*, *boeier*, *waterschip*, *schokker*, *botter*, *punter* etc. and several types of working boats.

The oldest medieval and real sea-going large ship excavated so far, is a three-masted cargo-vessel or warship with a length of c.30-35 m., which sank c. 1500. The ship is most probable a *hulk* (Vlek 1987; Reinders & Oosting 1989, 118).

Only one ship of the *Verenigde Oostindische Compagnie*, called *Buitenzorg*, is known to have been wrecked at the point where the *Zuiderzee* and *Waddenzee* meet. The ship was anchored near *Texel* in the winter of 1759/60, but dragged her anchors and was sunk by ice. Her remains were discovered in 1958. The lowest part of the stern (still 6 m high) can be seen in the Rijksmuseum for Ship Archaeology at Ketelhaven up until the end of October 1997, and from mid-1998 in the new institute at Lelystad. Parts of the only sea-going ship to have been completely recovered in the Netherlands (from lot E81 *Noord-*

Fig. 6. - *Artifacts of the late 19th-century tjalk on lot F 3 Oostelijk Flevoland.*

oostpolder) can also be seen. This is the 27 m long wreck of a mid-17th-century cargo ship, with a large, open hold and a completely closed ceiling planking, particularly suitable for timber haulage and grain transportation (Fig. 5).

Observations on the conservation applied by NISA

The inventory, equipment and cargo found on shipwreck excavations in the *IJsselmeerpolders*, provide a unique picture of shipbuilding and live on board (Fig. 6). All objects recovered from the shipwrecks are conserved and those not on display are stored ship by ship in the NISA-depot as well as in a computer database for study purposes. The collection currently holds about 20,000 objects of all kinds of materials, and is growing steadily, for a few vessels are excavated each year. Depending on the age and type of vessel, the number of objects recovered can vary from 50 to 500 (sometimes more). The whole collection can be seen in the new NISA-depot at Lelystad, which will be open to the public in the summer of 1998.

About one third of all the objects found in shipwrecks are made of wrought or cast iron of greatly varying types and qualities. Around 1975, aggressive conservation methods for metals were abandoned in favour of research into better or new methods (Vlierman & Van Dijk 1980). The most effective method of removing the hard concretion has been found to be annealing, whereby the iron object is heated in a special furnace, developed in the late 1970s (Van Dijk 1986). A modified version of the technique has also been used on coins (*ibid.* 1985 & 1987).

Once the wooden artefacts have been conserved, cleaned and re-assembled, they receive treatment with linseed oil (large straightforward dried objects). For PEG-impregnated and smaller objects, beeswax or furniture oil is used.

Until the start of treatment, leather is kept immersed to avoid the risk of drying and distortion. After thorough rinsing, the material is saturated with a soft variety of the plastic polyethylene glycol, dissolved in water. If reconstruction is required following conservation treatment, the leather is rubbed with castor oil to make it supple and easy to handle (Van der Land 1982).

Textiles are rarely found, as most fabrics decompose rapidly. Silk, linen and cotton in moist conditions develop the first signs of decay within a short period, and are rarely found in shipwrecks of more then a century old. Wool is the exception. In favourable conditions (e.g. embedded in clay, or within luting material), it may survive for long periods.

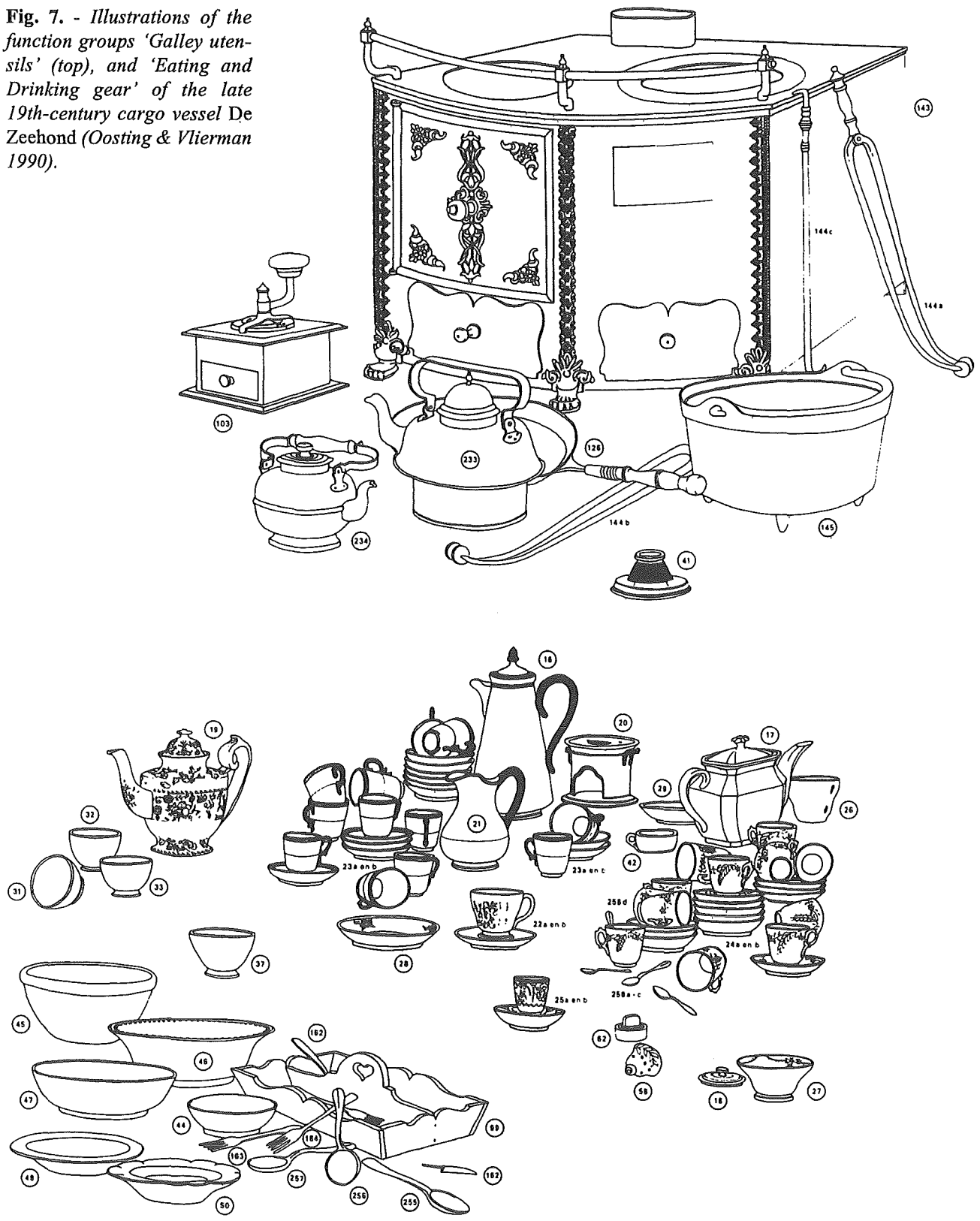


Fig. 7. - *Illustrations of the function groups 'Galley utensils' (top), and 'Eating and Drinking gear' of the late 19th-century cargo vessel* De Zeehond *(Oosting & Vlierman 1990).*

Investigation and classification

The large ships excavated so far have yielded unexpectedly detailed information. Research into the objects found on board the mid-17th-century merchantman (E81 *Noordoostpolder*) has led to the conclusion that almost all the artefacts recovered during the excavation (except for a couple of spare blocks) were worthless at the time of sinking (Vlierman in prep.).

The reason for this is also valid in the case of the other large ships found in the *IJsselmeerpolders*. All the ships were at least 3.5-5 m high, so that, when a ship sank in the shallow *Zuiderzee*, the deck would,

for most of the time, have been at or near low-water sea level. Consequently, it would still have been possible in the first days after the shipwreck to salvage the cargo and inventory. Equipment for this has been found on board several ships. We may conclude that although the large ships wrecked on the *Zuiderzee* can provide much information on their methods of construction and shape, less can be said about their equipment and inventories.

In order to gain a better insight into the equipment and inventories to be found on board small inland water vessels, we have tried to classify objects by function. This has been primarily to facilitate comparison between inventories from small- and medium-sized vessels which sailed on the *Zuiderzee*. For this purpose, we used the over seven hundred objects recovered from the late 19th-century cargo vessel the *'Lutina'* and classified them by function. We felt this method was useful, in spite of the fact that similar methods have created problems when applied to ships of the Dutch East India Company (Green 1977).

The following factors determined the method of classification applied to this *IJsselmeerpolder* wreck:

1. It is a small cargo vessel
2. The recovered inventory appears to be complete
3. The objects date from recent times and are well recognizable
4. The accommodation plan of the ship was easy to reconstruct and the objects were found on or near their original location
5. The ship had a small crew (probably only two).

The artefacts were divided into the following categories: equipment, inventory and personal belongings, which in turn were subdivided into eleven groups.

The general classification of the ship as a whole is as follows (Reinders 1985):

A. Ship with standing and running rigging
B. Equipment
   1. Ship's equipment
   2. Working equipment
   3. Military equipment
C. Inventory
   4. Documents and stationary
   5. Navigational instruments
   6. Tools
   7. Household effects
   8. Kitchen utensils
   9. Eating and drinking gear
   10. Victuals
D. 11. Personal belongings
E. Cargo, Merchandise

At this point it ought to be possible to present an example of an inventory dating within the period c. 1500-1800 and classified according to the above-mentioned functional groups.

As stated earlier, the data from only a few shipwrecks have been completely analysed so far, and over one hundred and fifty files await more detailed research and publication. Recently (1996), two reports have been published. One on two late 18th-century prams with their inventories (McLaughlin-Neyland & Neyland 1993), two excavations of the 1970s. The second one concerns a late 17th-century freighter, a NISA-excavation by an international team of nautical archaeologists in 1993 (see Birgit Schröder, *The inventory of a small late-seventeenth century freighter, excavated in Eastern Flevoland, The Netherlands*, in this volume; Neyland & Schröder 1996).

Four illustrations, taken from the publications of two late 19th-century inventories, give an impression of the extensive range of the functional groups: the *'Lutina'* which sank in 1888 (Zwiers & Vlierman 1988), and a tjalk, *'De Zeehond'*, wrecked in 1886 (Oosting & Vlierman 1990). The archaeological report on *'De Zeehond'* includes a comparison of the equipment and inventories of both ships.

The inventories indicate a different crew structure, which could be checked afterwards by studying existing documentary information. The *'Lutina'* had two old men on board, the skipper and his mate, while *'De Zeehond'* carried a young family. At the museum in Ketelhaven, we have organised two family reunions for the descendants of the ship's crews.

Late medieval ship inventories

The difficulties in recording artefacts of late medieval ship inventories according to the method of classification used for the nineteenth-century cargo vessels of the *Zuiderzee* were outlined and the following points, which are the first provisional results of the comparison, were made (Vlierman 1992, 10-22; 1993, 70 and Hocker & Vlierman 1996, 6.2):

- more or less comparable cargo vessels contained 25-100 artefacts in the late medieval period, 150-300 in the 18th and early 19th century, increasing rapidly to 500 or more in the second half of the nineteenth century;
- artefacts found on medieval ships cannot easily be recorded using the eleven categories mentioned above, because of their smaller number and multi-functional nature.

For the late medieval period, a division can only be made into three basic groups:

1. Objects associated with cooking, eating and drinking
2. Tools

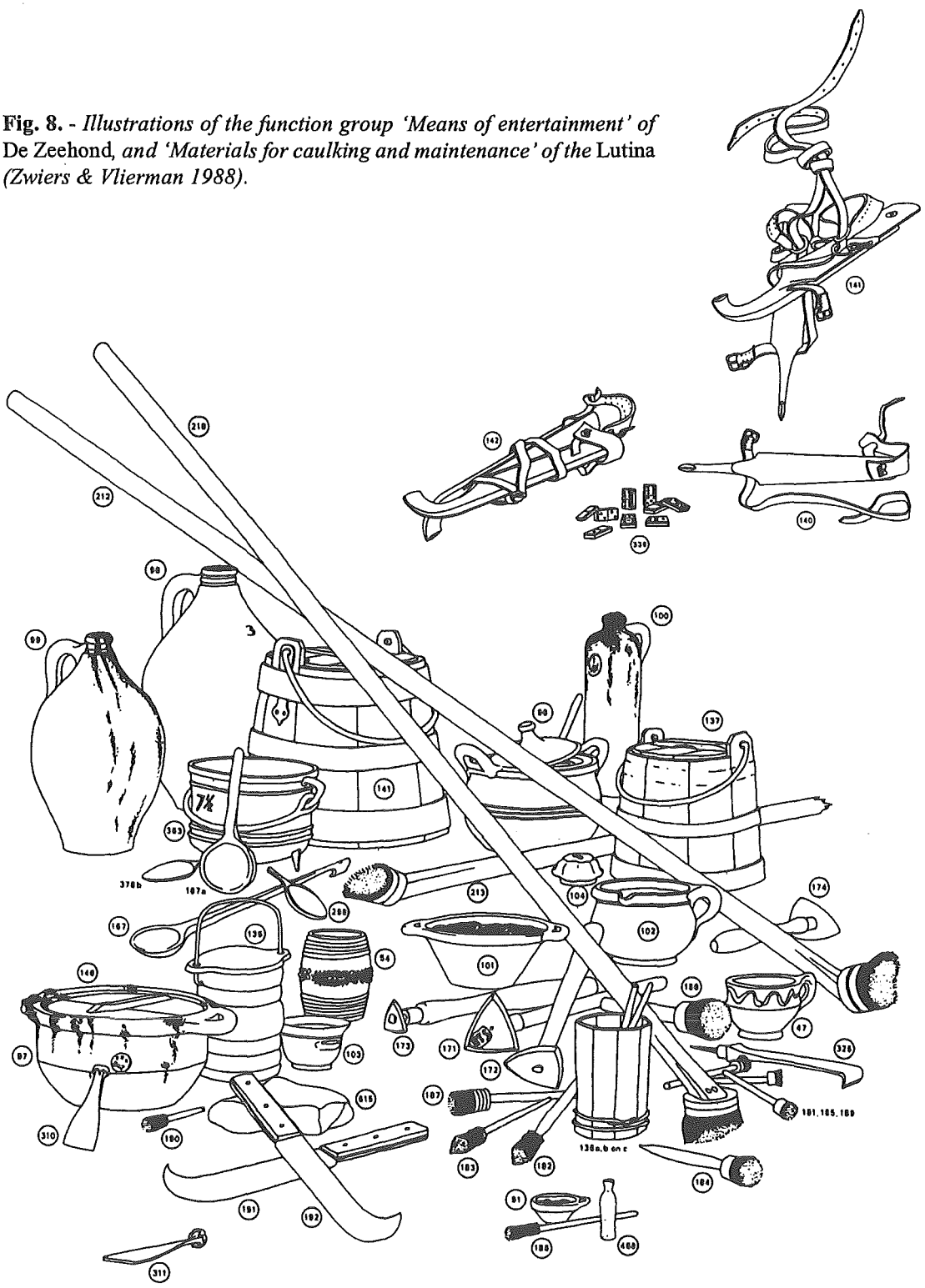


Fig. 8. - *Illustrations of the function group 'Means of entertainment' of* De Zeehond, *and 'Materials for caulking and maintenance' of the* Lutina *(Zwiers & Vlierman 1988).*

3. Personal belongings and weaponry.

The archaeological potential of ships as integrated artefacts ('time capsules') are incomparable sources of information on daily life, and as such they need to be accorded the greatest attention by archaeologists, dealing with late and post-medieval sites in north-western Europe. Ships often contain numerous artefacts which were in use at the same time on board, and when found elsewhere are usually undatable (Fig. 9).

A comparison of complete inventories found on board ships of the same type but dating to different periods not only yields information as to the number of artefacts, but can also offer the opportunity to compare assemblages of, for instance, carpenters' tools, and cooking, eating and drinking utensils and vessels.

Fig. 9. - *The ceramics, a brick and floor-tile from the hearth, and a split-pin of antler (for rope-splicing) found on board a cog wrecked c. 1325, from lot N 5 Oostelijk Flevoland (Reinders et al. 1980).*

Kleij (in print) discussed how the ship's inventory can be used to identify the home port. The inventory can also be used to gain an insight into the presence of families and the number of people on board. Van Holk (in print), discussed this subject for the period c.1600-1900, and outlined the methods used to collect information from artefacts. Such methods also offer perspectives for the identification of standard objects (Vlierman 1994), groups of items or the typological development of form, such as the development of the late medieval ship carpenter's axe and caulking iron and rose bolts (Vlierman 1985 and Hocker & Vlierman 1996A, 6.3), or the development of *sintels*, one aspect of our research to date that has greatly enhanced our capability to date medieval wrecks (Vlierman 1996), which I will discuss in this section later on (see Vlierman*: A caulking method used as an aid to date shipwrecks from the Hanseatic period*).

Publications

To gain further insight into the material culture present on board small and medium-sized inland vessels, it clearly is necessary to investigate and publish the collected information of as many shipwreck excavations as possible from the IJsselmeerpolders in the near future.

Our first excavation report, concerning a 16th-century fisherman, has been published in 1978, and was followed by the reports of three late-medieval ships, three medieval riverboats (near Arnhem), four 17th-century working-boats, a 19th-century cargo-vessel from the province of Overijssel, a late 19th-century *tjalk* from the province of Groningen and a cog-like vessel. Recently (1996), nine reports have been published in the series *Flevoberichten*; they concern: two 18th-century peat-prams; sintels – A caulking-method to date shipwrecks of the Hanseatic period; thirteen small medieval ship (fragment) finds outside the bounderies of the *Zuiderzee*; lead tokens from the *IJsselmeerpolder* wrecks; a 15th-century small cog found at Almere; a 16th-century working boat at Workum; a *waterschip* on lot Nz 42; a late-17th century Dutch freighter, and Living and working on board inland vessels (1600-1900).

In 1983, we started work on the publication of the ceramics found on board some late and post-medieval ships in the *Corpus van Middeleeuws Aardewerk van gesloten vondsten in Nederland en Vlaanderen (C.M.A.)* series.

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Karel Vlierman
Centrum voor scheepsarcheologie (ROB)
Vossenmeerdijk 21
8251 PM Dronten
The Netherlands

P.M. Floore & J.H.G. Gawronski

Frozen Renaissance
Some new information on the finds of the wintering site of Willem Barents on Novaya Zemlya (Russia) 1596-'97

Since the rediscovery of the perfectly preserved wintering place of Willem Barents on the northeast coast of Novaya Zemlya in 1871 by the Norwegian hunter Elling Carlsen, the site gradually degraded to the deplorable situation of 1993. Only scanty remains of four logs remained which roughly indicated the rectangular place where once the famous hut stood (fig. 1).

Gerrit de Veer's diary of 1598 gives us a unique account of the voyages of Barents and his men in the northern seas and their subsequent wintering on Mys Spory Navolok, Novaya Zemlya in the years 1596-97. Notwithstanding this important report, our picture of the earliest episode of Dutch exploration and commercial expansion is still far from complete. Little is known about the preparations and organisation of these long distance voyages, the adaptation of the winterers to the arctic climate and daily life during the winter. Even simple questions such as the size of the hut remain unanswered. Archaeological research could potentially complete this picture if anthropogenic disturbances of the last century had not destroyed the subsoil. This was the main problem the expedition of 1993 had to solve.

In the past 120 years, not only the structure of the wintering hut disappeared but also most of the artefacts which were left behind by the departure of the winterers in the spring of 1597. Carlsen in 1871 and Gardiner in 1876 collected most of the best preserved and complete artefacts from within the house. These finds were eventually purchased by the Dutch government and are kept in the Rijksmuseum in Amsterdam. Other expeditions which also collected finds from the site were the 1933 Russian Miloradovich expedition, the Russian expeditions of Kravchenko between 1977 and 1982 and the Russian-Dutch expeditions of 1993 and 1995. The 20th-century expeditions differed from the earlier ones. Their research has been recorded and published and furthermore the majority of their finds were discovered outside the structure.

Apart from these visits and research, several unrecorded visits of soldiers and tourists probably also took place. We do not know what was collected during these visits but Kravchenko demonstrated that a lot of the construction of the hut was burned in campfires during these visits.

Due to the lack of proper descriptions and graphic documentation from the first visits to the wintering site in the 1870s and the rapid destruction of the site, the first extensive archaeological researches executed by a Russian-Dutch expedition organised by the Russian Academy of Sciences and the University of Amsterdam had also to concentrate on elementary problems such as the size and position of the house, establishing the location of the debris deposits and mapping the activity areas in and around the structure. After the promising results of the research of 1993 and after having ascertained the absence of disturbance of the subsoil, the expedition of 1995 could concentrate on these issues.

The site

The *Behouden Huys* is situated about 45 m from the steep ridge of a flat promontory which drops 4 m down to the *c.* 120 m wide beach. Nowadays, nothing more of the original wooden building is visible than four beams which lie in a north-south oriented rectangle of 8.50 x 5.90 m (fig. 2). The beams have been crudely manufactured from tree trunks. They were partly semi-circular and partly rectangular in section and their width varied from 20 to 40 cm. The remains of a fireplace could be recognised, situated south of the centre of the rectangle. The north beam is extremely eroded and fragile, but it is partly buried and therefore considered to be still *in situ*, tilted slightly northwest-southeast. The other three beams are less relevant indicators of the original layout, as they lie loose on the rocky surface and might have been displaced since the discovery of the house in 1871 by the Norwegian hunter Elling Carlsen. He reported that the lower part of the structure consisted of a layer of four beams (about 80 cm high) which had been assembled in a log cabin fashion (Bonke & Floore

1995; Hacquebord 1995, 1996; Honoré Naber 1917). This situation matches De Veer's account which states that the house was constructed in a 'Nordic' way from tree trunks which had been taken from the beach of Ice Harbour. Analysis of samples taken in 1993 confirms that all four remaining beams are of Siberian pine (*Larix gemelinii*). According to De Veer, the men erected a frame of beams which they lined with deck planks from the ship. Remains of these wall and roof planks are lacking nowadays, but were still present in the 19th and early 20th century. Unfortunately, De Veer does not specify the size of their house. The earliest source of information on this matter is a letter from Carlsen written in 1872 where he stated that the building was 16 x 10 Norwegian yards (10.05 x 6.28 m). During a visit some 60 years later by the Russian surveyor B.V. Miloradovich, the structure was already deteriorating. Nevertheless, the beam-basis was still intact and measured 9 x 6 m (Miloradovich 1934). The surveys in recent years produced slightly varying measurements; in 1982, the rectangle was 8.60 x 6.20 m (Kravtchenko 1983a, b), in 1992 7.80 x 5.50 m (internal size: Hacquebord 1995, 1996) and in 1993 8 x 6.90 m (Boyarsky 1994). The most recent configuration of about 8.50 x 5.90 m in 1993/1995 corresponds best with the earliest measurements in 1982. The west- and east-beams are only 5.32 and 5.56 m long and thus shorter than the presumed length of the house. The remaining length of the eroded north-beam is about 5.80 m. Only the south beam appears more or less complete with an intact corner joint (23 cm long) at one end. Its length of 6.24 m is a first indication for the external width of the house. A fifth beam of 6.20 m long has now been found near the rectangle, and has been interpreted as a roof beam. This constructional element gives a presumed width of 6.15 m for the frame of the house.

Another striking feature is the presence of three semicircular concentrations of rocks which were buried under moss and were situated along the east- and west-beams (respectively on the southeast corner, near to the northeast corner and at the southwest corner of the rectangle). Their origin is connected with repetitive soil freezing which is characteristic for the arctic environment and leads to the fragmentation and sorting of rocks, creating these so-called sorted circles. Nevertheless, the specific layout of these features shows signs of possible human interference. Their composition and sorted rocks are more refined than usual and, above all, they are not circular, but semi-circular with straight sides. It is likely that these circles were modified by the builders while they were preparing the foundation of the house. Actually, the distance between the straight sides of the southeast and southwest sorted circles is about 6.20 m and coincides exactly with the presumed house-width as deduced from the south-beam and the roof beam. This means that the longitudinal lower beams of the house would have been placed along these features. Such a hypothesis provides an essential starting point for the reconstruction of the original position of the rectangle. The east-beam, following the straight sides of the two east-platforms, would have been positioned slightly more northeast-southwest than is the case now. In the same way, the west-beam should be shifted more towards the west. Further support for this hypothesis comes from the fact that in such a configuration the longitudinal sides have a straight-angled connection with the north-beam *in situ*.

Only a few other wooden building elements were recovered, such as a short beam (1.68 m) with a longitudinal notch at one end, lying on the surface at the southeast corner of the rectangle, and some buried fragments of decayed planks and small-sized beams in the clayish soil at the west and north sides. The only significant find was a rectangular block with an iron nail at 1 m distance from the east end of the north beam which had been buried in the solid clay deposit at a depth of 20-25 cm underneath the 16th-century surface level. It appears as the base of a vertical support, which according to its location would have been situated at the exterior of the building. Neither De Veer nor Carlsen mention such supports. Although De Veer writes that they had problems in penetrating the frozen subsoil and that they had to stop such attempts, this find shows that they actually were capable to dig holes.

As we combine the archaeological data with theoretical principles of 16th-century measuring and dimensional systems, further details about the layout and the size of the house are revealed. First of all, the position of the north-beam and the presence of stone circles which had been adapted to fit the longitudinal foundation beams, prove that the beam-rectangle was originally positioned slightly more northeast-southwest. This means that the east-end of the present south-beam would have been shifted more to the south, as was still the case when Kravtchenko recorded the site in 1982. Therefore, his measurements of 8.60 x 6.20 m can be seen as the most authentic configuration of the rectangle in recent years.

Secondly, the external width of the house can be established at 6.20 m on the basis of the stone lining of the lower beam-layers and the length of the roof beam. Carlsen recorded a comparable size of 6.28 m, which confirms the accuracy of his observations. These coinciding metric measurements provide a key to the historical units of measure which the Dutch would have applied in the 16th century. Dutch builders in that period measured in *ellen* (yards: 0.68 m) or

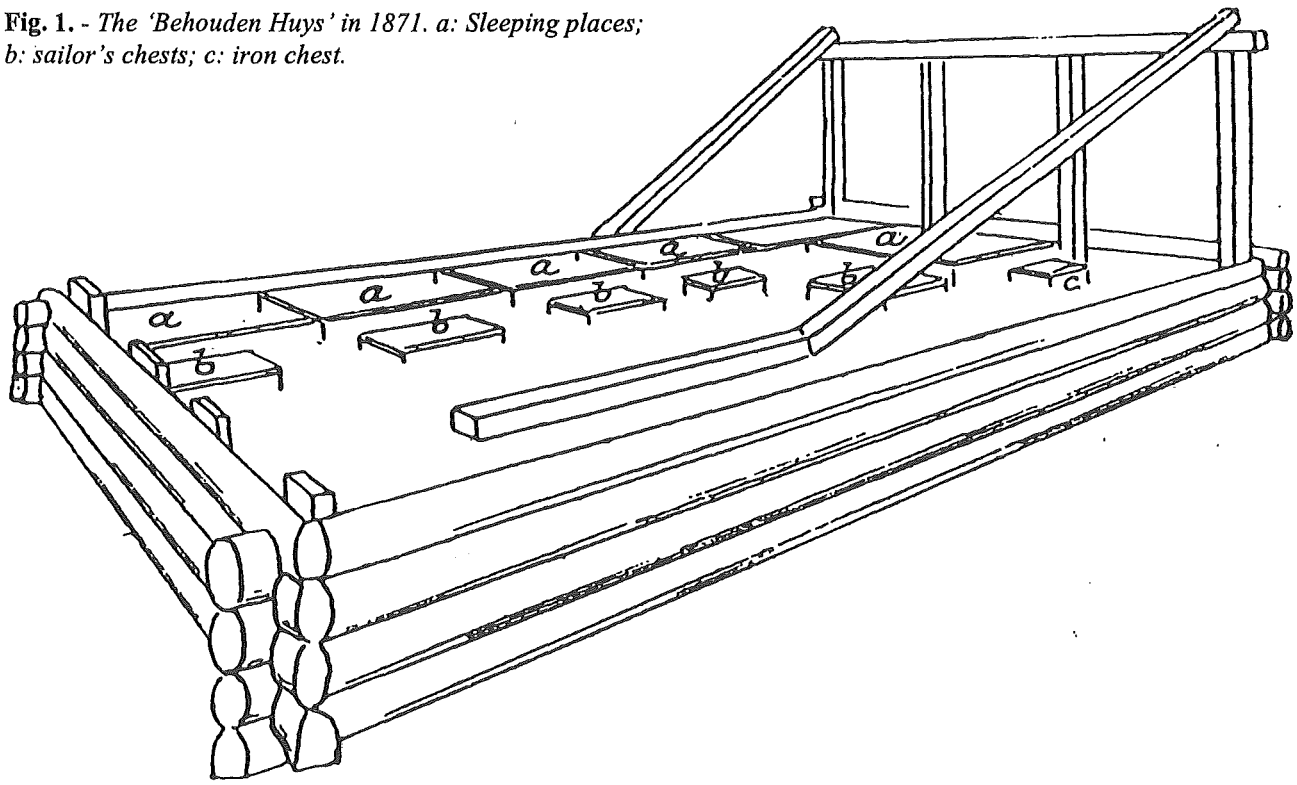

Fig. 1. - *The 'Behouden Huys' in 1871. a: Sleeping places; b: sailor's chests; c: iron chest.*

treden (paces: 0.70 m)(Staring 1885). This would mean that the house had been conceived as 9 *ellen* or *treden* wide, resp. 6.12 or 6.30 m.

Thirdly, this inferred width combined with 16th-century mathematical principles which were based on the medieval concept of the so-called 'Golden Section', offers a key to the overall design of the house, including its length. Carpenters based their constructions not on the present metric graduation, but on a geometry of rectangles which consisted of a series of interrelated units (Coecke van Aelst 1553; Wells 1993). The mathematical ratio which was derived from this 'Golden Section' was essential for the Renaissance ordering of the physical world and represents a pervasive dimensional principle for building and for the visual and applied arts. We can assume that the carpenter and builders of the *Behouden Huys* used this rule when they had to define the three-dimensional layout of their construction in the bare environment of Novaya Zemlya. Its crude basics are expressed by the ratio 3:5, which means that a width of 9 results in a length of 15 *ellen* or *treden* (10.20 or 10.50 m). Calculation of the length with the mathematical approximation of 1.618, which was applied to enlarge units within the 'Golden Section' ratio and in this case the external width of 6.20 m, produces a longitudinal unit of 10.05 m. This outcome coincides exactly with Carlsen's observation. Even when taking into account that the ideal building ratio has been used in a crude manner in view of the unusual circumstances and the necessary improvisations, the original total length of the house can be established at about 10 m. This would mean either that the present east and west beams are not original longitudinal constructional elements or that the long sides of the lower structure had been composed of at least two tree trunks.

Finally, the distribution of the finds in the south area inevitably shows that the porch could not have been added to the 10 m long beam-rectangle. Analogous to the image of the house in the contemporary engravings, the archaeological evidence proves that this element must have been included in the basic design of the house (fig. 4.3.4). On the basis of this assumption we can interpret De Veer's account of the building procedure (October 2nd-17th, 1596) that first the north, east and west sides of the frame were covered with deck planks. Subsequently, large sized provisions, such as barrels of beer, were transferred into the house through the open south side. Lastly, a strip at the south end of the beam-rectangle was cleared from snow and the outer south wall – together with an internal partition of planks from the ships cabin – was put up. The find pattern in the south area also indicates that the porch would have been about 1.40 wide, which is equal to 2 *treden*. The remaining living space would be 8.60 m. This conclusion is contradicted by Carlsen's drawing (fig. 3) which shows no internal partitioning of the 10 m long rectangle. He indicates a row of four bunks along one longitudinal wall with an empty corner at the end and an adjacent fifth bunk against the short wall. In view of

both the present archaeological and historical data there can be some reasonable doubt about the accuracy of his drawing of this particular detail, a drawing which he made one year after his visit. The engraving depicting the interior of the house in the German edition of De Veer by Hulsius shows a row of five bunks. In a living space of 8.60 m each bunk would be 1.70 m long, which is a more realistic size than the 2.00 m according to Carlsen. Kravtchenko also found remains of small-size beams and planking in the southeast corner of the living area which might have belonged the these bunks. As a result of this reconstruction, the doors of the porch had been placed on top of the base of tree trunks. The fact that on the contemporary engravings the doors seem to fit flush with the exterior surface can be explained by the accumulation of snow around the house, which covered the lower layer of tree trunks, including the raised threshold of the doors. The size of the doors can be inferred from two rectangular notches in the rim of the south-beam. They had been carved at almost equal distance from the centre of the beam and therefore served to fit the posts of the central door, which would have been 99 cm or 3 *voet* (feet) wide. The width of the notches of 7 cm indicates that the door posts had been manufactured from 2 *duims* (inch) rectangular timber from the ship. Due to the repetitive shifting of the beams, it remains uncertain whether the south beam belonged to the external basis or was part of an internal partition. In the latter case, the notches would be related to the entrance from the porch to the living area. The significance of similar notches of 10-12 cm wide and 60 cm apart on the north beam is still unclear. Possibly, these notches are the remains of an adjustment of the design, as initially an entrance at the north side might have also been planned.

The artefacts and their distribution

At a rough estimate, about 90 objects have been recovered in 1871 by Carlsen, one manuscript and two maps in 1875 by captain Gundersen and some 160 objects during the visit of Gardiner in 1876. These 19th-century collections, which are kept mainly in the Rijksmuseum in Amsterdam (except for the manuscript in the Maritime Museum Prins Hendrik in Rotterdam and some 20 Gardiner finds in the Tromsö Museum), consist of well-preserved and to a large extent complete artefacts. While in 1933 Miloradovich only recovered some dozens of finds (kept in the Museum of the Arctica and Antartica, St. Petersburg), the investigations of Kravtchenko led to a collection of some 600 find numbers, which still included a fair amount of (semi-)complete artefacts (kept in the Regional Historical Museum of Arkhangelsk). The survey of the Institute for Heritage in 1992 added 732 finds which were recovered from the surface. Bearing in mind that material has been and is still being removed by the growing number of tourists, who undoubtedly collect souvenirs, the latest excavations of 1993 and 1995 were fruitful as they saved a varied and rich inventory from further dispersal, but above all as they supplied essential documentation on the distribution of material remains on-site.

Although a specialised analysis has yet to be completed, some preliminary interpretations of the find locations can be presented here. The first striking result is the quantitative discrepancy within the overall north-south distribution of the archaeological material. The 1993 finds record is less extensive compared to that of 1995 and consists of 417 find numbers comprising some 3.200 items. The larger part of these finds originated from within the house and from the (south-)west area, while the area north of the house yielded only a relatively small amount (fig. 2). Nevertheless, the largest number of material remains has been recovered in 1995 in an intense and widespread distribution all along the south and east areas. The 1995 excavation produced an extensive record of 1.032 find numbers in total, comprising about 6.200 items, with the exclusion of 26 find numbers (30 items) which were related to the shipwreck survey on the beach. After substraction of 71 find numbers (114 items) which represent samples for wood, seed, pollen, insect and other ecological analysis, the inventory of cultural remains consists of about 6.100 items, grouped in 961 find numbers. 96 find numbers (153 items) are a residue of the previous excavation of 1993 which resulted from a thorough check of the spoil using metal detectors.

In general, we can distinguish two kinds of finds from the winter site. First the special group of artefacts which were left behind, stored and ordered, by the winterers consisting of domestic goods belonging to the equipment of the ship and used during the wintering, such as ceramic vessels for storage and food preparation, tools such as files, axes, hammers and augers, wooden barrels and trunks. Secondly, we can discern personal belongings of the crew such as clothing and shoes. The last important group of artefacts which were left behind is the cargo of the ship. The objects which were recovered from the house belonged to the most valuable part of the cargo. They consisted of ornamental pewter plaquettes, pewter candlesticks and pitchers, bundles of etchings by Jacob de Gheyn and Hendrick Goltzius, venetian glassware and a clock. These finds which are very exceptional for an archaeological site were collected

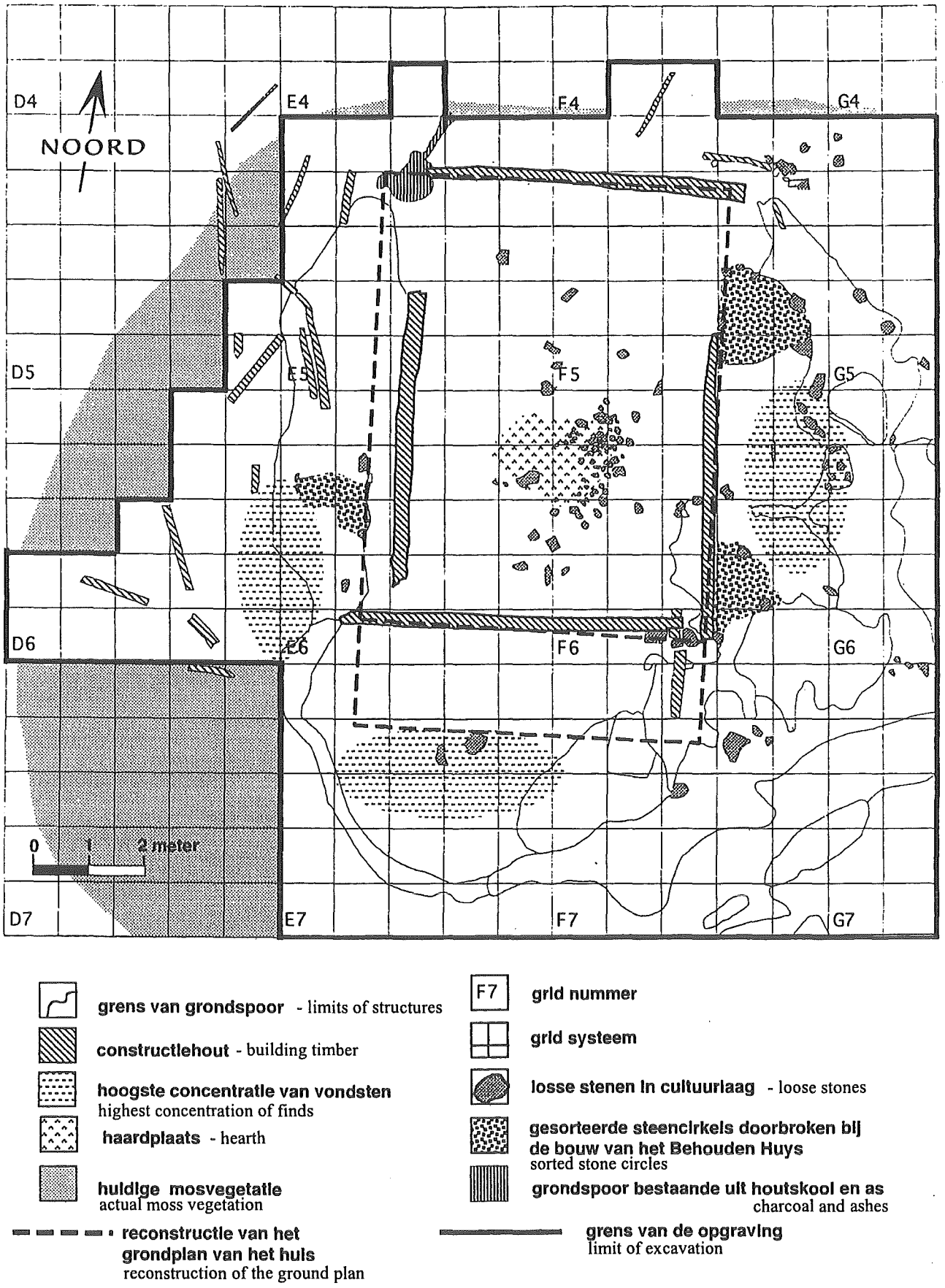

Fig. 2. - *Excavation of the 'Behouden Huys' on Novaya Zemlya 1993-1995.*

almost exclusively during the expeditions of Carlsen, Gundersen and Gardiner between 1871 and 1876. The completeness of the contents of the house and the nautical background of the finds make the site more comparable to a shipwreck site than to any contemporary archaeological settlement site on land. How-

ever, we consider that the group of artefacts which was left behind is the result of a deliberate selection. De Veer clearly points out that the survivors took along a part of the cargo and some of the equipment on their way home.

Apart from these groups, we can also distinguish the group of finds belonging to the debris deposits around the house and – to a lesser degree – found on the floor of the hut. This material was collected exclusively from 1933 onwards. The rubbish resulting from the ten months stay in the house consists of food remains such as animal and fish bones, coal, textiles, pottery, pieces of metal, rope and leather. Compared to the '19th-century finds' which were most probably stored in trunks and boxes inside the house, the '20th-century finds' from the rubbish deposits are worn, fragmented and heavily used. Before the excavation of 1993, it was not clear to what degree the subsoil had been disturbed by activities of recent visitors. The excavation of the floor of the house soon pointed out that the finds were still *in situ*. The subsoil appeared to have been left untouched by human activity. This was demonstrated by the finds of parts of the skeleton of polar foxes which were still in anatomical position. Fragments of pottery were found with all the sherds present and in the right position.

Although the accounts of Carlsen, Gundersen and Gardiner were never meant as scientific reports, it is possible to extract some information from them about the location of their finds and thus, in combination with recent archaeological information, it is possible to give a probable reconstruction of the use of space inside and around the house.

On the one hand, the find pattern reflects the disintegration process of the house. The wooden structure seems to have collapsed in a southern direction under the influence of prevailing northeastern winds. Thus, for instance, iron nails which would have belonged to the construction have been equally distributed over both the interior of the house and a area of 4-6 m west, south and east of it, but they are virtually absent in the north area. On the other hand, this distribution is related to the living and working processes and in particular to the discard of refuse. De Veer describes in detail the winterers' routine during their nine months stay to keep the house tidy by dumping garbage and human waste outside (Honoré Naber 1917; Roeper & Wildeman 1996).

Such domestic efforts account for a number of clusters of mixed materials, such as ceramics, glass, coal, tar, pewter ware, cork, lead shot, leather, bones and nails. These clusters occur partly inside the house, but mainly outside to the east, south and southwest. The clusters indicate the location of the three doors of the porch which was *c.* 1.7 m. wide and covered the whole southern side of the house. The space inside the porch is marked by a diminished scattering of finds compared to the clusters just outside the presumed outline of the house, thus clearly distinguishing this space as a part of the house that was not used so extensively. A key pattern is represented by the spread of coal and bones, as these two classes of material are related to food processing. Apart from clustering around the fireplace, three deposits outside the house can basically be recognised: there is one main cluster along south-section of the east beam (F6/10,15-G6/1,6), another at two metres distance along the central part of the south-beam (E7/9,10-F7/6,7) and a third one along the south-section of the west-beam (E6/1,6,12).

The other categories of materials partly coincide with this basic pattern and partly show additional clusters. For example, concentrated deposits of fragments of red-glazed ceramics, stoneware and glasseach of which probably represents an individual vessel – are also found at the southwest and southeast corners and at some locations around the fireplace. Pewter tableware shows another variant with a cluster in the northwest-corner in addition to two east and southwest deposits. While some pewter fragments have been found directly south of the south-beam, no remains were located in the interior area of the house. The clustering of leather fragments not only indicates an outward discard at the east and west deposits, but seems also to define an interior working area in the west-section of the house, north of the fireplace. A similar clustering of nails in this area can also be partly explained by this assumption. Lead shot, which had probably been produced locally – because tools for this purpose were available from the ship's inventory – has been found only at two locations: either in the presumed working area north of the fireplace and at the east-southeast side outside the house. Noteworthy is the find of a piece of a felt hat which was cut to fit in a shoe. Microscopic analysis of matter found on this object revealed pieces of Spanish Fly (*Lytta vesicatora*) used for the medicinal properties of Cantharides, a substance which was administered for kidney diseases in the 16th century. A secondary symptom is the generation of heat and it could be that they used Spanish Fly to fight cold feet.

The information about the finds given by Carlsen and Gundersen adds more about the reconstruction of the interior. Carlsen's drawing shows a row of bunks along the east side of the house. These bunks are also depicted on the print of the interior of the house as published in the German edition of De Veer (1598) (fig. 1). It is striking that small finds in the subsoil which are abundant around the hearth are almost

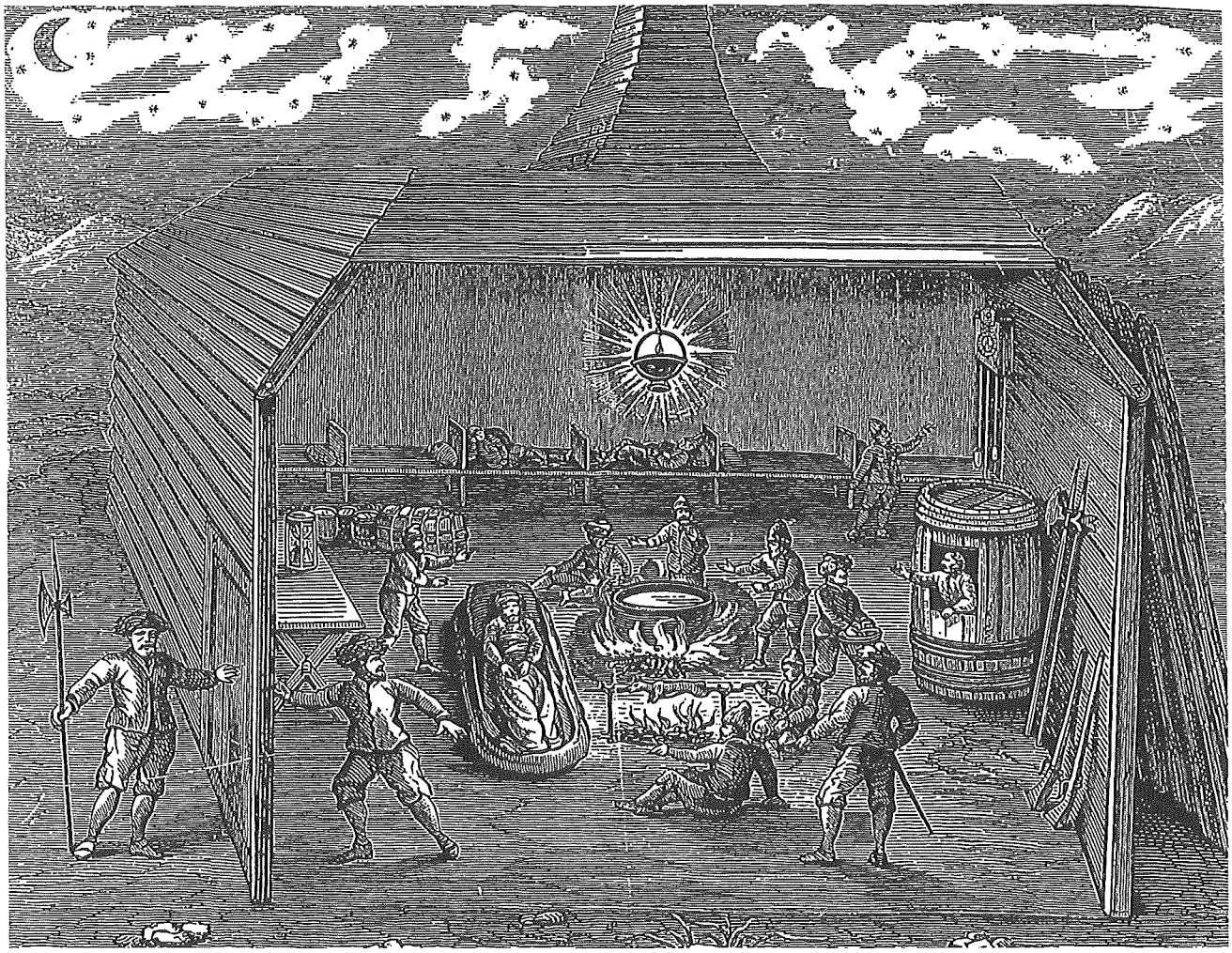

Fig. 3. - *Representation of the 'Behouden Huys'.*

missing on a strip of 1.5 m wide where one would expect these bunks to have been placed. In front of the bunks stood four chests or trunks. One chest was probably empty and filled with ice. In another chest, Gundersen found two folded maps and a manuscript with a translation of the account of the voyage of Pet and Jackman to the north. Two other chests contained seven files, a hammer, an auger, chisels, two circles, pieces of navigation instruments, some bundles with engravings, a wooden flute, three Dutch books and some pieces of coloured clothing. From one of these chests came the remains of the flags of Amsterdam and the United Provinces.

Against the south wall of the hut stood also one bunk with a length of *c.* 1.60 meter. Next to this bunk, Carlsen found the remains of a big metal money box with a lock in the lid.

The central space in the house was used for a hearth on which an open fire was kept burning throughout the whole winter. The diameter of the hearth was *c.* 2 m. The winterers used small pebbles from the beach to create a platform on which the fire burned. This building method was based on customs of traditional hearth building in the Netherlands to prevent risk of fire because of the flammable peat ground. It is not clear why they built the elevation; probably they tried to increase the heat-release. Anyhow, it served a purpose for during the winter the fire place was raised with pebbles at least two times. Carlsen describes the find of two copper pots standing in the middle of the fireplace. Nearby he found three wooden porringers with brass rims. The research of Kravtsjenko resulted in the find of a small semi-circular wall built of two layers of stone with a height of 15-20 cm. The wall was probably erected to screen the draft coming from the doors on the south side of the house. Near the wall, Kravtsjenko found a small polar bear cut out of a lead bullet.

From the diary of De Veer we know that the cargo and the ship's supplies were stored in the house. During the winter months, all the barrels with beer, sherry, water, salted meat and fish, cheese and beans were piled up against the empty west wall and in the porch on the south side of the house. The food supplies were just sufficient to last through the winter. By the beginning of the summer of 1597, most of the

barrels were empty. The staves of the barrels were used as fire wood as only a few were recovered, the hoops were thrown on the roof to keep tight the sails which they had spanned over the roof planks to make the roof waterproof.

Although the research concerning the finds is not yet completed, the preliminary results show that the site of the '*Beholden Hues*' is a peculiar and important source of information concerning the background and organisation of early Dutch explorations in the arctic. For us, the tragic failure of the last Barents voyage is an outstanding opportunity to catch a glimpse of a part of the archaeology of European mercantile expansion which is still not all that well known.

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drs P.M. Floore & dr J.H.G. Gawronski
Institute for Pre and Protohistoric Archaeology
University of Amsterdam
Nieuwe Prinsengracht 130
1018 VZ Amsterdam
The Netherlands

Birgit Schröder

The inventory of a late seventeenth century freighter, wrecked in the Zuiderzee

1 Introduction and Methodology

During the summer of 1993, the *Centrum voor Scheepsarcheologie* (CSA, now NISA/Nederlands Centrum voor Scheepsarcheologie, Ketelhaven) fielded an international team of nautical archaeology graduate students and CSA members from the United States, the Netherlands and Germany. Directed by Robert S. Neyland, the team excavated and recorded an unique freighter from land formerly covered by the Zuiderzee, known today as the IJsselmeerpolders. Subject of this paper is the artefact assemblage of this vessel, designated as 'H 107' after the agricultural lot on which it was found (Neyland & Schröder 1997).

A total of 281 artefacts make up the inventory of the wreck. These have been categorised according to function. This system was devised by Reinder Reinders and allows the comparison between the inventories of different ship types wrecked in the same period and/or comparison of changes within the inventories of similar ship types over a period of time (Reinders 1985, 86). Concerning the H 107 inventory, one problem with this system is that it was developed for 19th-century wrecks for which the functions of most items are well understood. In applying this system to a ship from the time around 1700, there are sometimes the same difficulties in determining the specific function of certain objects – many objects may be multi-functional rather than fitting into a single specific category. Furthermore, some categories are incomplete or not represented at all. In H 107, the categories represented were administrative objects, instruments for navigation, tools, domestic effects, hearth and galley, eating and drinking, victuals and provisions and personal possessions. Categories that were not represented at all include weapons, documents and cargo. Categories underrepresented are working equipment, administrative and navigation.

2 The Inventory

a) Ship's equipment

The category of ship's equipment can be well represented in shipwrecks from the IJsselmeerpolders. The types of items necessary to operate a vessel include anchors, sails, cordage and spare equipment (Fig. 1). The bulk of H 107's iron fittings and fasteners were poorly preserved iron objects, the majority of which were located in the bow area. Some of the bolts, spikes, and nails may not have been spares, but may come from the hull itself, particularly from the collapsed and destroyed starboard side. On H 107, the category ship's equipment includes bolts, as several rosebolts and forelock bolts, staples, and of course lots of nails of different sizes. Other objects belonging to this category are of wood, such as wedges and plugs, a single cleat and several small wood pieces or chocks, perhaps for minor repairs.

One artefact related to the stern of the ship is a fragment of a gudgeon. An exceptional iron object in the architectural category is a heavy counterweight, which was held to the mast by three iron straps and assisted in raising and lowering the mast. It consisted of the portion of a cast-iron cannon from the breech to just below the trunnion. The mast would have pivoted in the tabernacle upon a larger bolt (120, l. 50 cm). A pivoting mast was a necessity when passing under canal bridges. It is not easy to define precisely which type of cannon this fragment comes from, but according to R. Roth from the Ordnance Society some tentative identification might be possible: The fragment could be that of an English Culverin Extraordinary or a Culverin Ordinary bored up or cast for the Dutch 12 pounder calibre (R. Roth, written communication 23.11.95).

Near the remains of the mast and mast tabernacle, another important artefact related to the rigging was found. This was the gooseneck, referred to as '*lummel*' in Dutch, which connected the end of the boom ('*giek*') with the main mast. The example from H 107

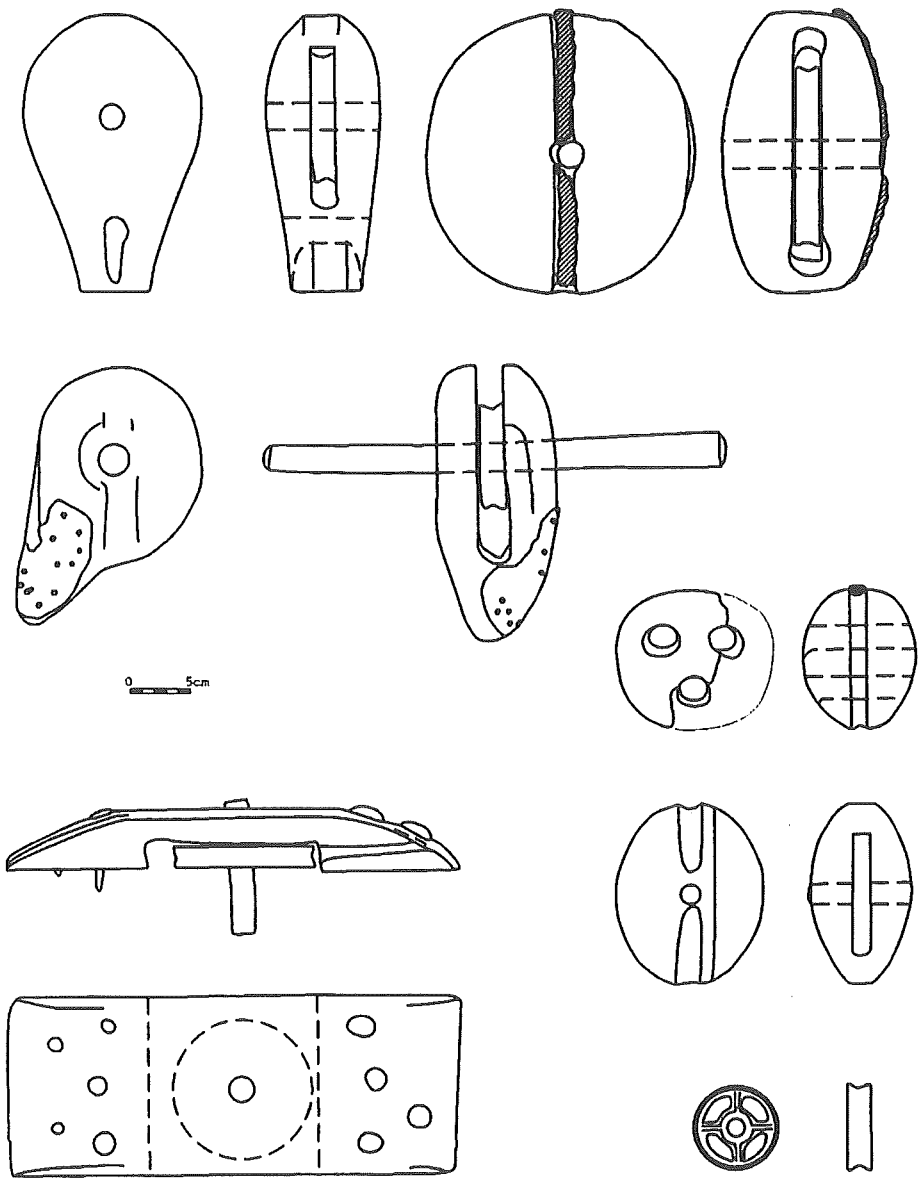


Fig. 1. - Some elements of the ship's equipment.

is a simple hook with a rectangular cross section. The presence of a gooseneck is an indication for the rather early use of a gaff-sail, which is especially interesting since on many small Dutch freighters such as '*tjalks*', the gaff sail was not widely used even until the beginning of the 20th century (Marquardt 1994, 188). Together with the gaff sail, it seems reasonable to propose that H 107 carried a foresail and a flying jibsail or '*jager*'.

The metal piece which capped the head of the stem and contained the eye for the forestay was also preserved in the wreck.

Besides the constructional items, there are not many artefacts in the ship's equipment category. The inventory consists of 4 single blocks, 2 cheekblocks (for the leeboard), 1 deadeye, one wooden and one bronze spoked-sheave, several rope- and strop-fragments, 4 hooks which most likely once belonged to blocks, and some rings and chain parts. A roll of textile was recovered from underneath the port side planking in the bow, and a folded sail or tarpaulin, possibly of linen, was recovered from the port side amidships, immediately aft of the mast step. Of all the meters of rope that would have been used in the ship only a few examples survived. In the stern there was a double loop of rope, having a large and a small loop. It might have been used in mooring the stern of the vessel. The pump tube, a leather gasket and three pump valves were recovered during the excavation. The well preserved tube, called a '*pumpkoker*' in Dutch, was 233 cm long, with a maximum outer diameter of 18 cm at its head and a minimum of 13 cm at its heel. From the provenance of the pump tube in the wreck it is likely that the pump was positioned just forward of the sail beam with its heel placed in the chine. The H 107 pump is of the common pump variety as described by William Falconer at the end of the eighteenth century (Falconer 1780, 221).

b) Working equipment

There is only one object which can be placed in this category, a leather piece used probably as the hand-protection the Dutch call a '*handplaat*'. It was found in the bow and looks like the leather top of a clog or shoe. Although it is perforated, it could be the raw material of a shoemaker rather than the finished upper part of a shoe. It shows traces of use on the upper side, and two rounded wearmarks, possibly from the fingertips of a left hand, on the inside. The '*handplaat*' was used to protect the fingers while handling heavy cargo like bricks.

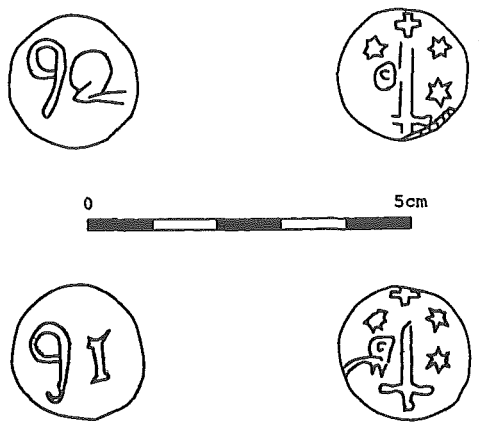


Fig. 2. - *Two lead tokens.*

c) Administrative

This category is represented by three objects: two lead tokens and a writing pen (Fig. 2). Missing are administrative artefacts such as stationary, ship's papers, a slate chalk board and similar items.

Two lead tokens were recovered from the wreck (d. 1.9 cm). Both tokens have the coat of arms of the City of Haarlem on one side; on the same face what appears to be the letter 'C' has also been stamped into it. On the reverse sides one token has the number '91', the other bears the number '92'. These are thought to be the abbreviations for 1691 and 1692 (Kleij 1991, 107) The purpose of these tokens is not certain, but comparable pieces were recovered from another small 17th century freighter, OZ 71 in Southern Flevoland (Vlierman & Kleij 1990, 4). It has been suggested that the tokens might represent the payment of fees for the maintenance of lighthouses or fires, which could have been sold once a year to those skippers using certain Zuiderzee routes. These fees would have paid for the maintenance of such lights. Another possibility is that they represent annual toll payments to a city, in this case Haarlem, for the use of locks and canals (Wijsenbeek 1994, 122).

A writing pen was discovered in the bow lodged underneath a frame. It does not contain a lead and is not a pen in the modern sense of the word, but instead was most likely a kind of pen holder or 'stylus'.

d) Navigation

The only artefact from this category is a fragmented compass. An identical compass was found on the wreck of a so-called '*Ventjager*', the wrecking of which dates to about the same period of 1700 as H 107 (file OH41, NISA Ketelhaven). The presence of the compass confirms that H 107 could have manoeuvred not only upon the inland rivers, but also in the waters of the Zuiderzee and the Wadden Zee.

e) Tools

The category of tools concerns those items used for the management, maintenance and cleaning of the ship. Twelve recognisable tools were found in the wreck, including two pots which served as maintenance equipment for the vessel (Fig. 3). In the bow, a drill, an axe, an adze and a pair of tongs, two whetstones and a marlin spike were recovered. In the stern, the tool assemblage found there consisted of a hammer, caulking iron and two pots which most likely were used for maintenance work. These pots are believed to have been used for caulking equipment at the time the vessel was wrecked. Because they were found in the stern and show clear traces of reuse outside the kitchen, they have been added to the category of 'tools', not to the kitchen assemblage as was the case for the other pottery found in the bow. The larger vessel is a clear-glazed tripod pot of crude manufacture. In Dutch and German, the type usually is referred to as '*Grape*'. The pot contained some tar in the bottom of its interior. The smaller of the two pots from the stern is the only grey paste earthenware vessel recovered aboard the ship. It is entirely covered with a glaze coloured sea-green through addition of copper oxide. The bottom is slightly burned outside, but the clean interior indicates that it was not used for heating tar (Schröder 1994, 24-25).

The jumbled bricks in the stern could represent a kind of working platform, since none of them shows traces of burning like the hearth in the bow. They might also be added to the tool category. The bricks were clustered together with the fragments of the two reused ceramic cooking pots.

There was a single clog found used as a tool kit. As an X-ray (RING, Amersfoort) reveals, it obvious-

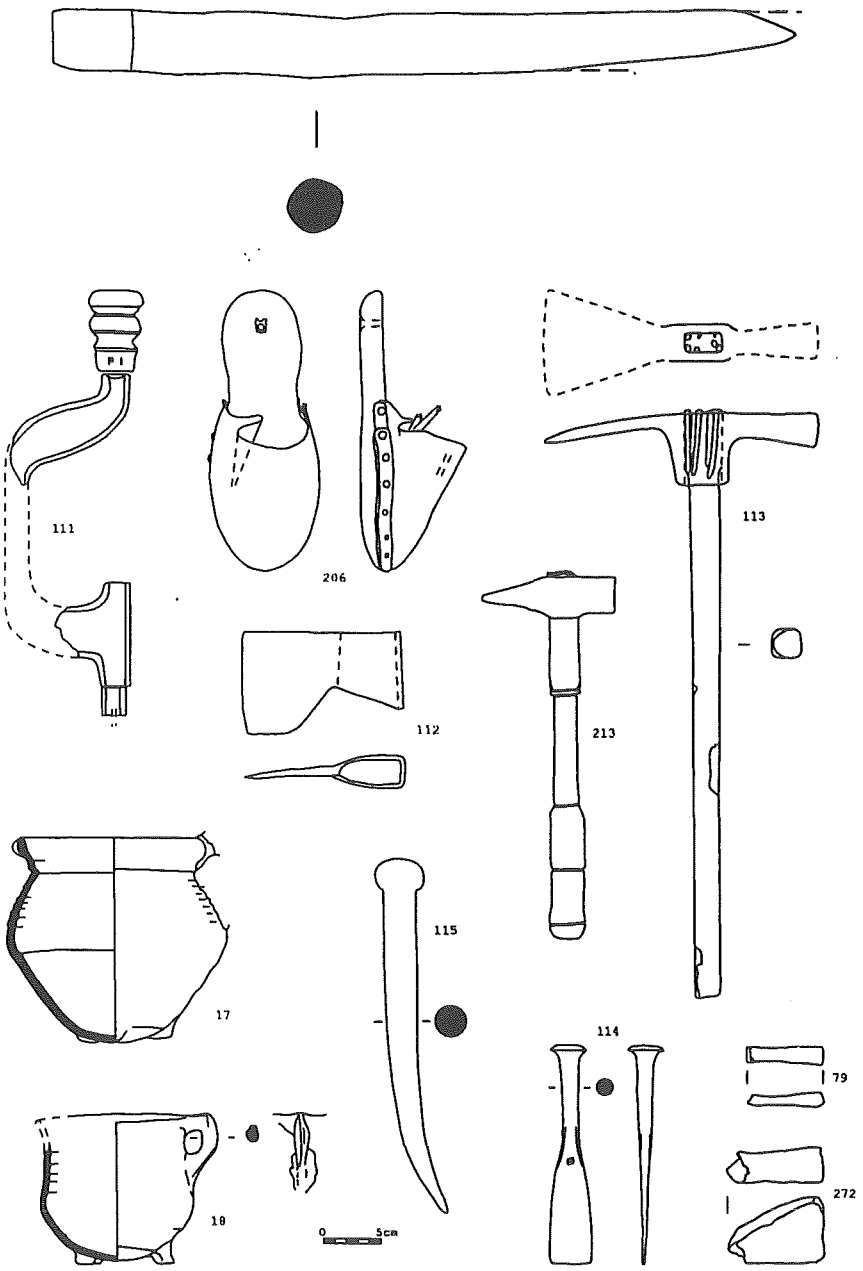


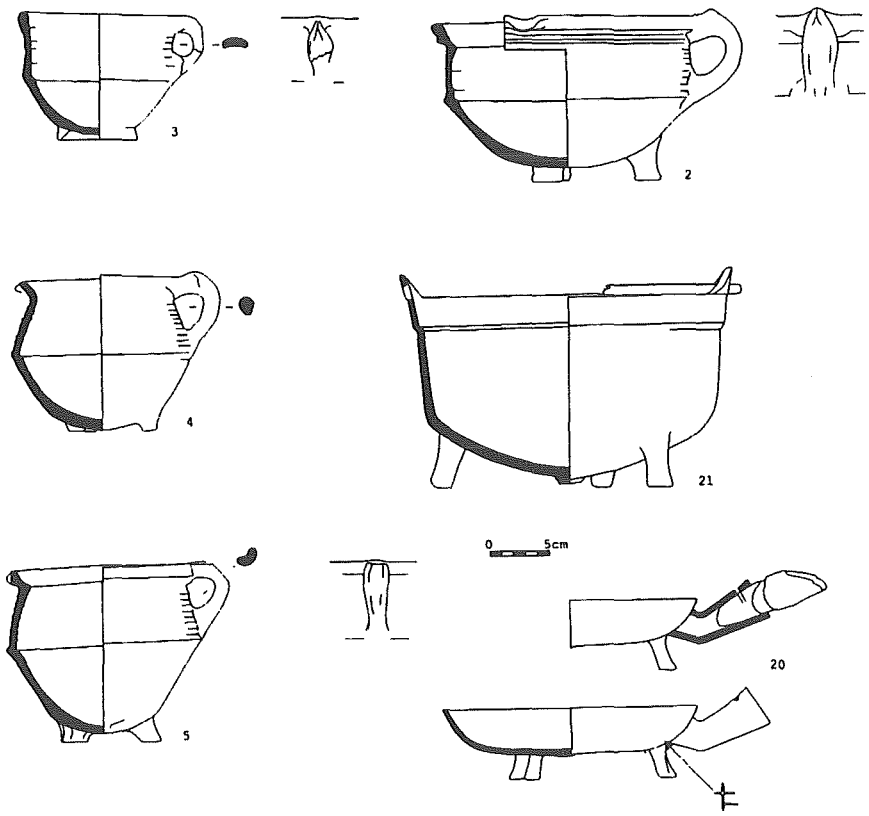
Fig. 3. - *Pots and tools which served as maintenance equipment.*

ly contained spare spikes, nails, and possibly drill bits. It has a wooden sole with a hole in the heel for hanging on a nail, and the leather upper serves as a ready container for small objects.

f) Domestic effects

Four objects aboard can be related to the category of domestic effects: a lamp, a single hinge, a brush and a decorated piece of wood that is probably a boxlid. The tin lamp has a surviving height of 9.3 cm and was found in the bow. The state of preservation was so bad that only the basic features could be recognised, but an X-ray image showed the object to be a type of oil lamp referred to in Dutch as a '*snotneus*' ('snotnose'). The popular term 'snotnose' was derived from the characteristic shape of these lamps: a cylindrical body with a nose-like tube sticking out. When the lamp was not lit, the oil-soaked wick hung from the tube and perhaps dripped slightly. The original appearance of the '*snotneus*' from H 107 cannot be reconstructed, but the basic style of lamp seems to be comparable to the 18th-century lamps found in the fortification of Bourtange (Lenting *et. al.*, fig. 183, 447). The lamp from H 107 shows the remains of a tab opposite the snout hole. Therefore, it seems likely that it was designed to be hung, as opposed to the examples in Bourtange, but this seems reasonable considering the limited space available and unpredictable movements aboard a ship.

Fig. 4. - *Cooking ustensils.*



A bronze hinge was found unassociated from any other artefact in the bow. Almost identical hinges on the lid of a wooden box (OH 41, NISA file Ketelhaven, unpublished) show that the piece from H 107 most likely was used in the same way. A flat piece of wood with a hole and a carved decoration was found in the bow. This item was 18 cm long, 9.2 cm wide and 0.5 cm thick. It is decorated with a circle filled by low-relief carved grating. Its original function is not known, but it may have served as a lid to another box, perhaps holding small personal objects such as sewing accessories or toiletries.

Of the cabin ceiling, only a rectangular wooden part decorated with a straight carved bevel survived.

g) Hearth and galley

The remains of the hearth and galley assemblage indicate a working hearth in the bow. For the purposes of this analysis, the hearth and galley classification includes any item or feature related to the storage, preparation and consumption of food aboard ship.

A total of 92 complete bricks and 35 brick fragments were found on the wreck, as well as 16 complete green, yellow and brown glazed tiles and many small pieces of mortar. The majority of these materials were found in a concentrated cluster on the port side of the bottom of the bow. Also recovered in the bow were fitted wooden pieces to a hearth cabinet, as well as corroded pieces of iron that probably served as part of the hearth fittings. No hearth plate was located, but some of the bricks found in the bow were heavily charred and might have been used as part of a backwall protection to the hearth, which would explain the absence of an iron plate. Other objects indicating a working hearth in the bow were an iron trivet, two blocks of peat, and parts of a wooden chimney. The overall estimated length of the chimney is 54.5 cm, the width at the upper edge 26 cm and 70 cm at the lower edge. All pieces show additional holes and damages which make it likely that the chimney was made of reused wood parts.

Other items related to the hearth were several pieces of flint, the trivet and a brush. The brush is of a type usually used for cleaning the hearth, and known from town sites in Belgium and the Netherlands (Casparie & Lenting in Lenting & van Gangelen 1993, fig. 16).

A cast iron cooking pot and a bronze skillet were found in remarkably good condition just outside the bow on the port side. The skillet had three feet, a short wooden handle and a rim diameter of 20.5 cm. It also had a mark cast onto its outer surface. The cooking pot had an iron handle, three feet, casting sprue and a rim diameter of 25.9 cm.

When it comes to interpreting the functions of specific ceramic vessels, it has to be stated that the distinction between ceramic vessels used for cook-

ing, serving and storage aboard H 107 is not clear. This is comparable with the evidence from other IJsselmeerpolder shipwrecks dating from the same period and different from 'richer' well equipped younger vessels like Lutina or Zeehond, both of which date from the end of the 19th century (Oosting & Vlierman 1990, 59-66). The classification in three sub-categories therefore is rather artificial and had to be chosen as a matter of consistency.

When the freighter sank, at least nine ceramic vessels were in use aboard. With the exception of one pot of grey earthenware, all of them are of red earthenware. In the bow we recovered one pitcher, four cooking pots (three tripod skillets, one pot with base ring), one decorated tureen and fragments of a small decorated bowl. Only two pots came from the stern, but as mentioned earlier, these appear to have been used for maintenance work, not for cooking. Most of the ceramics were discovered in the bow, in the vicinity of the hearth wreckage, associated with other hearth and galley objects. All of them are redware items. A unique example among the tripods is a large cooking pot. Its surface is covered with a clear lead-glaze, which overlays a white clay slip on the bottom of the inside. This gives a yellowish colour to the bottom of the interior. The spout is placed at right angles to the handle. The form of the rim indicates that it probably was designed to hold a lid (K. Vlierman pers. comm.). Three smaller cooking pots also were recovered: two tripod skillets and one pot with a base ring. The pots have a clear lead glaze on the inside, with also partial clear lead glaze on the upper half of the exterior. An exceptional example among the redware pottery is the large bowl or tureen with decorated interior described later. With the exception of the large tripod, all pottery objects listed above have a more or less blackened bottom part and show heavy wear marks.

h) Eating and drinking

Compared with other wrecks from the Zuiderzee polders, the lack of plates is an exception, but this could have been usual among poorer people in the late 17th century and aboard a small ship with limited space (Braudel 1985, 212-214; McLaughlin-Neyland & Neyland 1996, 31).

The decorated tureen (Fig. 5) seems to have been in use for a while after it lost its second handle and is only slightly blackened, probably because it was used only for warming food on the hearth and otherwise may have served as a dish for the table. Apart from the handle missing, the object is well preserved. The interior is entirely covered with a white slip, the centre decorated with a large stylised 'IHS' painted in *ringeloor*-technique with copper-oxide green and iron coloured light brown. Other decorative elements are incised wavy lines around the rim. The entire inner surface and parts of rim and handle are covered by a layer of clear lead glaze. The only vessel which could be defined as a dish for being used only on the table is a small bowl, found shattered in the bow. When recovered, its sherds were in a poor state of preservation, and it is reasonable to assume that the bowl or plate had already been broken and out of use for some time when the ship sank (Schröder 1994, 17).

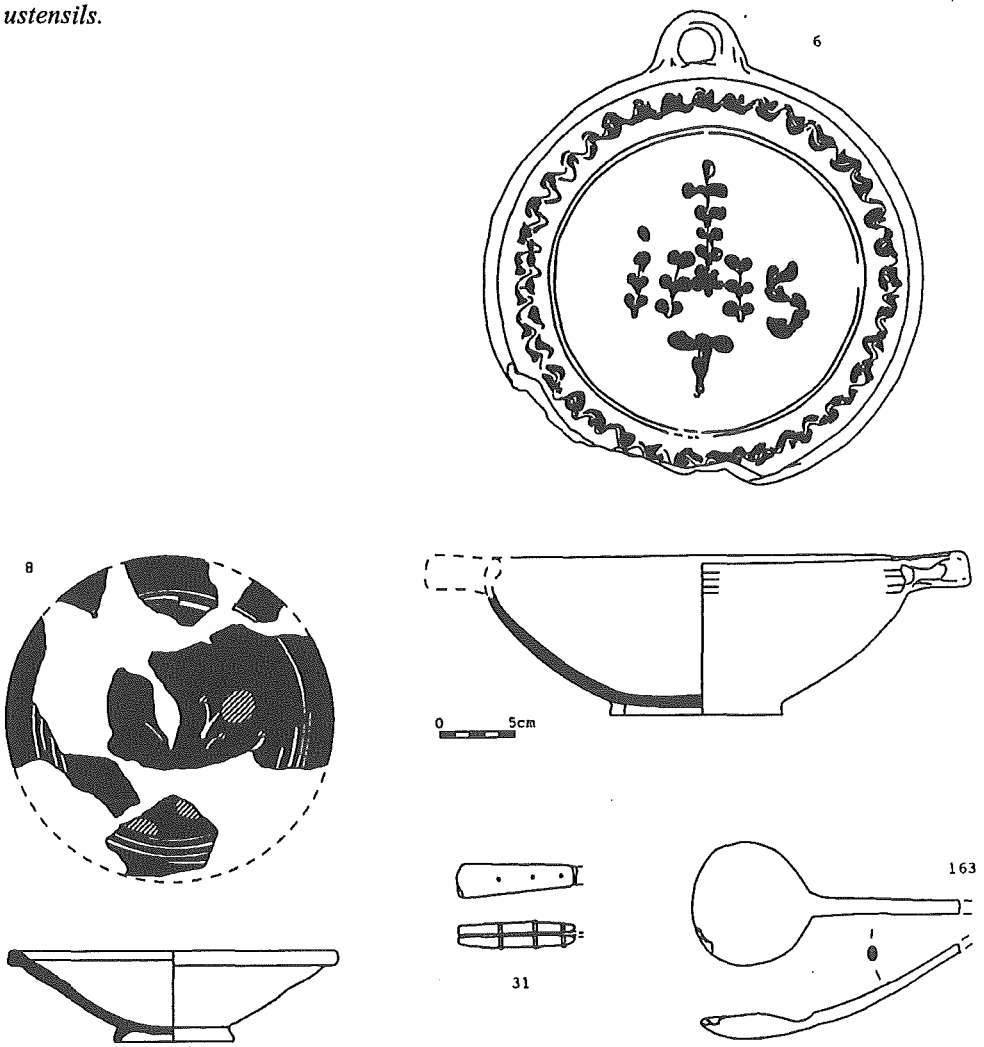
An undecorated wooden spoon recovered in the bow was doubtlessly used on the table.

i) Victuals and provisions

Only a few objects aboard can be linked with the storage of food and drink and also have to be looked upon as being multifunctional. The large pitcher has a trefoil handle, the interior and portions of the exterior are covered with a dark brown glaze coloured with iron oxide. The only decoration is a fine incised double line running around the shoulder. A similar pitcher is known from OZ 71, another 17th-century wreck in South Flevoland, and was used both as a storage utensil and a serving pitcher. The type probably contained water (Vlierman & Kleij 1990, 9, 52-53).

Two of the glass bottles of the wreck can also be regarded as containers for some kind of liquid. The best preserved glass item was a complete onion bottle, a common type which contained wine. It is made of green glass and has no impressed seal. The type is rather common in the transition phase between 17th and 18th century (Lenting *et. al.* 1993, 384, fig. 87). Another green glass bottle had a long neck and a flattened body wrapped in straw, a type known to have been used between 1650 and 1750 for exporting water from the famous sources in Spa in the Southern Provinces (Museum Boymans, 184, 194-195). They often are referred to as '*Franse Flessen*' ('French flasks'). It is difficult to give a precise period of time for this kind of bottles. For example, a very similar bottle has been recovered from the wreck of the 'Mary Rose', sunk more than 100 years earlier during the reign of King Henry VIII of England. Despite these possibilities of defining the original purposes of both bottles, they could have been reused for different liquids at the time the ship sank. There was no evidence of the contents left inside the vessels.

Fig. 5. - *Eating and drinking ustensils.*



k) Personal possessions

The functional category of personal possessions includes objects of private ownership such as clothing, grooming accessories, pocket money, personal tools and items of leisure. Despite the definition problem in regard of 'real' private ownership, the class is highly informative about daily life aboard a ship. Personal possessions include three buttons and several shoes. Each of the buttons is of different manufacture: one is a tin button with mushroom-shaped head, one a bowl-shaped tin button with wooden interior, and the third is entirely made out of wood. They were found in the stern, as was the only sewing accessory, a small pin. A second bronze hinge was a single, very small one recovered loose in the stern. Comparable hinges are known for instance from the leather cover of a bible from another wreck in the IJsselmeerpolders.

All of the nine nearly complete shoes and leather fragments were recovered in the bow. Two of the shoes are single clogs of different size (big and medium) with wooden soles and leather caps fastened with copper rivets. The other shoes are entirely made of leather and of a common type known from other shipwrecks (NISA files, Ketelhaven). They are also of different sizes. There is a pair of large sized shoes, three shoes of medium size and a very small shoe obviously made for a small child. However, old shoes often were used for scrap leather, so further conclusions about age or number of people aboard are not possible. Besides the shoes, also single shoe and other leather fragments were recovered. Some of them seem to be spare pieces for repairs for shoes or as patches for trousers and jackets, or intended to be used on the ship's pump parts.

A knife was found on the starboard side near the mast step, adjacent to a marble and a piece of flint. The wooden handle which is fixed to the blade end with three rivets is preserved. The marble is the only other object besides the little shoe which could be connected with a child being on the ship at some time.

The remains of a little glass bottle were recovered amidships. The delicate '*flacon*' was made of very thin, transparent olive green glass and can be regard-

ed as an uncommon item aboard a working vessel of this type.

The sub-category smoking is well represented in the wreck assemblage. There were 11 complete kaolin pipe bowls and many fragments. Most of them were scattered in the bow compartment. Their type is referred to commonly as 'Gouda' pipe. The pipes play a role in dating the ship, because heel marks and bowl shape can be chronologically interpreted within certain limits by providing dates for a *terminus post quem* (see chapter 3). Several pipe bowls have heel marks, such as a double headed eagle (probably representing the coat of arms of the city of Deventer), the monogram 'IHS', a crowned 'M', a ramshead and a drum. There were also examples of a type of bowl decorated on both sides with an abstracted rose, called a 'Tudor rose' pipe. The bowl shapes represented are the more trunnel-shaped '*Trechterkop*' and some slightly ovoid examples (compare Duco 1987).

Another item of leisure, but which also could have been necessity during the winter, was recovered resting near the mast step at the beginning of the bow area: a single ice skate. Only on one of the three severely corroded copper coins found in the vessel, the date and most of the design are still visible. It could be identified as being a '*Duit*'. One face shows the coat of arms of the City of Utrecht, and the other face has the inscription 'CIV TRAIECT' (= *civitate Traiectum*) above the date 1667. This type of coin was minted in Utrecht between 1657 and 1689 (Verkade 1848, No. 646, 147-148 and Pl. 116-4).

3 Dating and Discussion

Several methods of dating have been applied to H 107, including the dating of the sedimentary stratigraphy, dendrochronology, and the dating of kaolin tobacco pipes and other artefacts. Taken together, these all indicate an approximate sinking of the ship about A.D. 1700, give or take a decade.

Dendrochronological analysis has been carried out by the '*RING*' in Amersfoort and revealed that the oak trees which were used to build the hull were felled between the inclusive dates of 1685 and 1693. A turn of the century date for the wreckage is suggested by the style and form of many artefacts found with H 107, such as ceramics and kaolin pipes. Most of them have parallels from other dated archaeological sites in the IJsselmeerpolder area. Another proof that H 107 sank sometime during or after 1692 are the two lead tokens recovered from the wreck. As to the pipes found aboard H 107, it can at least be said that none of them contradicts the general dating of the wreck to the time around 1700: heel stamps, bowl shape and stem thickness can roughly be placed between 1675 and 1715. The ceramics can be dated to the second half of the 17th century. Therefore, it seems possible that H 107 was built at the beginning of the last decade of the 17th century and sank in the first decade of the 18th century. That the vessel had a short career is also suggested by the relatively few hull repairs or scars that would have been present on an older hull.

The scatter of artefacts indicates that galley and living quarters were located in the bow, while the stern was used to store equipment. This situation is different for example from that of two other vessels recovered in the IJsselmeerpolders which both had their living compartment in the stern (Mc Laughlin-Neyland & Neyland 1996, 54). It is difficult to say more about the specific function of the vessel except that it was a freighter, probably for bulk cargo such as bricks, turf or grain. The lack of any evidence for a cargo, however, makes it likely that the hold was empty when the ship was lost. The inventory consists of common equipment and inexpensive items for everyday life and work aboard. Many of the objects show traces of repair or reuse, or are of an inexpensive quality as with all of the pottery. There were no examples of refined earthenwares such as porcelain or stoneware which have been found on town sites representing wealthy or moderate income households. None of this indicates that the skipper or owner of the ship was extraordinarily poor as compared with the living standard of his time. However, it was certainly necessary to save money aboard whenever possible, and most of the time everyday life must have been very hard.

The provenance of almost none of the items in the inventory can be determined, but in some cases it is likely that certain objects are not local products from the Northern provinces where the ship was wrecked. The 'IHS'-decorated bowl differs in clay composition and decoration from the other redware pottery (Schröder 1994, 15). The best parallels can be found among Lower Rhine ceramics. The 'IHS' symbol, acronym for *'Iesus Hominum Salvator'*, became a very common Catholic symbol following the Counter-Reformation; therefore it is of course very unusual within the Northern Provinces dominated by Calvinism (Tauch 1988, 383-387). The sea-green pot of grey earthenware is also likely to be a product of the Rhineland, probably from Köln or Frechen or from another place in the bordering river Maas region (K. Vlierman pers. comm.).

The location of the wreck suggests a voyage along the northern route, perhaps to the cities of Kampen and Zwolle in Overijssel or farther north to Friesland

and Groningen. Several Lower Rhine artefacts also indicate a possible involvement in the trade between the northern and southern regions.

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Birgit Schröder
Arminstrasse 12
70178 Stuttgart
Germany

Stéphane Vandenberghe

Découvertes importantes datant de la fin du 15ième et le début du 16ième siècle provenant du fond de la mer du Nord en face du port de Zeebrugge

Depuis 1990 de nombreux objets intéressants ont étés retirés du fond de la mer du Nord, non loin du port de Zeebrugge. Au début on était d'avis que ces découvertes provenaient de "l'Anna-Catharina", un voilier de la Compagnie des Indes, dont l'épave devait être située à proximité de celle d'un autre navire *nommé "'t Vliegend Hart"*. Les deux bateaux étaient partis pour un long voyage en direction de l'Inde orientale et firent malheureusement naufrage pendant le voyage fatal du 3 février 1735. Le navire *"'t Vliegend Hart"* qui sortit en 1730 du chantier naval de Middelburg, a été localisé depuis 1980 et fait l'objet de recherches par des plongeurs Néerlandais et Anglais. Les objets usuels et canons provenant du second bateau, non-identifié, sont étudiés par nous au nom de l'association "Maritieme Archeologie", auparavant "Anna-Catharina". Nous avons rapidement constaté que l'hypothèse de la découverte du bateau "Anna-Catharina", qui avait coulé en 1735, n'était plus tenable, puisque plusieurs chandeliers en style gothique tardif et quelques jetons portent au revers les armoiries de Philippe le Beau (1482-1506). Les vestiges du navire même n'ont jamais été retrouvés, mais bien une très grande quantité d'objets en cuivre et en bronze, en étain, en fer, en plomb, en os, en bois et en pierre. Vu la présence de quantités d'objets identiques, nous pensons avoir affaire ici à un navire de commerce, cependant bien armé de canons. Vu le grand courant de la mer du Nord, il est probable que le voilier même ne sera plus jamais retrouvé.

En outre le voisinage du site actuel a été dragué régulièrement avec pour résultat que le paysage sous-marin y est très endommagé.

La majorité des objets retirés du fond de la mer consiste en ustensiles en bronze ou en laiton. Impressionnant est le grand nombre de chandeliers de table dont cinq types différents ont été découverts, complets ou en éléments détachés. Ces chandeliers fondus et non marqués sont d'origine flamande ou allemande (Nürnberg). Il est pour le moment difficile d'en situer la provenance. Il en va de même pour d'autres ustensiles tels que mortiers à pilon, robinets ainsi qu'un chaudron à trois pieds. Une importante

Fig. 1. - *Mortier.*

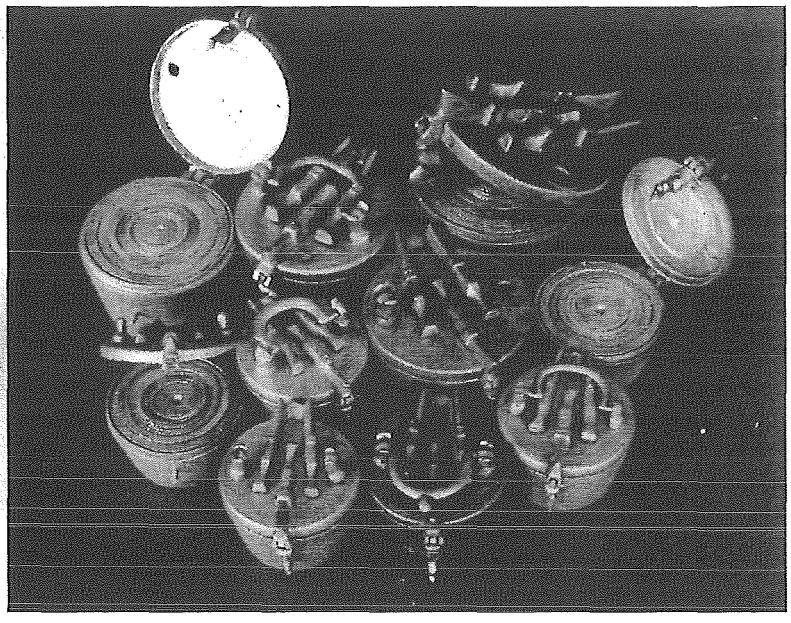

Fig. 2. - *Un nombre de piles à godets.*

Fig. 2. - *Clochette, étui portatif à aiguilles, dé à coudre, moule à reproduire des médailles représentant "la Messe de Saint Grégoire", etc.*

Fig. 3. - *Extrémités de manches de couteaux ornées d'une gravure.*

découverte est constituée d'une vingtaine de petites piles à godets d'une ou de deux livres; presque tous les exemplaires sont pourvus, sur le couvercle, de poinçons de Nürnberg (le lis et une feuille de trèfle). Ces très fins instruments de mesure qui s'emboîtent étaient employés pour différents pesages. Les changeurs et orfèvres se servaient de ces étalons depuis le Moyen Age. Cela est bien illustré par le panneau représentant Saint Eloy, patron des forgerons, peint par Petrus Christus et daté de 1449. L'œuvre d'art en question provient de Bruges et est conservée au Metropolitan Museum of Art à New York. La ville allemande de Nürnberg avait jusqu'à la fin du 18ème siècle le monopole en ce qui concerne la production des piles à godets. Egalement liés au pesage des monnaies sont quelques poids monétaires ou deneraux carrés. Ils étaient employés pour le pesage du *"forint"* hongrois ou double ducat, de *"l'excelente" ou "dobla excelente"* et du *"le castellano"*, deux monnaies de type espagnol. Une petite balance sensible et repliante en fer avec un plateau rond et un plateau triangulaire fait défaut, mais une boîte en cuivre avec anse qui contenait au départ la boîte en bois de poirier avec les deneraux carrés était bien présente. Vu que de nombreuses monnaies nouvelles et anciennes circulaient ensemble autrefois, une boîte avec poids monétaires était utile pour préserver le public de transactions désavantageuses.

En ce qui concerne le domaine de la numismatique, quelques jetons ont été découverts. Ils étaient faits pour des calculs arithmétiques. Tous les exemplaires représentent la figure de Vénus à gauche, tenant un oiseau dans la main droite. Au revers se trouvent les armoiries couronnées de Philippe le

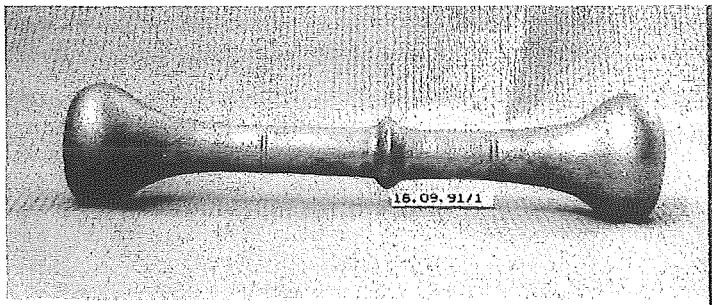

Fig. 5. - *Pilon.*

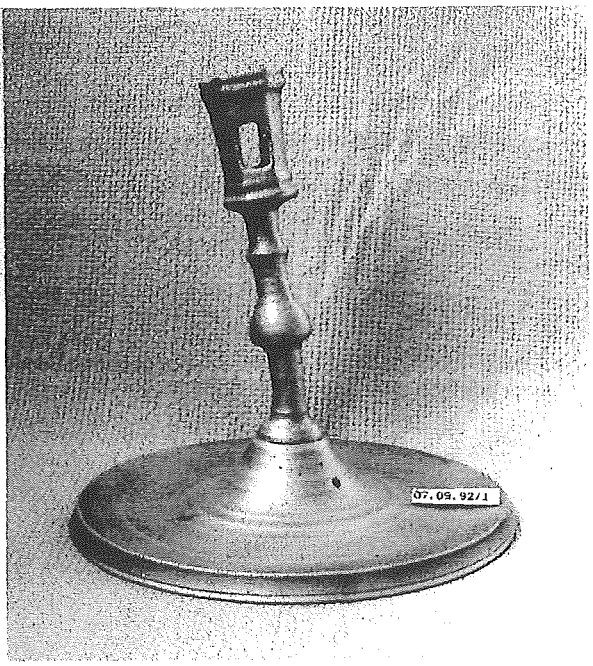

Fig. 6. - *Chandelier.*

Beau (1482-1506), ainsi qu'un texte dégénéré comme c'est s'est également le cas à l'avers. Ces jetons de calcul étaient aussi bien frappés dans les Pays-Bas qu'à Nürnberg. Malheureusement, seul deux monnaies très endommagées ont été découvertes. Elles sont attribuées sous réserve à l'Italie du Sud ou la Sicile (Alfonse, 1416-1458 ?).

Parmi les objets plus quotidiens sont trois chaudrons en cuivre qui s'emboîtent. Il s'agit ici de produits non achevés puisque le rebord est replié, tandis que l'anse en fer forgé manque. Dans le même métal est un chaudron rond qui était utilisé comme passoire en raison des trous nombreux, et qui est également non achevé. Un pot à trois pieds fondu en bronze est malheureusement endommagé.

Nous devons aussi mentionner un grand nombre de petits objets en cuivre comme des petites clochettes de dimensions diverses qui servaient d'accessoires de vêtements, une porte de lanterne de petite dimension, toutes sortes d'agrafes de costume, un étui portatif à aiguilles portant un œillet gravé sur chaque côté, des centaines de petites et grandes aiguilles, des dés à coudre s'emboîtants et même la partie supérieure d'un ostensoir. Nous comptons aussi des éléments de manches de couteaux parmi le matériel archéologique. Quelques pièces sont ornées d'une gravure (*recto-verso*) à l'extrémité, représentant par exemple Sainte Catherine, Sainte Barbe, Saint Jean où quelques têtes d'animaux. Un compas de bateau intact, dans le même métal, constitue une découverte unique; c'est pour le moment le seul instrument de navigation. Nous rencontrons divers petits et grands plats en étain avec des marques des fabricants, ainsi que quelques cuillères aux extrémités en forme de pommes de pin.

Il est dommage que les poinçons des étainiers ne soient plus lisibles à cause de l'oxidation du métal. Très intéressantes aussi sont deux salières dont le type nous est connu de la littérature spécialisée et scientifique. Sur base des marques (une main) il est possible de les attribuer à la ville d'Anvers. Unique en son genre est un moule en schiste qui représente en taille douce le thème iconographique de "la Messe de Saint Grégoire". Cette représentation à probablement été introduite à la fin du 14ème siècle et était depuis la moitié du 15ème siècle jusqu'au concile de Trente très populaire dans l'art occidental. L'apparition du Christ en souffrance au-dessus d'un autel est représentée sur ce moule qui servait à produire des médailles. Devant l'autel se trouvent le pape Grégoire le Grand agenouillé et, auprès de lui, un ou deux cardinaux, évêques, haut dignitaires ecclésiastiques, des saints ou autres spectateurs. De nombreux instruments de la souffrance *ou "arma passionis"* sont ajoutés à la figure du Christ. Une médaille ronde portative en étain porte sur une face la même représentation. Le revers montre Marie avec l'enfant Jésus sur une faucille de lune.

Comme nous l'avons déjà mentionné au début, le navire était armé de quelques canons en fer. Un exemplaire est entièrement conservé, y compris l'affût très lourd en bois de chêne. Cette arme à feu, ainsi qu'un autre petit canon chargeant par la culasse subissent actuellement un procédé de conservation. Puisque l'artillerie est de grand calibre, nous n'avons pas affaire à un caboteur. Un nombre de boules de

canon en pierre taillée ou en fonte sont de différentes dimensions.

Puisque la recherche d'une partie de chargement d'un navire inconnu datant de la fin du 15ème siècle ou du début du 16ème siècle est achevée, nous préparons avec quelques collègues un rapport final approfondi qui résultera en une publication scientifique.

Stéphane Vandenberghe
Stad Brugge - Dienst van de stedelijke musea:
Museum Gruuthuse
Dijver 12
8000 - Brugge
België

Volker Vogel

Schleswig – Stadt und Hafen im 11./12. Jahrhundert

Das Archäologische Landesmuseum der Kieler Christian-Albrechts-Universität betreibt zwei langfristige Forschungsprojekte, deren übergreifendes Thema das Entstehen urbaner Siedlungsformen an der inneren Schlei im Mittelalter ist. Das eine befaßt sich mit der Siedlung Haithabu, das andere mit der benachbarten Stadt Schleswig. Die Schlei ist eine schmale, fjordähnlich tief ins Binnenland eingreifende Ostseebucht, die als Wasserweg das Innere des Landes für den maritimen Handel erschließt. Hier, an ihrem Ende, lag im frühen Mittelalter die Siedlung Haithabu, ein Handelszentrum vorwiegend des 9. und 10. Jahrhunderts mit stadtähnlichen Strukturen und Funktionen. Mit seinem entgültigen Niedergang in den sechziger Jahren des 11. Jahrhunderts entstand auf dem gegenüberliegenden, nördlichen Ufer die Stadt Schleswig. Beide Plätze waren zu ihrer Zeit bedeutende, weil zentral gelegene Hafenorte für den Fernhandel zwischen Westeuropa und den Ostseeländern, an beiden Plätzen sind in den vergangenen Jahrzehnten langjährige und großflächige archäologische Untersuchungen vorgenommen worden. Nachfolgend sollen die wesentlichen Ergebnisse der Ausgrabungen in Schleswig in summarischer Kürze vorgestellt werden.

Vorauszuschicken ist, daß Schleswig die am weitesten südlich gegelegene Stadt im mittelalterlichen dänischen Königreich war und neben seiner wirtschaftlichen auch eine besondere politische Bedeutung hatte. Es war Zentrum eines Herzogtums, beherbergte einen Königshof in seinen Mauern und war überdies Sitz eines Bischofs, dessen Bistum bereits 948 begründet worden war. Das um 1200 niedergeschriebene Stadtrecht deutet auf frühere Anfänge städtischer Organisation des Gemeinwesens.

Am Beginn der Ausgrabungen in Schleswig standen zwei übergeordnete Fragen, die sich in Zusammenhang mit der offenbaren Verlagerung der Siedlung von Haithabu am Südufer der Schlei nach Schleswig an deren Nordufer erhoben: Wann begann die mittelalterliche Besiedlung auf dem Nordufer der Schlei, und wie verlief der Prozeß der Herausbildung der mittelalterlichen Stadt aus der frühstädtischen Siedlung in diesem weit abseits römisch-urbaner Tradition gelegenen Gebiet? Im Jahre 1969 wurde das Forschungeprojekt "Ausgrabung Schleswig" begründet. Die gezielt angesetzten Geländearbeiten begannen noch im gleichen Jahre und wurden bis 1984 in meist ganzjährigen Kampagnen fortgeführt[1]. In diesem Zeitraum konnten wesentliche Teilbereiche der mittelalterlichen Topographie archäologisch untersucht werden (Abb. 1), so daß es heute möglich ist, sich eine recht genaue Vorstellung von der Genese der Stadt Schleswig zu machen[2].

Die mittelalterliche Besiedlung auf dem Nordufer des inneren Schleibekens begann demnach im 11. Jahrhundert (Abb. 2). Seit etwa 1070 bestand eine Ufersiedlung mit dicht beieinanderstehenden, einräumigen hölzernen Häusern, die sich an schmalen Bohlenwegen aufreihten. Der Konstruktion nach waren es Pfostenbauten mit Schwellbohlen und senkrechter Wandverbretterung[3] (Abb. 3). Zur Siedlung gehörte ein Hafen mit Kaianlagen und Landebrücken. Weiter landeinwärts gab es zwei Kirchen mit ihren Friedhöfen, die ebenfalls seit dem 11. Jahrhundert belegt waren[4]. In das Jahr 1071 läßt sich auch das älteste Haus im Norden des Stadthügels datieren. Siedlungsablagerungen von etwa 1 Meter Dicke unter seinem Schwellenkranz lassen allerdings auf einen Siedlungsbeginn noch in der ersten Hälfte des 11. Jahrhunderts schließen.

Die Datierung der ältesten archäologischen Befunde bezeugt demnach ein kontinuierliches Sied-

[1] Das Projekt wurde für die gesamte Zeitdauer von der Deutschen Forschungsgemeinschaft in großzügiger Weise finanziert.

[2] Zusammenfassend: V. Vogel 1983; ders. 1989. Zu Einzelthemen vgl. die *Reihe "Ausgrabungen in Schleswig. Berichte und Studien"*, Wachholtz Verlag, Neumünster, in der bisher 11 Bände erschienen sind.

[3] Vogel 1991.

[4] Vogel 1971; Lüdtke 1984.

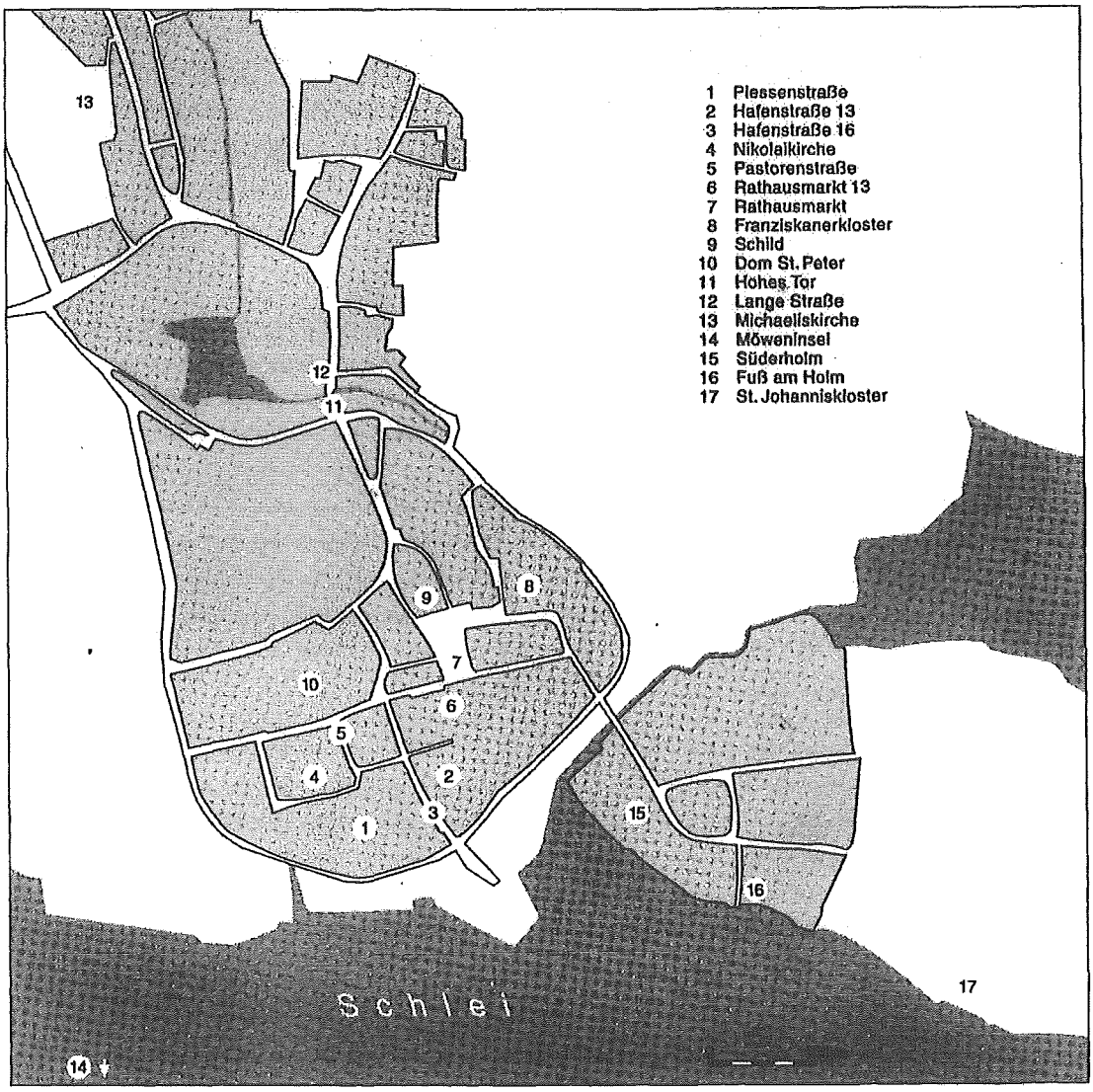

Abb. 1. - *Schleswig. Verteilung der wichtigsten Ausgrabungsplätze.*

lungsgeschehen und einen lückenlosen Übergang von Haithabu nach Schleswig, während eine früher in der wissenschaftlichen Diskussion favorisierte Siedlungslücke heute ausgeschlossen werden kann. Eine Reihe von Kleinfunden deutet sogar auf eine Phase zeitlicher Überlappung beider Siedlungen hin, so etwa das Spektrum der verschiedenen Warenarten der Haushaltskeramik. Unterstrichen wird der innere Zusammenhang beider Plätze durch den fernhändlerischen Charakter des frühen Schleswig, der sich nicht nur in den Hafenanlagen dokumentiert, sondern auch im Fundgut andeutet.

Im 11. und 12. Jahrhundert scheinen der Hafen und die Ufersiedlung mit ihren nördlichen Ausläufern das Siedlungsbild zu dominieren. Zwischen 1120 und 1160 wird dann – nach dem gegenwärtigen Forschungsstand – etwas weiter nördlich der Siedlung St. Peter, die romanische Basilika des Bischofs errichtet. Ein wahrscheinlicher Vorgängerbau ist bisher archäologisch nicht nachgewiesen, und es ist deshalb weiterhin nicht auszuschließen, daß er südlich der Schlei, also in Haithabu gestanden hat. Das Bistum war ja schon 948 begründet worden.

Ein Königshof im Nordosten der Stadt ist die dritte bedeutende Komponente neben der Bischofskirche und der Händlersiedlung. Aus Schriftquellen erschlossen, dürfte er schon im 11., vielleicht sogar schon im 10. Jahrhundert bestanden haben. Alles spricht dafür, daß jener große profane Steinbau mit Saal und festem Turm, der unter dem nachmaligen Franziskanerkloster ausgegraben wurde, ein Überrest des Königshofes ist. Er ist bisher aber nur in einer Bauphase des späten 12. Jahrhunderts archäologisch nachgewiesen worden[5].

[5] Es gibt stratigraphisch ältere Fundamente, diese konnten aber wegen statischer Gefährdung der noch stehenden Klostergebäude nicht freigelegt und untersucht werden.

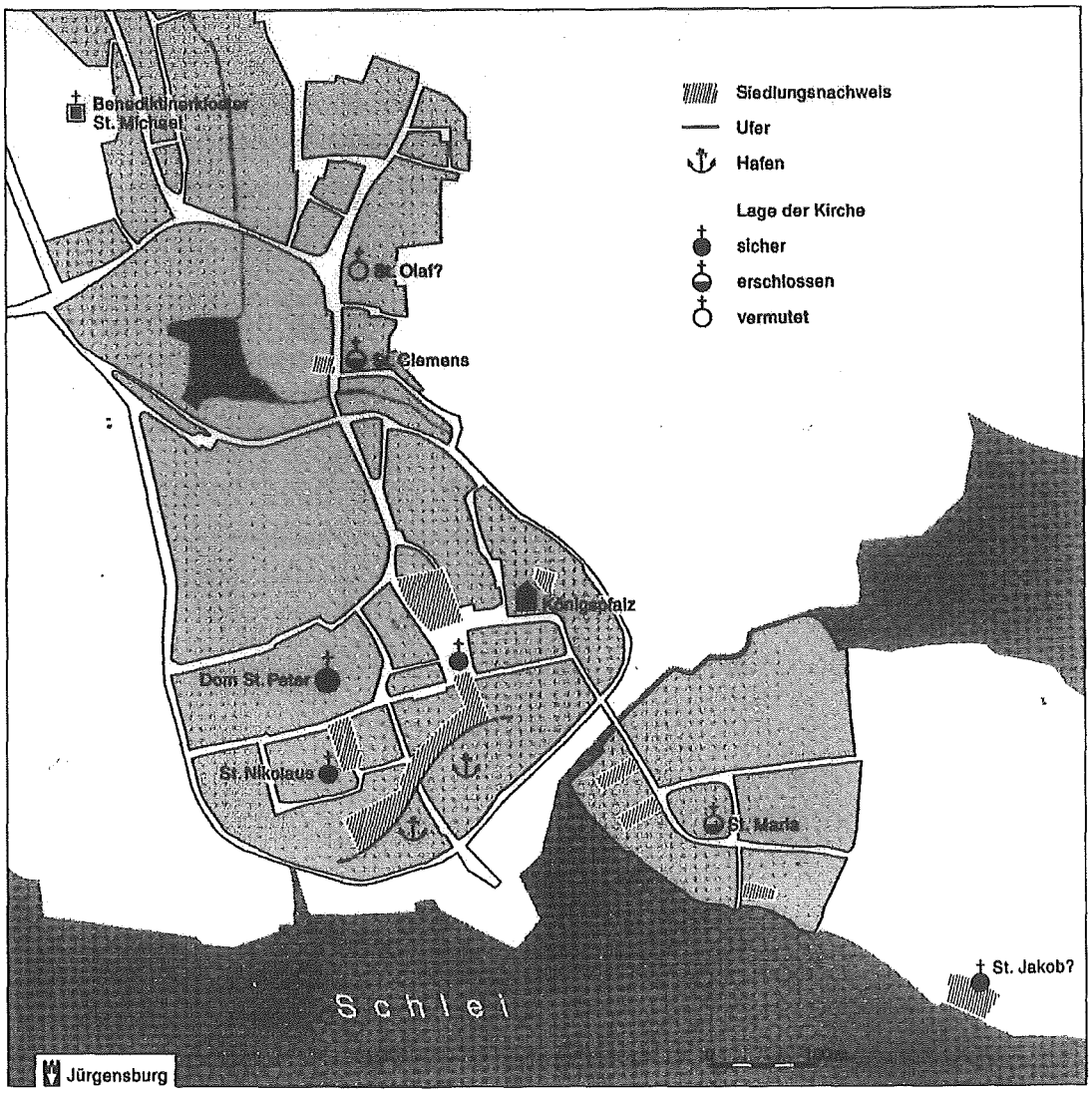

Abb. 2. - *Schleswig. Topographische Merkmale des 11. bis frühen 13. Jahrhunderts.*

Was die spärliche schriftliche Überlieferung andeutete, ist nun archäologisch weitgehend gesichert: Die Siedlung, die dem zerstörten Haithabu auf dem Nordufer der Schlei offensichtlich unmittelbar nachfolgte, war Fernhändlerhafen, Bischofssitz und Pfalzort der dänischen Könige. Weitergehende Überlegungen, die sowohl den Sitz des Bistums wie den des Königs bereits im 10. Jahrhundert auf dem Schleswiger Ufer lokalisieren, wo sie nach den historisch überlieferten Zerstörungen Haithabus 1050 und 1066 durch die Fernhändlersiedlung ergänzt worden seien, finden – bisher jedenfalls – noch keine archäologische Bestätigung[6]. Als Hypothese behalten sie aber ihre Gültigkeit.

Bei dem Versuch, die früheste Topographie und die Siedlungsgenese Schleswigs zu rekonstruieren, müssen auch die 1196 bezeugten Kirchspiele St. Olav, St. Clemens und St. Jakob erwähnt werden (vgl. Abb. 2). Diese Parochialkirchen, aufgrund ihrer Patrozinien auch als Zentren auswärtiger Kaufleuten gedeutet, sind bisher nicht sicher lokalisiert. Südlich der vermutlichen Jakobskirche, direkt am Ufer der Schlei, wurden kürzlich Spuren einer von Fernhandel geprägten Siedlung des 11./12. Jahrhunderts freigelegt. Sie liegt 500 Meter östlich der Stadt auf der ehemaligen Insel Holm. Im Umkreis des für St. Clemens in Anspruch genommenen Areals wurden sowohl Bestattungen des 12. Jahrhunderts als auch

[6] Die Frage nach dem Grund für die Siedlungsverlagerung ist noch immer nicht befriedigend zu beantworten. Wenn König und Bischof allerdings schon im 10. Jahrhundert auf dem Nordufer gesessen hätten, wäre leichter zu erklären, warum die Fernhändler in der Mitte des 11. Jahrhundert, einer Zeit häufiger kriegerischer Überfälle auf ihre Siedlung, den Platz gewechselt haben.

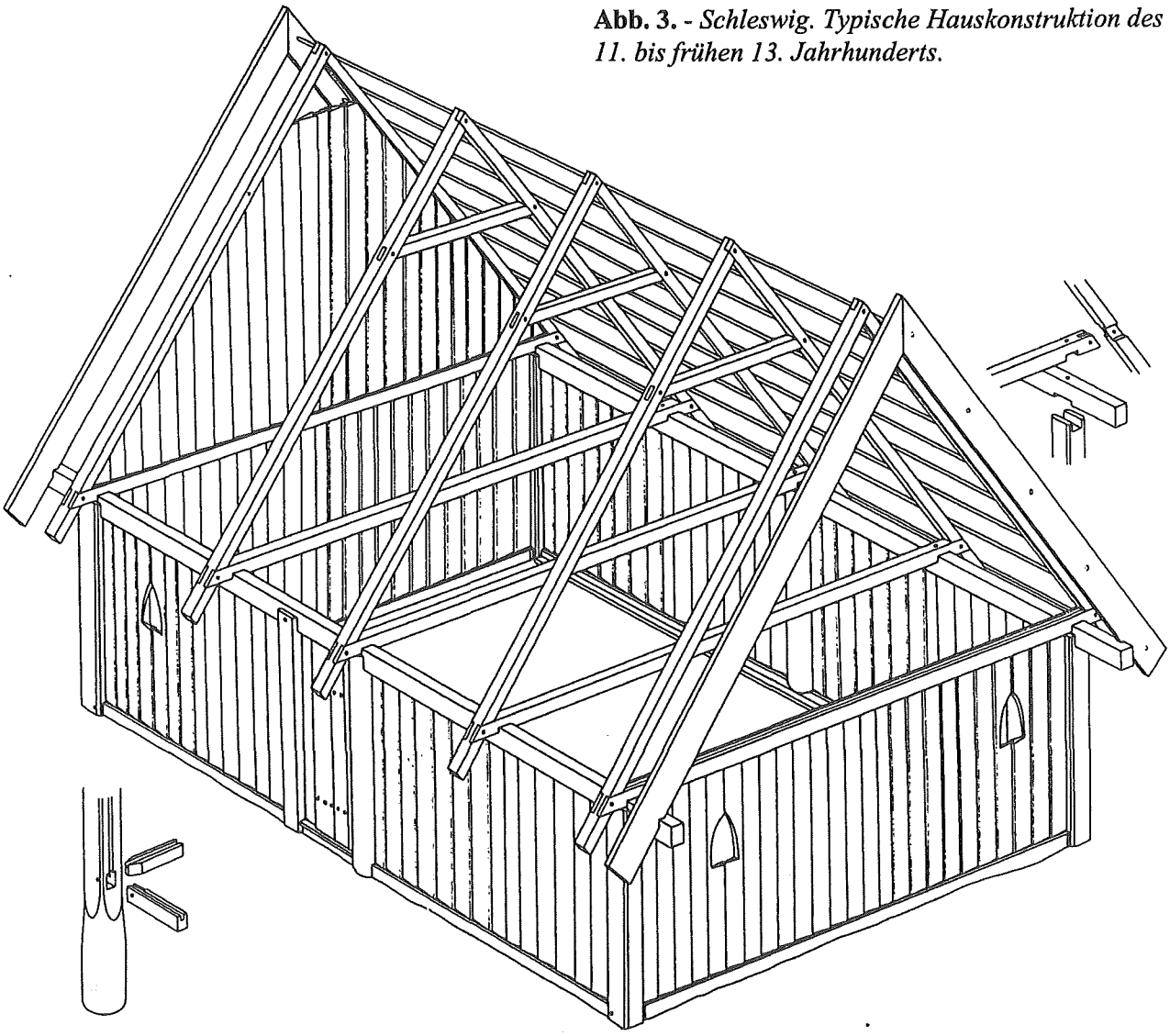

Abb. 3. - *Schleswig. Typische Hauskonstruktion des 11. bis frühen 13. Jahrhunderts.*

kleinräumig erhaltene Siedlungsspuren mit einem Fundinventar des 11. Jahrhunderts aufgedeckt. Auch diese liegen – nördlich – außerhalb der späteren Stadtgrenze, deren Verlauf hier durch eine bekannte Torlage gesichert ist. Für St. Olav wird mit gutem Grund ebenfalls eine externe Lage angenommen. Die Streuung dieser drei alten Kirchen deutet an, daß zu Beginn der Besiedlung des Nordufers mehrere mögliche Kerne einer künftigen Stadt existiert haben könnten, von denen nur der eine sich schließlich behauptet hat.

Weitere topografische Fixpunkte sind das ehedem vor den Toren der Stadt, aber in ihrem Weichbild gelegene romanische Benediktinerkloster St. Michael[7], die in das 11. Jahrhundert zurückreichende Fischersiedlung auf dem Holm vor Schleswig mit einer Marienkirche und das seit 1134 auf der heutigen Möweninsel gelegene herzogliche *castellum* (Jürgensburg).

Ehe über die weitere Entwicklung des hier entworfenen ältesten Siedlungsbildes zu reden ist, soll zunächst aus der Reihe topografischer Schwerpunkte der mittelalterliche Hafen ein wenig näher beschrieben werden (Abb. 4). Im Jahre 1971 wurden im Süden der Stadt die Fundamente des 1239 errichteten und um 1530 abgebrochenen Dominikanerklosters freigelegt. Die zum offenen Wasser hin gelegenen Klostergebäude waren über älteren Siedlungsschichten errichtet worden, die umfangreiche Holzkonstruktionen des 11. Jahrhunderts enthielten. Nachdem diese als Überreste ehemaliger Hafenbauten identifiziert waren, wurde das Ausgrabungsareal ausgeweitet. In den darauffolgenden Jahren wurde eine Fläche von 3.800 qm untersucht, die das ursprüngliche Ufer der Schlei im Mittelalter und weite Teile des Hafens erfaßte.

Der natürliche Ufersaum der Schlei verlief in der Mitte des 11. Jahrhunderts zwischen 60 und 150 m vom heutigen Ufer entfernt in einem flachen Bogen von Südwesten in nordöstlicher Richtung. Auf dem dahinter leicht ansteigenden Gelände entstand um

[7] Vellev 1973.

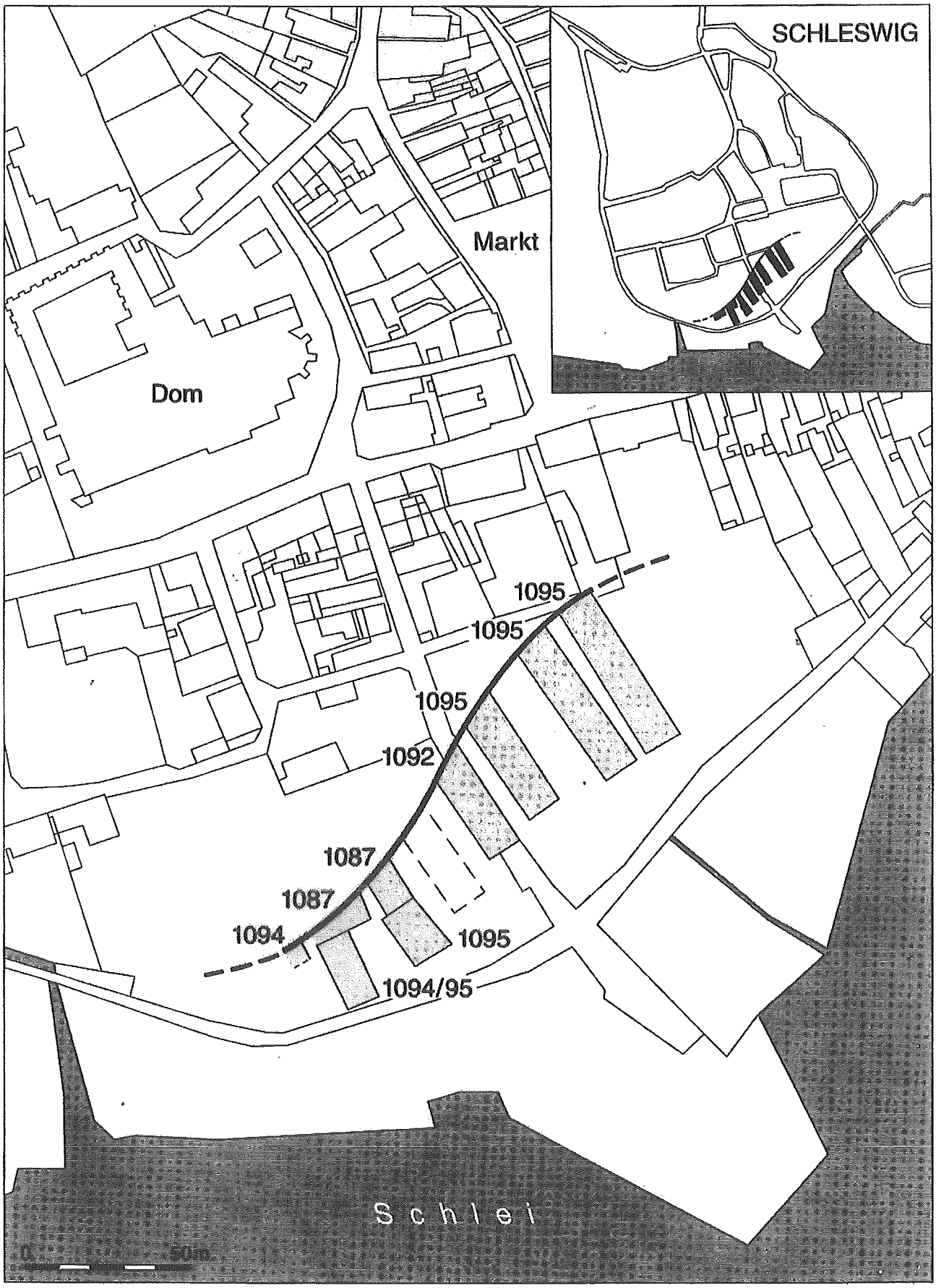

Abb. 4. - *Schleswig. Schleiufer und Hafenanlagen um 1100.*

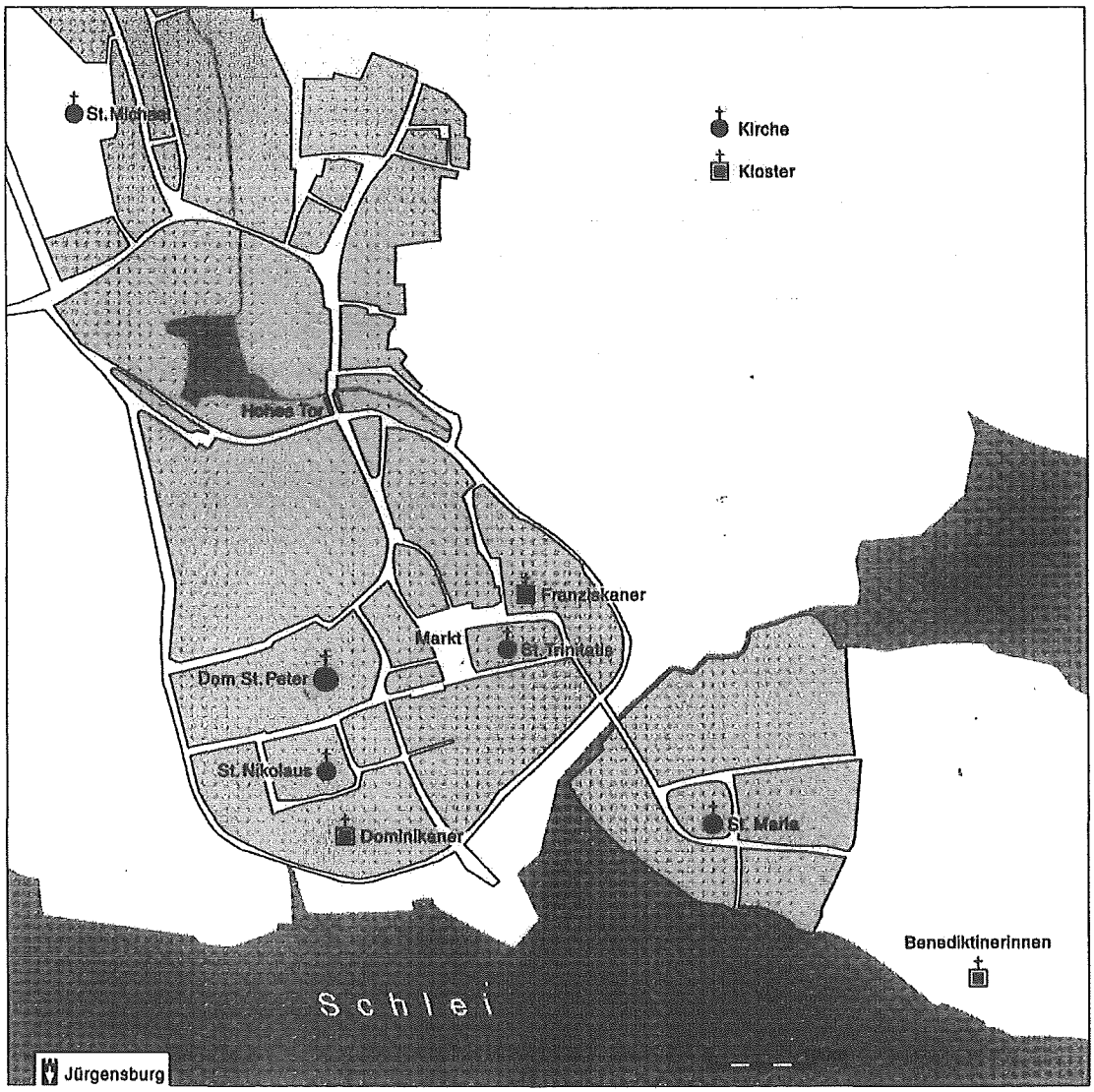

Abb. 5. - *Schleswig. Topographische Merkmale seit dem frühen 13. Jahrhundert.*

1070 die erste Siedlung, die man zunächst mit einem Faschinenwerk, ab 1081 mit einer palisadenartigen Holzwand gegen Hochwasser schützte. Sechs Jahre später ist vor dem westlichen Ende dieser Palisadenwand die erste Landebrücke (Abb. 4: 2) errichtet worden: ein von Spundwänden aus Eichenholz eingefaßter Erddamm von 9 m Breite, der 13 m weit in das Wasser der Schlei hinausragte. Westlich neben ihm errichtete man – ebenfalls im Wasser und bis zu 10 m vom Strand entfernt – einen parallel zum Ufer orientierten Kai (Abb. 4: 1). Beide Bauwerke, wie auch alle später aufgedeckten, waren in der gleichen Weise konstruiert, nämlich als dreiseitige Spundwandkästen – die vierte Seite war in das Ufer eingebunden –, deren Wände aus senkrecht verbauten Eichenbohlen bestanden. Durch Grundwasser und Staunässe sind die Hölzer so ausgezeichnet bewahrt, daß sie serienweise zur Datengewinnung durch die Dendrochronologie beitrugen. Ein in Resten erhaltener Rahmen, der durch Ankerbalken mit dem Ufer verbunden war, verdeutlicht, mit welcher Technik eine Stabilität der von innen mit Erde verfüllten Spundwandkästen angestrebt wurde.

Die mittelalterlichen Schleswiger Anleger unterscheiden sich also in ihrer Konstruktion deutlich von denen in Haithabu. Dort sind es über das Wasser führende, auf Pfählen ruhende Brückenstege, in Schleswig hingegen in das Wasser hineingesetzte, massive, holzverkleidete Erddämme. Die Dammschüttung weist in jedem Falle eine charakteristische Schichtenfolge auf. In den hölzernen Kasten war zuunterst, direkt auf dem sandigen Grunde der Schlei, eine 20-30 cm starke Reisiglage eingebracht worden, die in eine isolierende Schicht von Tierdung eingebettet war. Nach Auskunft heutiger Wasserbau-Ingenieure hatte diese Reisiglage statische Bedeutung. Darüber ist der Innenraum des Holzkastens bis in die Höhe der Spundbohlenköpfe mit Erde verfüllt worden. Einzelheiten über ursprüngliche stabilisierende Konstruktionen im oberen Bereich der Kästen

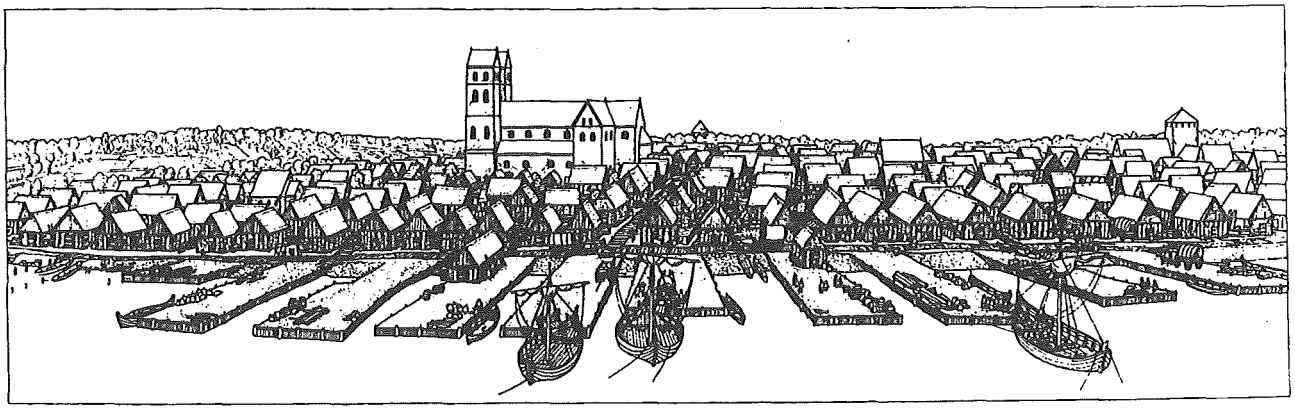

Abb. 6. - *Ansicht der Stadt Schleswig im 12. Jahrhundert. Versuch einer Rekonstruktion.*

konnten bisher nur ansatzweise beobachtet werden. Sicher ist, daß vereinzelt Gebäude auf den Landebrücken standen, in denen möglicherweise Waren oder Gerät gelagert worden war.

Die erwähnten beiden ersten Hafeneinbauten sind dendrochronologisch in das Jahr 1087 datiert. Bereits fünf Jahre nach ihrer Anlage, nämlich 1092, hat man weiter östlich eine weitere Landebrücke in gleicher Weise errichtet (Abb. 4: 3). Wiederum wenige Jahre später, im Jahre 1095, sind dann Bauarbeiten größten Ausmaßes durchgeführt worden. Zum einen wurde die hafenmäßig ausgebaute Uferstrecke durch das Errichten dreier großer, zusätzlicher Landebrücken in östlicher Richtung erweitert (Abb. 4: 7-9), zum andern wurden neue Brücken vor ältere Anleger gesetzt, um diese zu verlängern (Abb. 4: 4); die neuen Brücken erreichten nun Breiten von 11 bis 13 m, die größte die beachtliche Länge von ca. 45 m. Im gleichen Jahr wurde auch die ältere Kaianlage von 1087 durch eine vorgebaute Landebrücke abgelöst (Abb. 4: 5), und ein neuer Kai (Abb. 4: 6) wurde zusätzlich einige Meter westlich angelegt[8]. Die ausgegrabenen Anlagen besetzen eine Uferstreke von annähernd 150 m Länge, ohne daß im Osten oder im Westen der Grabungsflächen die tatsächliche Grenzen des Hafens erreicht worden wären.

Die Tatsache, daß sechs von insgesamt sieben Anlegern im gleichen Jahr entweder neu errichtet oder aber vergrößert wurden, zeugt eindrucksvoll von der wirtschaftlichen Bedeutung Schleswigs am Ende des 11. Jahrhunderts, die es seiner zentralen Lage im Netz des vorhansischen Ost-West-Handel verdankte. Die Schriftquellen dieser Zeit, u.a. das um 1200 erstmals aufgeschriebene Schleswiger Stadtrecht, sprechen denn auch von Handelsgästen aus Sachsen, der Rheinmündungsgegend, von Island, Schweden, der Insel Gotland, der südlichen Ostseeküste und aus Novgorod im Norden Russlands.

Der Ausbau von 1095 erfolgte also auf zweierlei Art: Zum einen wurde eine bis dahin noch natürliche Uferzone durch den Bau von Landebrücken in den Hafen einbezogen, zum andern erreichte man mit der Verlängerung schon vorhandener Landebrücken tieferes Wasser, mit ihrer Verbreiterung mehr Verkehrsfläche. Daß der Hafen sich auch noch im 12. Jahrhundert weiter entwickelt hat, ist aufgrund der Befundlage sicher. In zwei Fällen konnte nachgewiesen werden, daß Landebrücken von 1095 später selbst wieder durch angesetzte Bauten in das Wasser hinaus verlängert worden waren. Im Verlauf dieser Maßnahmen änderten sich nachweislich auch mehrfach die Bautechniken.

Während also der Hafen immer tiefer ins Wasser der Schlei vorgeschoben wurde, wuchs gleichenzeitig die Ufersiedlung in südlicher Richtung mit. Die älteren Landebrüken wurden mit Häusern überbaut, die zum Teil recht engen, ehemals Wasser führenden Räume zwischen den aufgelassenen Anlegern nutzte man für die Anlage von Bohlenwegen[9]. Hafenausbau und gleichzeitige Siedlungserweiterung haben so die ursprüngliche Oberflächengestalt im Süden der Stadt stark verändert. Das Siedlungsgelände schob sich durch die künstliche Aufschüttung

[8] Eine weitere Landebrücke dürfte in der nicht ausgegrabenen Fläche zwischen den Landebrücken Abb. 4: 2 und 3 gelegen haben.

[9] Die Vielzahl dichtgestaffelter Landebrücken wirft die Frage auf, welche Gründe einen so gewaltigen Aufwand gerechtfertigt haben könnten, und ob nicht eine einzige geschlossene, uferparallele Kaianlage den gleichen Zweck erfüllt hätte. Die spätere Umwidmung der Landebrücken zu Hausgrundstücken und der Zwischenräume – jedenfalls in zwei Fällen nachgewiesen – in (öffentliche?) Wege könnte ein Hinweis darauf sein, daß es sich bei den einzelnen Landebrücken um private, vielleicht genossenschaftliche Bauten gehandelt hat, und nicht um eine stadtherrliche Initiative.

der Brükendämme über das natürliche Ufer hinaus kontinuierlich in die frühere Wasserfläche vor, so daß eine wohl unbeabsichtigte Folge des Hafenausbaus der Zugewinn von Neuland war.

Die im Jahre 1239 erfolgte Ansiedlung der Dominikaner auf dem westlichen Teil der alten Hafensiedlung setzt ein vorheriges Ende des Hafens voraus. Welche tatsächlichen Ausmaße der mittelalterliche Schleswiger Hafen bis zu dieser Zeit angenommen hatte, ist ohne weitere Ausgrabungen nicht zu sagen.

Der im Vorangehenden beschriebenen frühen Topographie Schleswigs (vgl. Abb. 2), deren Kenntnis wir im wesentlichen der Archäologie verdanken, war keine sehr lange Lebensdauer beschieden. Die erste Hälfte des 13. Jahrhunderts brachte Veränderungen mit sich, die so grundlegend und umfassend waren, daß sie in ihrer Gesamtheit fast einer Neugründung der Stadt gleichkommen. Eine Reihe von Beispielen macht dies deutlich (Abb. 5). Die Ufersiedlung und der Hafen, zweifellos das wirtschaftliche Zentrum der frühen Stadt, werden nahezu vollständig aufgelassen[10] und ab 1239 von dem Dominikanerkloster überbaut; eine der älteren Kirchen am Nordrand der alten Hafensiedlung, St. Nikolaus, verliert ihren Rang als Gemeindekirche und gerät in die Abhängigkeit des Domes, eine zweite wird sogar abgebrochen und weicht mitsamt ihrem Kirchhof der Anlage des zentralen Marktplatzes der spätmittelalterlichen Stadt; die Kirchen St. Olav, St. Clemens und St. Jakob verschwinden gänzlich aus der städtischen Überlieferung; am Platze der vermutlichen St. Jakobskirche und der benachbarten Siedlung des 11. Jahrhunderts entsteht das Johannis-Kloster der Benediktinerinnen; die Pfalzbauten des dänischen Königs verfallen und werden 1234 den Franziskanern für ihr Kloster überlassen; in erheblichem Umfang, wenngleich nicht überall, werden sowohl Grundstücksgrenzen als auch Straßen und Wegeführungen relevant verändert. Es entsteht nunmehr ein Grundriß, der in weiten Teilen dem Gittermuster jener Städte gleicht, die im 13. Jahrhundert von den Schauenburger Grafen in Holstein planmäßig angelegt wurden, und das wir von zahlreichen anderen Neugründungen dieser Zeit kennen.

Die Gründe, die zu diesem umfassenden Wandel führten, werden vor allem in der Privilegierung der Konkurrenzstadt Lübeck gesehen[11], die eine Abwanderung der für die Stadt so bedeutenden Fernhändler nach sich gezogen haben muß. Die archäologischen Befunde scheinen ein strakes Ausdünnen der Bevölkerung anzudeuten, ohne das eine so großräumige Neueinteilung privaten und öffentlichen Baugrundes schwer vorstellbar ist. Von da an war Schleswig seiner überregionalen Kontakte beraubt, es wandelte sich zu einer kleinen Stadt mit Nahmarktfunktion für ein überschaubares Umland.

Die Ergebnisse sechzehnjähriger Geländearbeit und der Auswertung von Teilen der außerordentlich großen Fundmenge haben uns einen spürbaren Fortschritt an Erkenntnissen gebracht. Die Kontinuität der Besiedlung des inneren Schleibekens wurde nachgewiesen. Deutlicher als vorher ist zu erkennen, daß die schon früher für Haithabu festgestellten Kriterien städtischer Organisation in Schleswigs ältester Siedlungsphase ebenso oder verstärkt in Erscheinung treten. Der enge Stadtgrund (Abb. 6) ist dicht aufgesiedelt, die Präsenz von Herzog und König bürgt für eine geordnete Verwaltung, die Bedeutung des Handels manifestiert sich in dem die Siedlung dominierenden Hafen, die Mehrzahl der nachweisbaren Handwerke zeigt deutliche Züge von Spezialisierung, sieben Kirchspiele bezeugen eine durchgegliederte Kirchenorganisation[12]. Das Leben der Bürger wird schon im 12. Jahrhundert durch ein Stadtrecht geregelt, die Stadt früh von Wall und Graben geschützt. Das Schleswig des 11./12. Jahrhunderts zeigt sich uns heute als ein aus den Traditionen des Fernhandelswiks des 9. und 10. Jahrhunderts herausgewachsenes Gemeinwesen, dem aber an diesem Platze keine Zukunft beschieden war. In der Folge politischer und wirtschaftspolitischer Entscheidungen, die nicht mehr am Ort gefällt wurden, brachen im frühen 13. Jahrhundert die alten Traditionen ab, mit einer offenbar weitgehend neugeplanten, modernen Topographie begann ein neuer, aber auch ärmerer Abschnitt in der Geschichte dieser Stadt.

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[10] Nur die Landebrücke von 1092 (Abb. 4: 3) blieb offenbar bestehen; in ihren jüngeren Ausbaustadien ist sie als "Schiffbrücke" in alten Ansichten und Plänen dokumentiert und bildet am Ende der heutigen Hafenstraße (1299 "*platea piscatorum*") den Kern des neuzeitlich ausgebauten Stadthafens.

[11] E. Hoffmann 1983.

[12] Chr. Radtke 1985.

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Dr. Volker Vogel
Archäologisches Landesmuseum
der Christian-Albrechts-Universität
Schloß Gottorf
24837 Schleswig
Deutschland

Günter Krause

Archaeological evidence of medieval shipping from the Old Town of Duisburg, Lower Rhineland

Summary

Duisburg is the industrial centre at the confluence of Rhine and Ruhr. Its modern river trading port is still the largest in Europe and beyond. The beginnings of the town and harbour go back to Antiquity. In the Middle Ages Duisburg became a royal city that prospered mainly because of its advantageous geographic position at major cross-roads. The large port was then as vital for the city as it is today or even more. Duisburg lost its importance as a trade centre during the second half of the 14th century because the riverbed of the Rhine shifted. The importance of the port is proven by the relatively high quantity of archaeological contexts and objects related to shipbuilding, ship-repair and trade that were found during large-scale concept-based rescue excavations. Covering mainly period of the 9th to 14th century, they took place between 1980 and 1995 (Krause 1994, 49-75) alongside and next to the medieval riverbed of the Rhine forming the port. For the first time, a very early Carolingian and Ottonian stage (mid-9th and 10th century) of the use and development of staples and blanks for staples in shipbuilding was uncovered in northwestern Europe.

Topographical settings and historical tradition

Due to its situation at the confluence of Rhine and Ruhr at the end of the medieval '*Hellweg*' (salt-route) and next to other important cross-roads, Duisburg has been favourably situated from early times onwards with regard to transport facilities (fig. 1). That is certainly the reason for the continuous settlement in the area of the Old Town from at least the 1st century AD onwards (Krause 1994b, 529 ff.). Those ruling over Duisburg could control simultaneously the Rhine with the only river-crossing in the region, the mouth of the Ruhr and the above-mentioned cross-roads. Apart from modern disturbances, the remains of earlier river-courses of the Rhine and the Ruhr are clearly visible. Several riverbed shifts of the Rhine can be detected (fig. 1; Krause 1992a, 1 f.; Gerlach 1992, 71 ff.). The first datable shift of the Rhine occurred at the end of the 1st century AD (fig. 1, A; figs. 2-3). In the hollow of the bed of the Rhine of the 2nd to 10th centuries lies the modern '*Innenhafen*' (inner harbour basin) of the large trading port of modern Duisburg (figs. 1-2). It is the waterfront of the medieval and modern town. To the west, the small '*Dickelsbach*', and to the east (in front of the late medieval '*Stapeltor*' or Staplegate), the river Ruhr ran in a large curve into the Rhine. The medieval harbour is to be expected along the old Rhine front in the area of the modern 'inner harbour', not far from the central market place known as the '*Alter Markt*' (fig. 2, I), and in the former mouth of the Ruhr in front of the '*Stapeltor*'. Smaller boats may have docked in the mouth of the '*Dickelsbach*'. The merchants' quarter is supposed to have been situated between the '*Burgplatz*' (castle hill) and the '*Stapeltor*'.

The shift of the Rhine – until recently believed to have taken place at about 1200 AD – had left Duisburg at the bank of a dead river-branch that fell completely dry in the second half of the 14th century. Two extension areas of the former Rhine valley – a lower and a higher one – are still visible (fig. 5; Gerlach 1994, 559 ff.). Extension area 2 had been the immediate high water zone of the Rhine since the second century AD, extension area 3 in the north – below the '*Niederstraße*' was already a dry area located above the high water mark. From the castle hill, the distance to the west bank of the Rhine was only about 500 metres (figs. 1; 3). This short distance was an exception in the Lower Rhine area and therefore the natural reason for an important crossing being located below the castle hill. On top of this spur-like extension of the lower terrace into the high water zone of the Rhine, stone buildings had been erected already in Roman times (Krause 1992b, 93 ff.); later it was the site of a Merovingian royal court that developed into a Carolingian royal court and a royal palace of the medieval German kings (Krause 1994b, 542 f.). Below the palace precinct lay the market place, today called '*Alter Markt*' (old market).

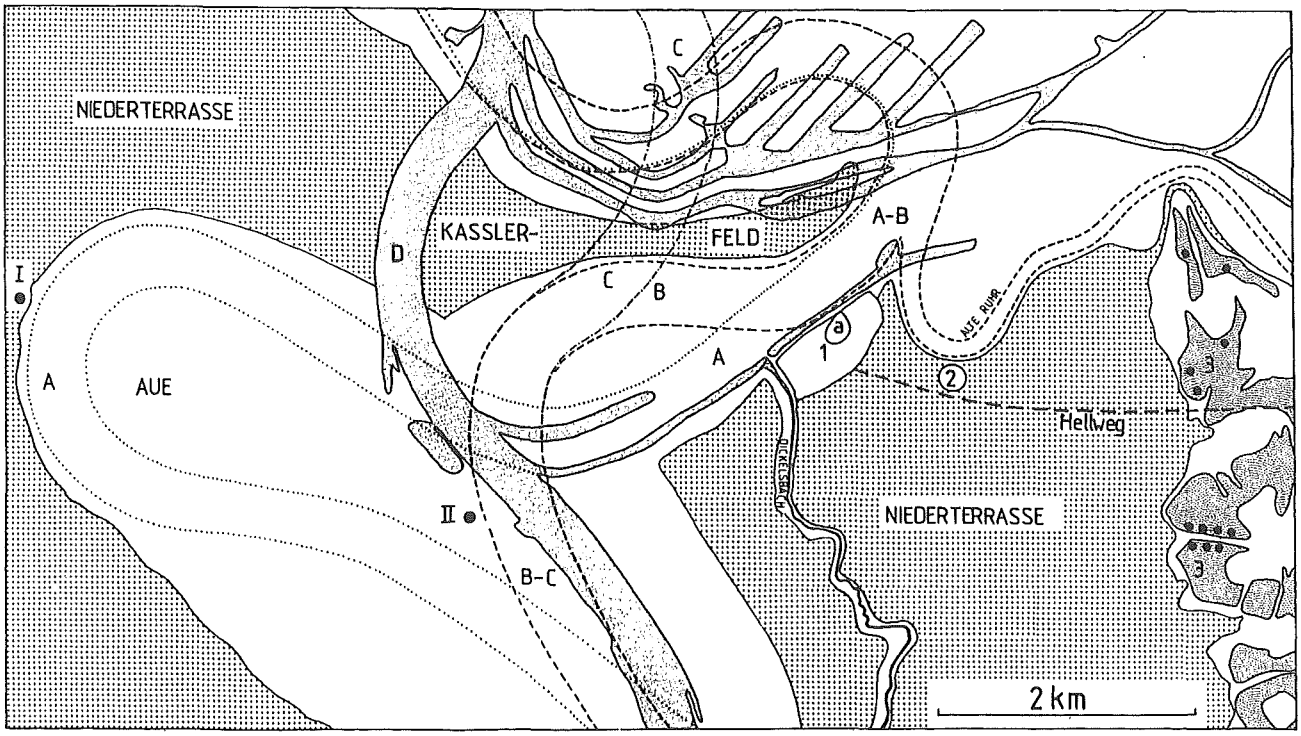

Fig. 1. *Duisburg and ist surroundings. Earlier courses of the Rhine and the Ruhr.*
I: Roman camp of Asciburgium, 1st century AD. D. Current course of the Rhine
II: Stone-built camp, Werthausen, 2nd century AD. 1: Duisburg within the town-wall at the end of
A: Course of the Rhine before 100 AD. 13th century (a: castle hill).
B: Course of the Rhine between 100-1000 AD. 2: Late Carolingian pottery kiln.
A: Course of the Rhine after its breakthrough near 3: Clay deposits and clay sources.
Essenberg, around 1000 AD.

For a long time, the market place could be reached by ship. In the 16th century, the customs house – called the 'old customs house' at that time and depicted on the town plan of 1566 (von Roden 1993, 55 and 58) – could still be found at its boundary, next to the palace precinct.

Reliable records of the trade activities of Duisburg from the 9th to 12th century are not very numerous. At the end of the 9th century, Frisian merchants were recorded for Duisburg, as they were for instance in Birten-Xanten, Cologne, Mainz and Worms. They were the main representatives of long distance trade activities at that time (Milz 1985, 3). Vikings attacked and stayed in the town already in 883/4, and the first clear historic record of Duisburg shows that a larger group of Vikings could winter in the '*oppidum Diusburh*' at that time (Milz 1985, 3). The Koblenz tariff of duties from the second half of the 11th century notes customs for merchants from Duisburg (Milz 1990, 36). Since the conflict between the emperor Henry V and the archbishop of Mainz, the merchants from Duisburg had to pay excessive custom duties. This was only withdrawn after the intervention of the emperor Frederic Barbarossa in 1155 (von Roden 1975, 151; Milz & Kraume 1992, 47 ff.). For the late 13th to 14th century, there are more sources related to the still important trade activities of Duisburg merchants, in spite of the gradual decline of the town (von Roden 1975, 95, 149 ff.; Milz 1986 u. Milz & Kraume 1992, 47 ff.). In 1286, the archbishop of Cologne calls the merchants of Duisburg 'people, who navigate on the Rhine more than others', and in the year 1306/7 more than 400 ships from Duisburg were registered at the customs post of Lobith (the Netherlands).

Already for early times, a hint as to the far-reaching trade relations of Duisburg and especially to those leading to the shores of the Baltic Sea is provided by the distribution of coins from the royal mint in Duisburg in the 11th and early 12th centuries (Berghaus 1983, 88 ff.).

At the end of the 14th century, the branch of the Rhine connecting Duisburg with the main stream of the river must finally have fallen dry. And the Ruhr had equally shifted its bed further away, to the north of the town (fig. 1). This caused the collapse of the trading activities of Duisburg as reflected in the City accounts (Milz 1990, 37). In front of the dry river banks of the Rhine and Ruhr, the Duisburg citizens began to strengthen the fortifications of their town,

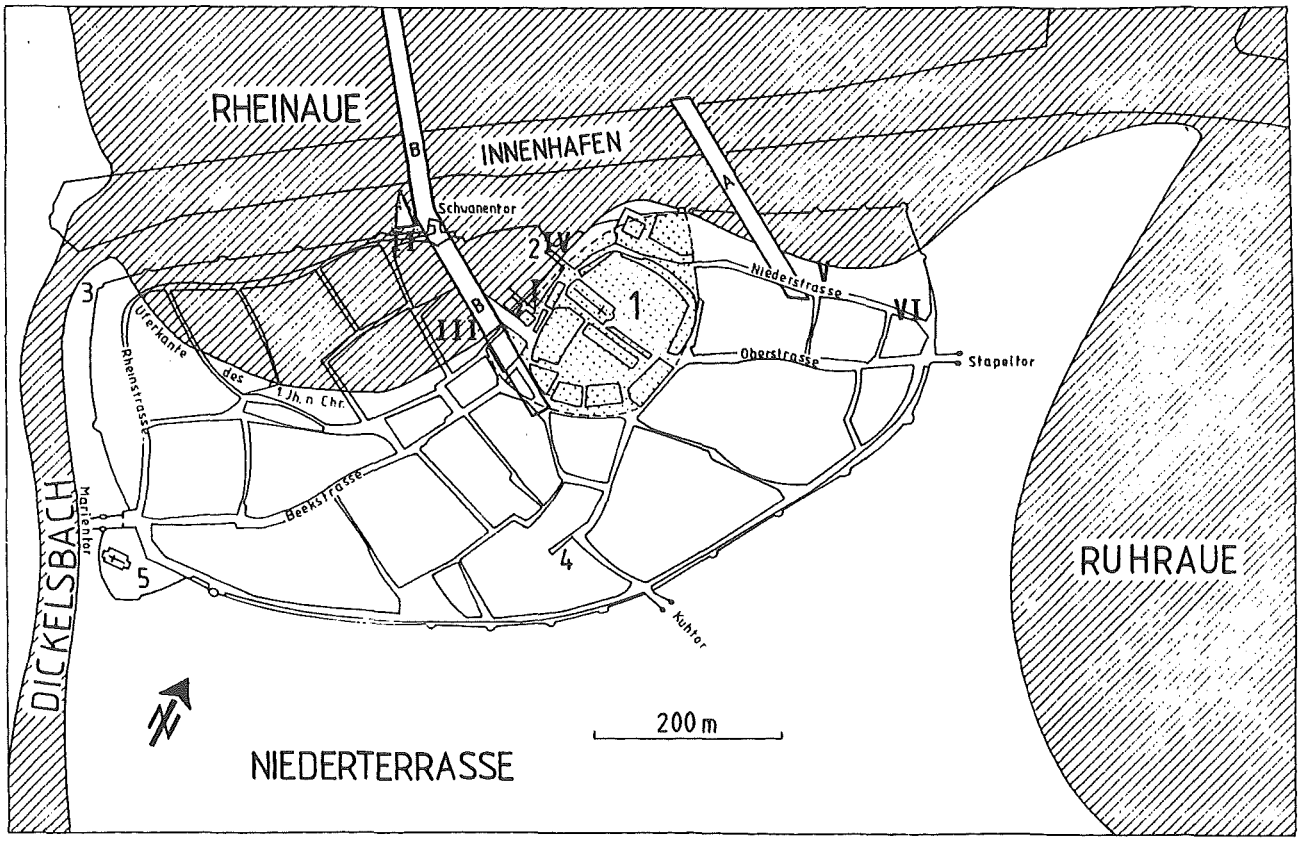

Fig. 2. - *The Old Town of Duisburg with the course of the Rhine in the Roman and medieval period; medieval Rhine within the area of the modern Innenhafen. 1: Castle hill. 2-6,VI: medieval noble estates: house of the king's steward, the duke of Limburg (?), 3 turris Hermannis Hugonis, 4 Grafenhof and Kesselshof, 5 later precinct of the Knights of St. John, 6 later monastery of the Brothers of the Holy Cross, VI presumed noble estate Niederstraße 47. Sites in the catalogue: I Alter Markt, II landing stage Schwanentor, III department store C&A, IV Inner Harbour, V Niederstraße Block D, VI Niederstraße 47.*

building additional walls and moats, and strongly changing the former harbour area. The city map of 1566 depicts the new situation. In front of the '*Schwanentor*' of the town-wall lies a small harbour with river-boats in a widening of the Dickelsbach that flows into the Ruhr; it is the last relic of the old trading port (Milz & von Roden 1993, 47).

The development of the modern '*Innenhafen*' since the first half of the 19th century has caused the destruction of the installations in the former harbour area, visible on the city map of 1566, or covered the remains of earlier activities between the inner harbour and the town-wall with the excavated material from the modern harbour basin. So it is very difficult to uncover and record the harbour of the medieval heyday of Duisburg, formed by the Rhine-bed in front of the town-wall. Similar changes have ocurred in the area of the former mouth of the Ruhr, which belonged also to the harbour zone.

Archaeological evidence

Among the remains of Roman navigation in the Duisburg area, there are a lead anchor stick and two iron anchors. However, medieval remains of shipping were not recorded or identified until the urban excavations in the Old Town of Duisburg began in 1980. Because of the large-scale topographical changes that took place in the area of the inner harbour and the early mouth of the Ruhr mentioned above, they were not to be expected.

The excavations that began in 1980 (Krause 1992a, 1 ff.) mainly came about in difficult circumstances. Only in the area of the Old Market (fig. 2, I) long-term excavations that were not under the pressure of deadlines took place from 1981 to 1990. All other investigations were carried out almost exclusively during construction activities. Usually, a preliminary timespan for obligatory archaeological excavations and qualified staff were not granted, even though there was plenty of time and funding[1]. These disadvantageous preconditions could be overcome by systematic and concept-based action and the

[1] This could have been achieved only with the constant support of the Rhenish monument authorities and the special institution for the archaeological monuments (*Rheinisches Amt für*

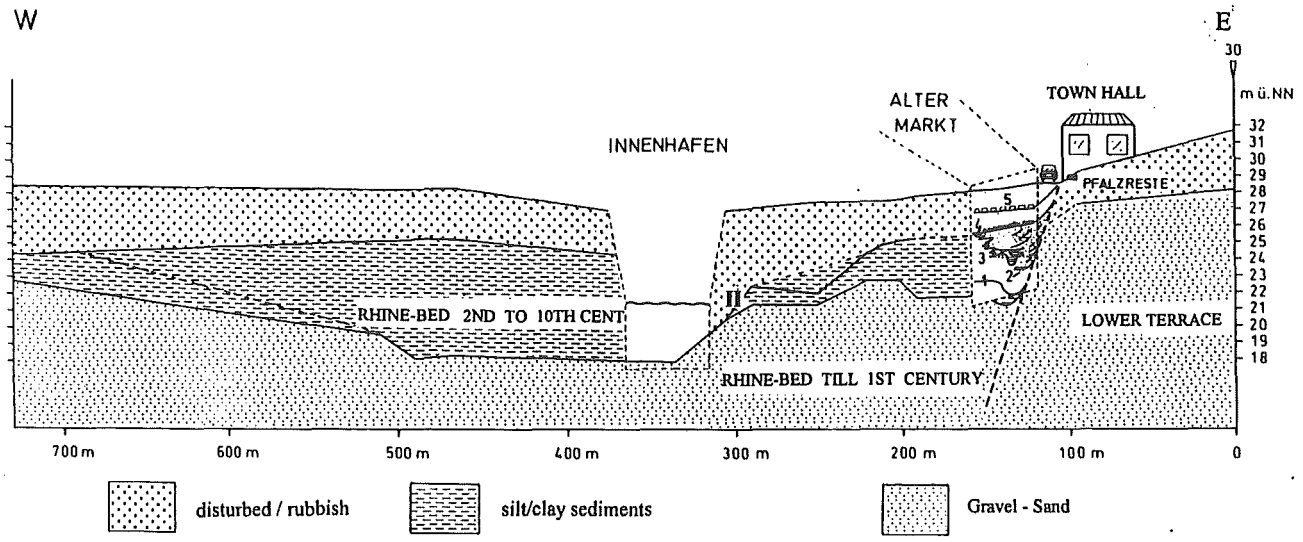

Fig. 3. - *Geological section through the underground from the castle hill to the modern Innenhafen (superelevated) after borings of the Geologisches Landesamt NRW (GLA) and observations during the construction of an underground railway. For the location of the section see fig. 2, B. The stratigraphic situation in the market area is projected into the section: 1 border between sand of the river bed and silt after borings in the market place, 2 footprint-layer 5th century, Carolingian pavement about 900 and moat of the 10th century, 4 pavement of the late 13th century, 5 pavement of the 18th/19th century. II position of site II, landing stage* Schwanentor *at the bank of the Rhine channel of the 2nd to 10th century (today modern 'Innenhafen').*

mobilisation of devoted and highly qualified volunteers over a long period and who were also at work in the evenings and week-ends. So the results of these efforts surpassed all our expectations. This was only possible when approaching the Old Town of Duisburg as a single coherent archaeological monument and after deciphering the essential traits of the historical topography of the town and its changes as explained earlier. Through interdisciplinary collaboration we were able to collect all available basic data related to endangered plots and places, to work out precise statements of the questions that could be followed up in the excavations. When doing so, the main interest went to the archaeological context of a site – not even the nicest objects – as for instance the stratigraphy of a building plot from the geological underground to our times and its documentation and the sampling of materials from all the different layers in a sufficient quantity for future investigation. After about 15 years of continuous activity, the Duisburg urban archaeological unit had uncovered an extensive body of material from numerous archaeological contexts of various kinds which provide us with a nearly continuous picture of the development of the city from its early beginnings in Antiquity to our times. It is important that all finds and samples recovered in the excavations have been kept and will remain available at least for post-excavation analysis. In the last years essential preparatory work has been carried out, so that numerous contexts and finds are available for special examination and further questions.

In the winter of 1989, the remains of commercial buildings on the waterfront were uncovered below the Niederstraße (fig. 4, 1; Krause 1992a, 40). They are long extended warehouses at street level with thin foundations of stone or brick, bordering each other and with massive facades on the Rhine. These warehouses and others using the town-wall as a retaining wall, disappeared at the end of the 15th century or even earlier when the Rhine trade came to an end. A comparable situation is found at the south-western side of the Rhine waterfront.

The working conditions in winter 1989 were extremely bad, so that the archaeological investigations had to take place during the excavations for the new buildings. Large motor lorries and bulldozers steadily crossed the foundations of the medieval warehouses and displaced and disarranged them in the muddy soil. That is the reason why small finds could hardly be extracted in their context or could not be extracted at all. Similar conditions were encountered during other archaeological activities (*e.g.* Krause 1992a, 31, fig. 26 photograph of situation).

Bodendenkmalpflege) according to existing monument legislation. But these authorities have been pressed to serve adverse (economic) interests. A controversy regarding the existing monument legislation has begun (Horn 1993, 19 f.) that even harms our State Constitution which protects the monuments. The outcome is a quite irresponsible, hardly lawful and perverse change in archaeological practice, not only in Duisburg (Krause 1994).

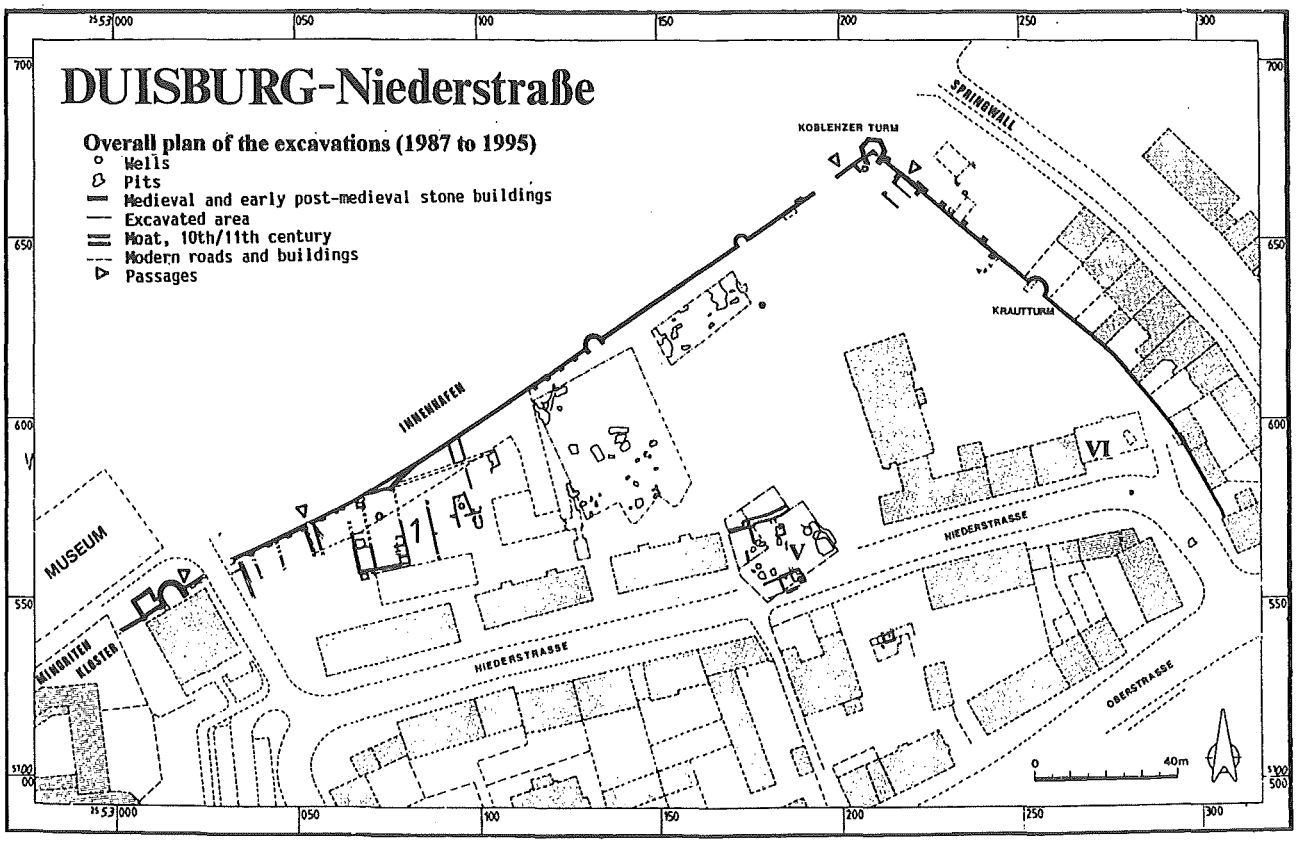

Fig. 4. - *Duisburg, Niederstraße. Overall plan of excavations from 1987 to 1995. 1: Commercial buildings, 12th to 14th century. V Niederstraße Block D, VI Niederstraße 47.*

Even less advantageous was the situation in the summer of 1994 within the area of the medieval town-wall – registered as an archaeological monument – next to the Schwanentor (fig. 2, II; figs 6 and 7), when a new landing-stage for sightseeing tours in the harbour was built and the excavation for its foundations cut through the medieval river-bank with the later walls and moats of the town wall[2]. The main Rhinebed before its final shift and its later stage as a dead branch of the Rhine that formed a part of the harbour presumably up to the 14th century was uncovered. The bed of the main river course before it shifted could be investigated only on a surface of one square metre. The rest had already been completely damaged. Nevertheless, the finds that were rescued from the bank of the Rhinebed before the shift provide an exact date for that fatal event for the later history and development of Duisburg. The event already happened before the beginning of the 11th century (cat.-no. II)[3].

In spite of these very fragmentary investigations, a very large number of staples and blanks for staples has been uncovered alongside the inner harbour area. Staples can easily be identified from the existing literature (Vliermann, fig. 11, 19)[4]. It is far more difficult to make a distinction between rivets, typical for

[2] We were given completely wrong informations concerning the depth of the excavation. The municipality did not want the constructors to be disturbed by the archaeologists at all nor did they want the building project delayed because of the obligatory archaeological investigations within the confines of this archaeological monument, endangered by construction activities. We were informed that the constructions would reach a depth of only 2.60 metres (disturbed soil). In reality, the depth was 6 metres. So the archaeologists could try only to make the best of this situation in the construction pit, before the landing-stage was built. In an emergency intervention, at least the main sections of the pit were recorded and some finds rescued.

[3] The important findings concerning the early date of the final shift of the Rhine are due to the efforts of Peter Müller. His utmost devotion to archaeological field work in Duisburg and the Lower Rhine area – implemented in addition to his work as a grammar school teacher for nearly 20 years – and his knowledge, competence and skill surpassed that of many full-time archaeologists, not only in the region. Without him the urban archaeology of Duisburg would never have gained its international reputation. He and other volunteers replaced the missing skilled personnel that was not granted permanently by the administration. Peter Müller's sudden death at the age of 54 on the 15th of October 1995 is a severe loss not only for the urban archaeology of Duisburg.

[4] To get safer evidence concerning the character of the finds related to shipbuilding, Mr. Karel Vlierman, *Centrum voor Scheepsarcheologie* of the *ROB* in Ketelhaven, The Netherlands, was consulted. He drew our attention to the blanks for staples and stated that Duisburg provides for the first time evidence of a very early Carolingian and Ottonian stage of the use and development

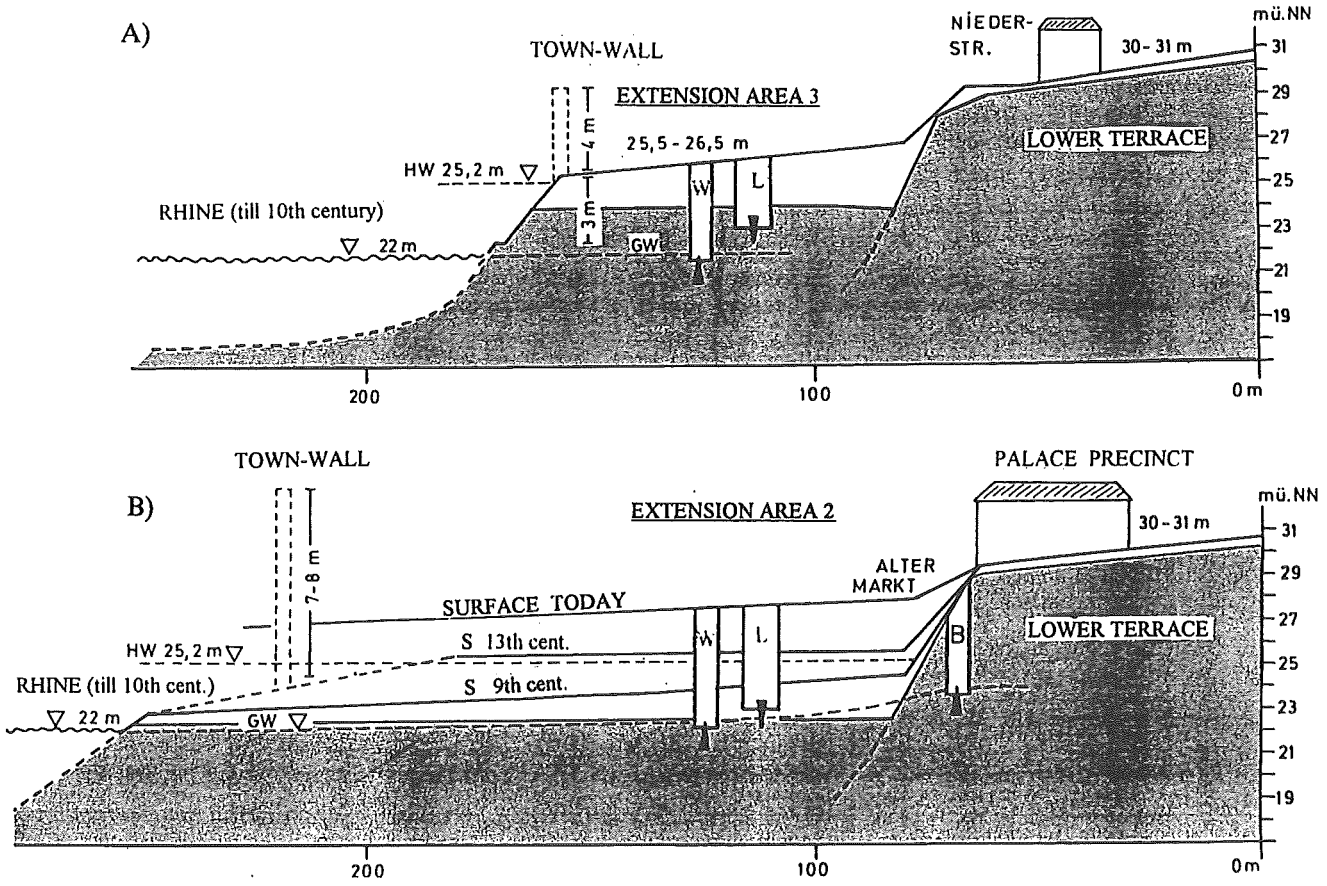

Fig. 5. - *Extension areas 2 und 3 with ground- (GW) und highwater levels (HW) and schematic representation of wells (W) and latrine pits (L) and former and modern surfaces (S). For the location of the sections see fig. 2, A u. B.*

Scandinavian or English ships (fig. 11, 22) and nails, because the finds are heavily corroded and could not be conserved and treated by a conservator until now, nor X-rayed. The selection of finds in this article does not contain all the find complexes alongside the inner harbour from the ‚*Niederstraße*' to the landing stage next to the ‚*Schwanentor*' and beyond. Nevertheless they are representative. For the western part of the Inner Harbour we lack further evidence. Of the objects looked through for the present report only

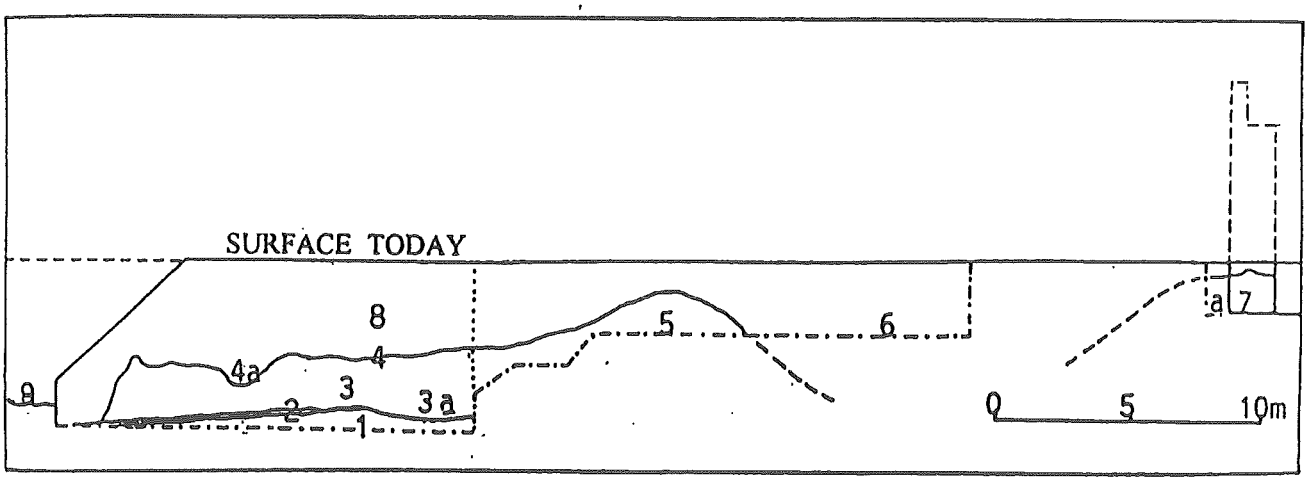

Fig. 6. - *Duisburg, site II. Section through the landing stage Schwanentor 1994. Overall plan. 1 lower terrasse, 2 rough gravels of the Rhine bed before the breakthrough near Essenberg, 3 sediments of the dead Rhine branch after the breakthrough, 3a channel at the bank of the dead Rhine branch, 4 bottom of the outer medieval moat, 4 a point of the post-medieval moat, 5 inner medieval town-wall, 6 inner medieval moat, 7 town-wall, 1st half of the 13th century (completed), 8 disturbed area resp. not examined, 9 water level of the modern Innenhafen; a location of cat.- no. 53.*

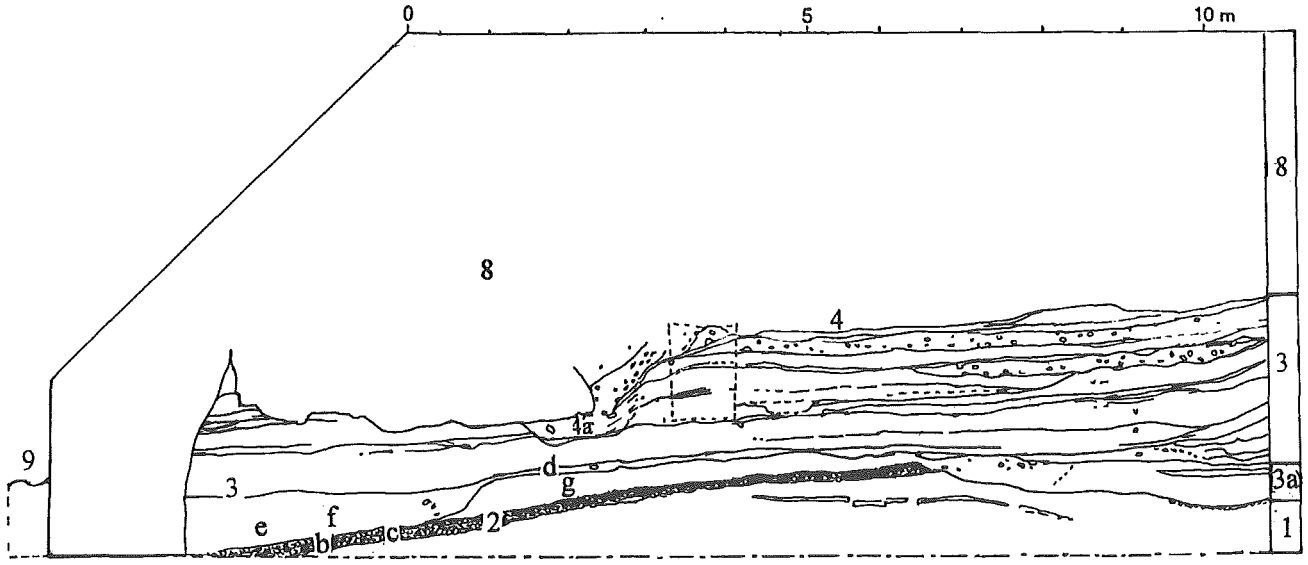

Fig. 7. - *Duisburg - landing stage Schwanentor (II). Detail from fig. 6, left side. For legend cf. fig. 6, b-g location of cat.-nos. 47-52.*

those were included that could directly be regarded as staples, blanks for staples or possibly rivets (cf. fig. 11, 22). Two staples are made of copper alloy (not included in the catalogue). All the others are made of iron. Many contexts from sites next to the Inner Harbour contain similar objects that were much too corroded to be drawn exactly, so that until now only the ‚tip of the iceberg' is visible. Not included in the catalogue are the many nails and other objects as registered in Ellmers 1990, 104. They are not typical for harbour activities only and would transgress the scope of this article.

All the finds are menaced with ruin. There is an urgent need for conservation treatment.

Outlook

The contexts and finds briefly presented in this report clearly demonstrate the early importance of Duisburg for shipbuilding, ship-repair and long distance trade. They cover especially the time from the second half of the 9th to the end of the 13th century. The remains of a rope from the Old Market, dating to the 12th century, may belong to the same complex (Farke 1992, 321 f.), and this is certainly the case with the bones of seafish (Heinrich 1992, 295-305) and unpublished dendrochronologically dated oak-wood – which does not come from the Lower Rhine region – from the Old Town.

The breakthrough and final shift of the Rhine before the end of the 10th century which complicated the easy crossing of the Rhine and the control of the river from the castle hill may have caused the interest of the medieval German kings in Duisburg to diminish, a development noticeable in the course of the 12th century. But the trading activities of Duisburg were not affected at that early time. On the contrary, the Rhine – which every year in winter and spring flooded the Old Market area and lower parts of the City (extension area 2) until the shift of the river and left only the higher extension area in the east of the Old Town and the mouth of the Ruhr for shipping activities – at that time was no longer a threat. The first fortification of the town, known so far, must have been built shortly after the shift, but still in the 10th century (Krause 1993; 1994b, 544 ff.). It includes at least the eastern part of the waterfront. That was only wise after the shift of the Rhine.

According to the finds, the area of the early ship-landing and harbour activities at the Rhine front stretched from the north-east tower (Koblenz tower) of the town-wall to the zone west of the '*Schwanentor*' (fig. 2). Remains of settlement activities along the whole of the Rhine frontage of the medieval town in its east-west extension from the late 9th century confirm the assumption that this area must have been even larger. The area in front of the '*Stapeltor*' and the mouth of the Ruhr above the high water level of the Rhine was an ideal landing and harbour place during the whole year. Here the colony of the Frisian merchants may have been situated, as well as the camp of the Vikings, wintering in Duisburg in 883/4. Numerous excavations and watching briefs in most parts of the Old Town clearly exclude the existence

of staples and blanks for staples in shipbuilding in north-western Europe (see Vlierman). We want to express our gratitude to Mr. Vlierman for his kind help and informations.

of the Frisian colony and the Viking camp inside the medieval Town. As well the mouth of the '*Dickelsbach*', the early channel of which lay east of the precinct of the Knights of St. John before the tenth century (fig. 2, 5) and could have been used for harbour activities. Striking is the frequency of early noble estates in the vicinity of the water (fig. 2, 2-3, 5-6, VI). What is the role of the nobility in the formation of medieval shipping and long distance trade? The shifting of trade activities from the bank of the Rhine into the warehouses and houses of the merchants becomes evident in the Niederstraße (fig. 2, VI, fig. 4, VI; cat.-no. VI; Ellmers 1990).

Near to the mouth of the '*Dickelsbach*', south of the precinct of the Knights of St. John (fig. 2, 5) an excavation by an expensive company for business archaeology took place recently, excluding for the first time the urban archaeological unit of the museum and their knowledge as well as the public to 'safeguard' the building of a musical hall from them. There is no information at all concerning the results. A much larger archaeological project was conducted by the civic department of underground engineering with badly qualified non-permanent personnel from 1992 to 1994, mostly paid by the labour exchange. That project concerned a complete city quarter directly in front of the precinct of the Knights of St. John. It was argued that the urban excavations fitted that department much better than the museum that had done the archaeological field work in Duisburg and parts of the Lower Rhine region permanently for more than 60 years (Krause 1994c, 51 ff., 66 ff.). The knowledge of the existing urban unit of the museum would have been essential for the success of these two projects, to make them efficient and meaningful. Without any problems it would have been possible to find out if the harbour activities had touched these areas or not. But the supreme reason for these excavations according to the commissioner was to get rid of 'archaeological pollution' without much trouble and sensation, not to use it for the enrichment of knowledge related to Duisburg's past as a main goal.

Even larger construction activities have begun in 1996 near the mouth of the medieval Ruhr and the area between the town-wall and the Ruhr close to the 'staple gate' (fig. 2), certainly an important part of the medieval trade-port and the presumed zone of the Viking camp from 883/4 and the colony of the Frisian merchants of the same period. Here a new city quarter springs up without any appropriate consideration for the historical topography and the archaeological monuments that were denied any interest[5], as a part of the ‚International Building Exhibition Emscher Park', to be named hopefully ‚Little Amsterdam' in the time to come. Most of the Old Town will be converted into an ‚International Service Park of the Future' (fig. 2). For this building exhibition, the State government of North Rhine-Westfalia called together town-planners, masters builder, landscape architects and other creative people to turn the whole region inside out, something which has been termed a chance for Duisburg that will not come back for a century (Duisburgs neue Seiten 1994). It is self-evident that the urban archaeological unit of the museum and its volunteers are no longer welcome because they regard the Old Town of Duisburg from a different point of view. That is the reason why they were eliminated and are treated as *personae non gratae*, while the results of their work and the finds are left to oblivion and decay. The new philosophy is: Only without respect for the past can Duisburg win the future! But the trade-port of Duisburg – the largest in the world – is still an essential characteristic of the town, so that there exists no real contradiction. The harbour and its history are part of the City's identity and cannot be neglected in any planning and construction process without causing severe damage to it.

Catalogue

Preliminary remarks: Only part of the finds from the Old Market (cat.-no.I), Niederstraße Block D (cat.-no. V) and numbers 103 -104 (cat.-no. VI), pre-

[5] The author lost his responsibility in the meantime and the City began to prosecute the volunteers. His special knowledge of the archaeological monuments and past of Duisburg has become unwelcome. He himself, the material and results of urban archaeology in Duisburg were excluded from the museum that houses all the facilities for that work and for the preservation of the evidence (Tromnau 1992, 36-37). They are left without personnel and with only symbolic funding for decay and loss. The medieval harbour area in and at the mouth of the early Ruhr was declared a zone of pure geology by a willing successor and any further qualified archaeological attention and work there have been suppressed. The architect of the master plan for the inner harbour park, Sir Norman Foster, stated that 'the industry brought the water to Duisburg'. Instead, the modern artificial mouth of the Ruhr was declared to be the basis of the urban history of Duisburg (Krause 1994c 70 ff.). Since 1995, mainly a private business company headed by a former unskilled helper in archaeological excavations turned employer and completely dependent on the City, is charged with archaeological fieldwork. To distract the interest from the Old Town and its monuments the main archaeological activities have been directed to some fields in the rural southern suburbs of Duisburg, where investors are said to pay for necessary fieldwork, though nothing of interest has been found there in spite of intensive surveying before the intervention of that company and other new archaeological projects, directed by economic interests.

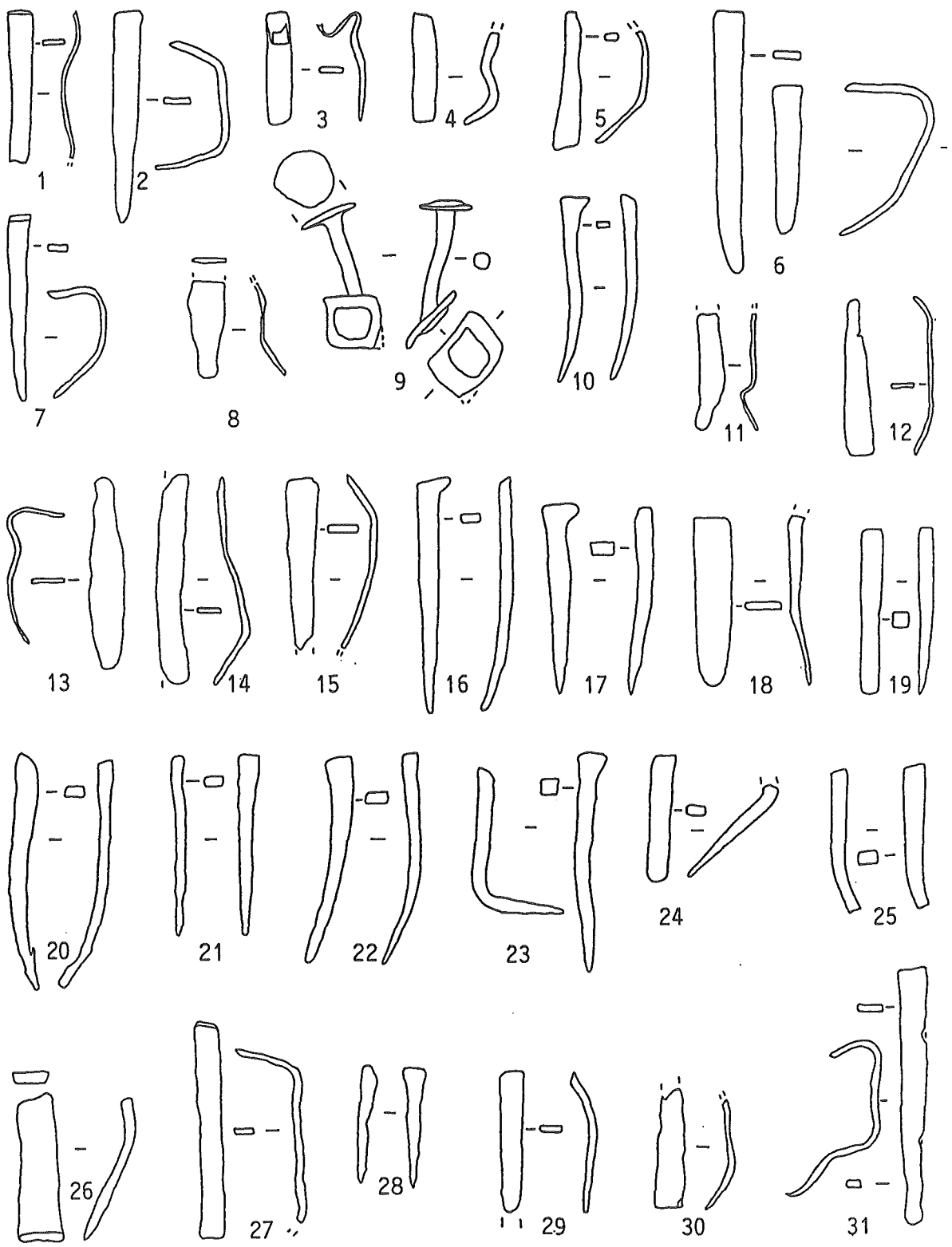

Fig. 8. - *Duisburg - Alter Markt. Staples, blanks for staples and rivet (9). Cat.-nos. 1-31. 9th-13th century. Scale 1:2.*

sented in this report could be treated in the conservation unit of the *Kultur- und Stadthistorisches Museum*. I have to thank the conservator Lydia Stark and the photographer Gertraud Neumann, who made all the necessary photographs of the objects. Nearly all the metal objects in this article were found together with pottery which can be dated quite accurately; the pottery finds range from a few potsherds to thousands of pieces. The absolute dates in the catalogue are approximate ones, derived from our stratigraphies. They are supported by dendro-dates and for the phase from the 11th century onwards by the evidence of coins. Some dated pottery contexts are presented in Krause 1993, 153-169. Quite often the staples or

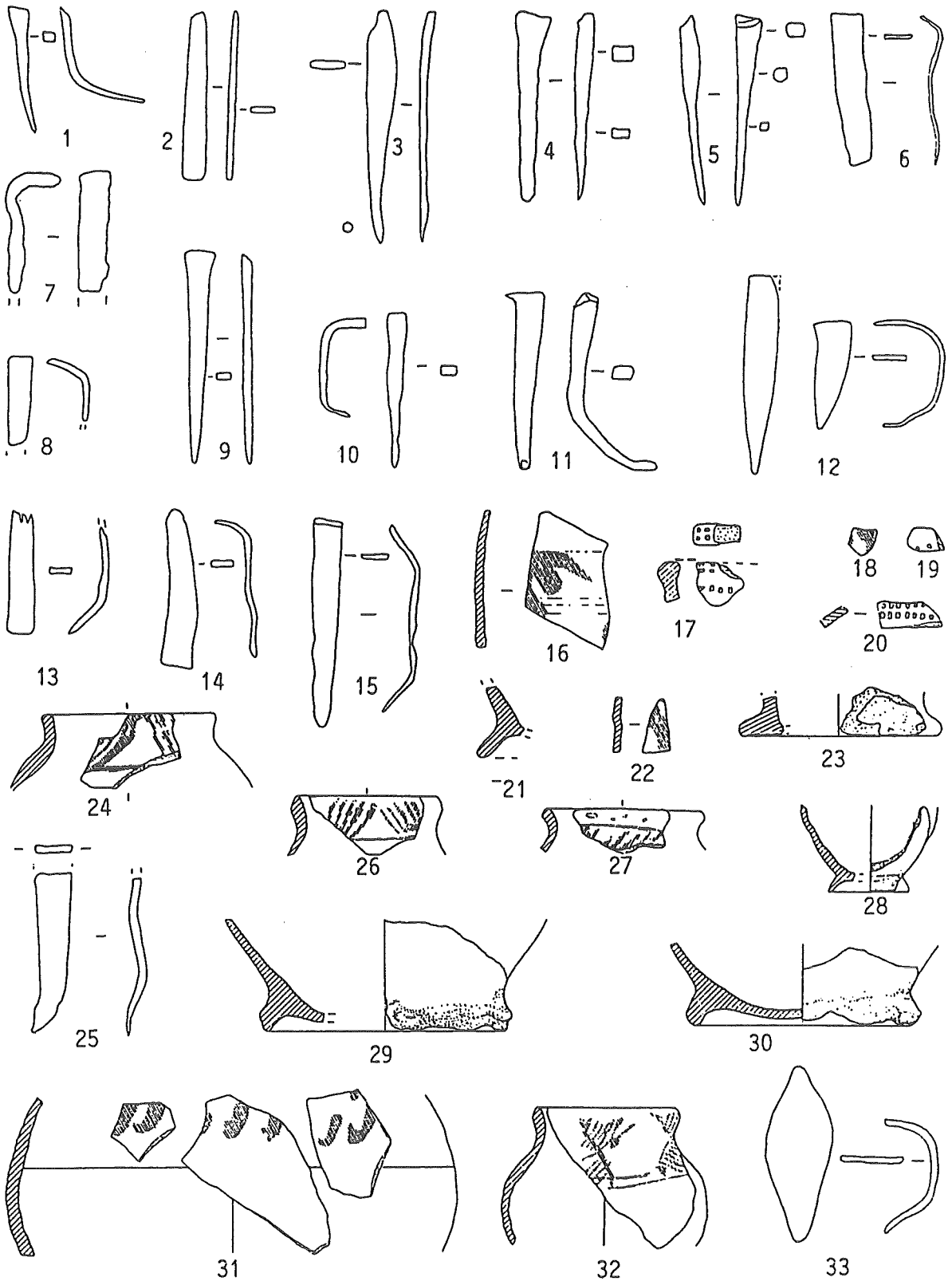

Fig. 9. - *Duisburg Staples, blanks for staples and pottery. 1-15 Alter Markt cat.-nos. 32-46. 16-33 landing stage Schwanentor cat.-nos. 47-53. 9th-12th century. Scale 1:2, pottery, scale 1:3.*

blanks for staples in the figures have been 'unrolled' in addition to or instead of the drawing of the bended object, which is not so assertive. Cross-sections are given or omitted according to the state of preservation of the objects. Drawings by Enne Haehnle, Düsseldorf and the author after his copies, as well figs. 2-3, 4; figs. 3; 5 after Gerlach 1994, 536 fig. 6 and 560 fig. 21; figs. 6-7 after P. Müller; fig. 11, 19, 22 after Ellmers 1985, fig. 70; 1992, fig. 2, 4. W. Toups, Duisburg, checked my English text.

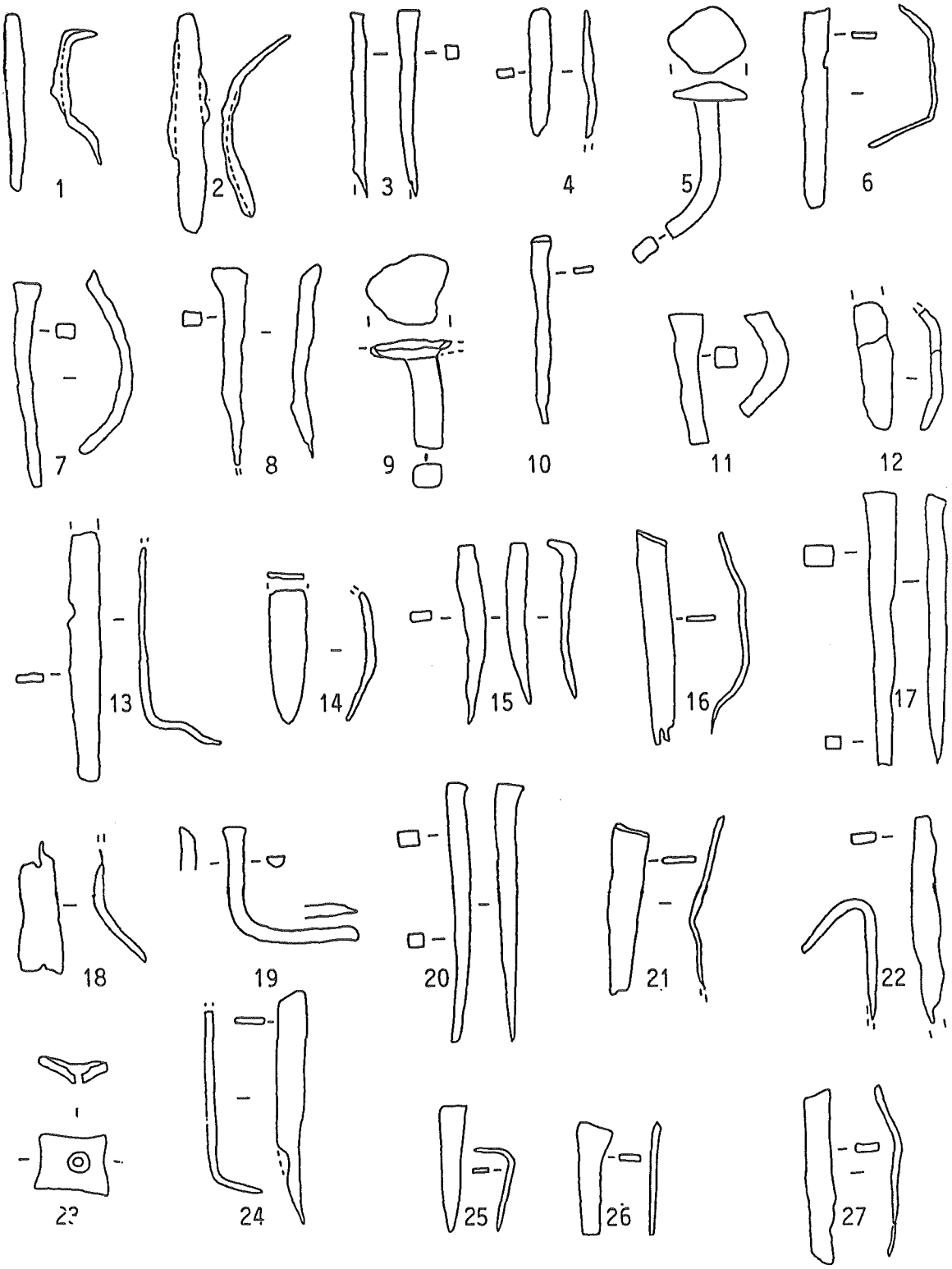

Fig. 10. - *Duisburg. Staples, blanks for staples, upper parts of nails or rivets (5, 9), rivet-lamella (23), 1-2 excavation department store C&A, cat.-nos. 54-55. 3-20 excavation Innenhafen, cat.-nos. 56-75. 21-27 excavation Niederstraße Block D, cat.-nos. 77-83. 9th-14th century, scale 1:2.*

I. Alter Markt
(Old Market, fig. 2, 1; Krause 1994, 530 fig. 1, 534 fig. 4). Nos. 1-3 trench 1, nos. 4-9, trench 1/5, nos. 10-19 trench 2, nos. 20-26 trench 2/8, nos. 27-31 trench 3, nos. 32-37 trench 4, no. 38 trench 7/10, no. 39 trench 8, no. 40 trench 12, nos. 41-42 sondage next to trench 3, 1980, no. 43 cellar 1, no. 44, cellar 2, nos. 45-46 cellar 4 resp. in front of it.

No. 1, staple inv. 82:31/24, 1st half of 12th century, fig. 8, 1. - Nos. 2-3, 2 staples inv.82:31/27, 12th century, fig. 8, 2-3. - No. 4, fragment of staple, other corroded fragments inv. 89:16/129, 10th century, fig.

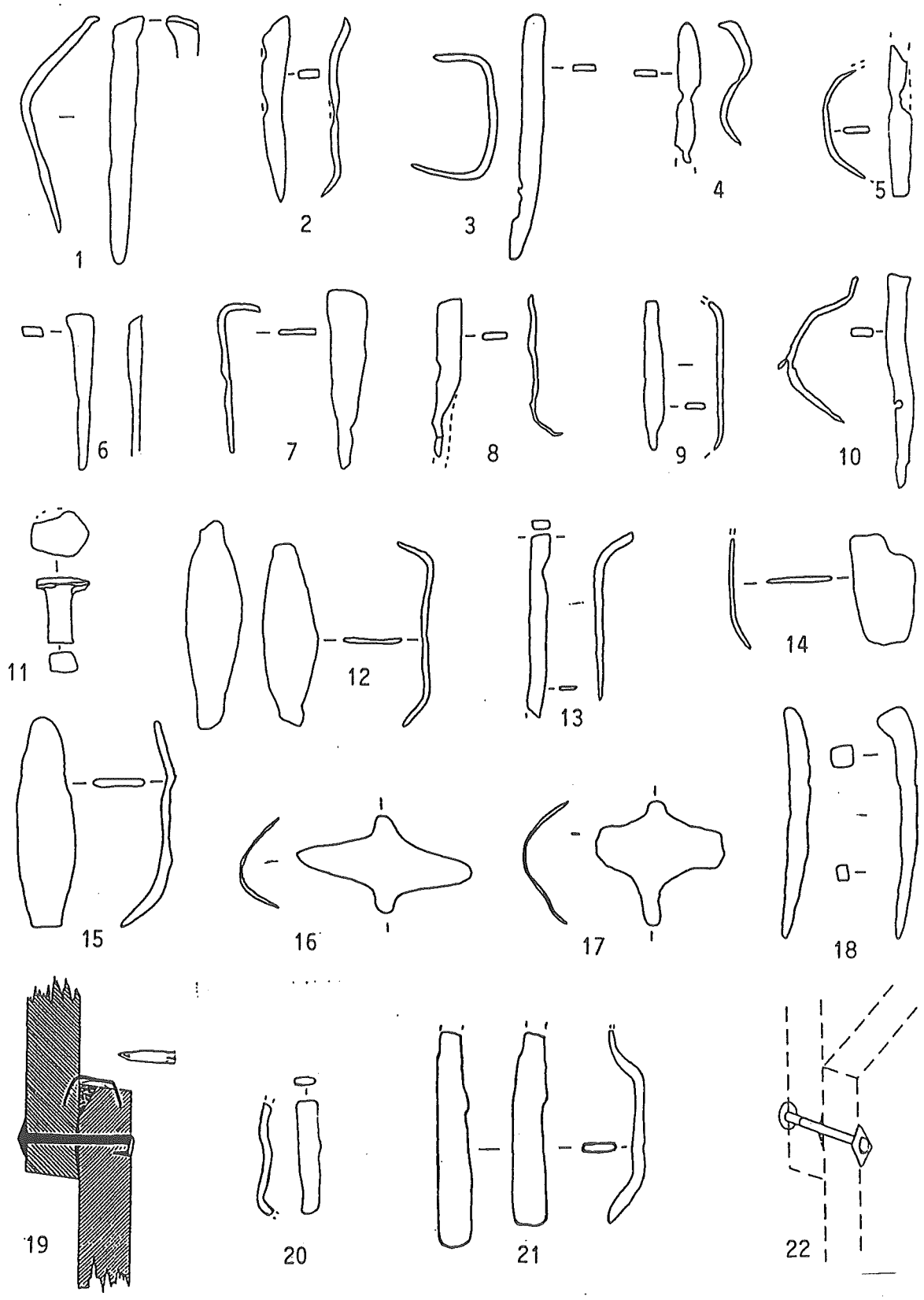

Fig. 11. - *Staples, blanks for staples, upper part of nail or rivet (11). 1-13, Niederstraße Block D, cat.- nos. 84-93, 97-99, 14-18 Niederstraße 47, cat-nos. 100-104. 20-21 landing stage Schwanentor, cat.-no. 52. 9th-15th century, scale 1:2. 19, 22 seam of planks, clinker-built method, 19 local tradition, 22 Scandinavian/English tradition.*

8, 4. - No.5, staple inv. 89:16/204, 1st half 10th century, fig. 8, 5. - No. 6, staple inv. 89:16/207, likely 10th century, fig. 8, 6. - No. 7, staple inv. 89:16/336, about 900, fig. 8, 7. - No. 8, blank inv. 84:40/56, last third 13th century, fig. 8, 10. - No. 9, complete rivet inv. 89:16/333, about 900, fig. 8, 9. - No. 10, staple

inv. 88:17/34, 2nd half 9th century, fig. 8, 12. - Nos. 11-14, 4 staples, 2 of them fragmentary, inv. 87:23/246, 12th century, fig. 8, 8, 11, 13 u.14. - Nos. 15-17, staple and 2 blanks inv.87:17/457, second half 12th century, fig. 8, 15-17. - Nos. 18-19, staple and blank inv. 87:17, last third 13th century, fig. 8, 18-19. - No. 20, blank inv. 85:4/2, probably about 1300, fig. 8, 20. - No. 21, blank inv. 85:4/4, about 1300, fig. 8, 21. - No. 22, blank inv. 85:4/9, last third 13th century, fig. 8, 22. - No. 23, blank inv. 85:4/14, last third 13th century, fig. 8, 23. - Nos. 24-26, 2 blanks and fragment of staple inv. 85:4/16, last third 13th century, fig. 8, 24, 25 u. 26. - Nos. 27-29, 2 fragments of staples and blank, inv. 82:32/15, 10th century, fig. 8, 27, 29 u. 28. - No. 30, fragment of staple, strongly corroded, inv. 82:32/21, 10th century, fig. 8,30. - No. 31, staple inv. 82:32/25, 1st half 11th century, fig. 8, 31. - No. 32, blank inv. 81:15/109, last third 13th century, fig. 9,1. - No. 33, blank inv. 83:33/10, 1st half 11th century, fig. 9, 2. - No. 34, blank inv. 87:25/10, about 900, fig. 9, 3. No. 35, blank inv.82:36/13, last third 13th century, fig. 9, 4. - Nos. 36-37, blank and fragment of staple inv. 86:5/205, about 900, fig. 9, 5-6. - No. 38 fragment of staple, corroded, inv. 86:5/106, 11th century, fig. 9, 7. - No. 39, blank inv. 83:37/5, last third 13th century, fig. 9, 9. - No. 40, blank, already bent like a staple, but not worked out, inv. 89:27/191, last third 13th century, fig. 9, 10. - No. 41, fragment of staple inv. 80:19, 10th century, fig. 9, 8. - No. 42, blank inv. 80:42, 10th century, fig. 9, 11.

Carolingian layers below the cellars of the medieval market hall: Nr. 43, staple inv. 88:20/249, about 900, fig. 9, 12. - No. 44, fragment of staple inv. 83:30/22, about 900, fig. 9, 13. - No. 45, staple inv. 86:5/19, before 900, fig. 9, 14. - No. 46. staple, in front of cellar 4, inv. 86:26/4, end of the 9th century, fig. 9, 15.

II. Duisburg - landing stage *Schwanentor* (figs. 2, II; 6 -7).

In the summer of 1994, the bank of the main river-bed of the Rhine before its final shift was uncovered. Directly on top of the rough gravel layer (with the remains of a wooden fastening) forming the river bed, follow the sediments (silt, clay) from a stagnant river-bed used as a harbour. Nos. 47-48 come from the gravel layer; Nos. 49-52 from the silt on top of it; No. 53 was found at the foot of the town-wall (figs. 6 a; 7 b-g).

No. 47, pottery inv. 94:5/72, 35 partially very small sherds, mainly of Carolingian type and age, of a light colour, some with rouletted decoration, one with brown paint on the outer surface and a piece of a foot ring, fig. 9, 16, 17, 19, 20, 21, one hand-made sherd, 3 grey-brown sherds of Pingsdorf type with dark-brown paint, fig. 9, 18, 22, 9th and 10th century. - No. 48, 8 sherds, same context as 47, inv. 94:5/74, 5 light-coloured carolingian sherds, among them a piece of a base, fig. 9, 23, a stoneware-like sherd of Mayen fabric, 2 sherds of Paffrath type, 9th and 10th centuries. - No. 49, from the silt, inv. 94:5/61, fragment of a staple and a light-brown rim-sherd of Pingsdorf type with red-brown paint, fig. 9, 24-25, 11th century. - No. 50, inv. 94:7/73, 21 potsherds, partially fitting to each other, among them 8 pieces of a hand-made cooking pot of Paffrath type, 13 sherds of Pingsdorf type from some 8 different vessels, among them 2 light-brown resp. medium-brown cups with red-brown paint, 3 light-brown bases of a little cup and of 2 larger pitchers, fig. 9, 26-30, sherd with dark-brown paint, 11th century. - No. 51, 40 partially fitting potsherds, belonging to 10 different vessels, inv. 94:5/71, mainly of the Pingsdorf type; a few of the sherds light-brown, the others with olive and grey colours, one vessel olive-coloured with dark-brown paint, small middle-brown cup with dark-brown paint, fig. 9, 31-32. 4 handmade black-brown sherds, one of Paffrath type, 11th century. - No. 52, 2 staples, 4 small potsherds: two of Paffrath-, one of Pingsdorf-type and one with yellow glaze on the outer surface of Andenne-type inv. 94:5/63, 11th century, fig. 11, 20-21. - Nr. 53, staple, found at the outer foot of the town-wall, together with potsherds dated to about 1200, inv. 94:5/8, fig. 9, 33.

III. Duisburg - building plot department store C&A (fig. 2, III; Krause 1994, 534 fig. 4), watching brief 1983/84 during excavation.

No. 54, staple, Quadrant D 2, inv. 84:6/86, about 900, fig. 10, 1. - No. 55, staple, only partially freed from clod of rust, Quadrant D 2, inv. 84:6/86c, 10th century, fig. 10, 2.

IV. Duisburg - building plot *Innenhafen* (fig. 2, IV; Krause 1994, 533 fig. 4), watching brief 1983/84 during excavation.

No. 56, blank inv. 84:7/30, last third of the 13th century, fig. 10, 3. No. 57, fragment of blank or staple inv. 84:7/9b, likely to be 15th-century, fig. 10, 4. - No. 58, part of a nail or rivet inv. 84:7/4h, beginning 13th century, fig. 10, 5. From the stratigraphical deposits in the southern section of the excavation (finds by P. Müller, Nos. 59-68). - No. 59, badly conserved fragments of a staple inv. 84:7/5/73, 11th century. - No. 60, staple inv. 84:7/5/72, 1st half 11th century, fig. 10, 6. - Nos. 61-62, 2 blanks inv. 84:7/5/67, badly preserved remains of staples, 2nd half 10th century, fig. 10, 7-8. - Nos. 63-64, 2 blanks inv. 84:7/5c/87, 1st half 10th century, fig. 10, 10-11. - No. 65, fragment of a staple inv. 84:7/5c/82, 10th century, fig. 10,

12. - No. 66, upper part of a nail or rivet, badly preserved fragments of staples inv. 84:7/5c/44, 10th/11th century, fig. 10, 9. - No. 67, fragment of a staple inv. 84:7/5c/57 and other badly preserved fragments, 10th century , fig. 10, 13. - No. 68, fragment of a staple inv. 84:7/5c/58, be-ginning of 13th century, fig. 10, 14. - No. 69, blank inv. 84:7/4m, likely 11th/12th century, fig. 10, 15. - No. 70, staple inv. 84:7/9h. 10th century, fig. 10, 16. - No. 71, blank inv. 84:7/2a, 2nd half 13th century, fig. 10, 17. - Nos. 72-74, fragments of 2 staples and 1 blank, an additional fragment of staple and other not identified pieces inv. 84:7/35, Carolingian well, felling date of the oak used in the construction 870, dating Burghart Schmidt, Univ. Cologne, fig.10, 18-19. For publication of finds from the well cf. Krause 1988, 42 ff., figs. 5-6. No. 75, blank inv. 84:7/1n. 11th/12th century, fig. 10, 20.

V. Duisburg - *Niederstraße*, building plot Block D (fig. 2, V; fig. 4, V), watching brief during excavation, summer 1989.

During six weeks of activity we could collect about 9000 potsherds and numerous other objects from contexts, mainly belonging to the 10th century; the younger layers had already been cut by the excavation. These finds were the subject of a magisterial thesis in the University of Bamberg in 1994.

No. 76, fragments of 2 staples from pit 36 inv. 89:17/894/95, end of 9th century. - No. 77, fragment of a staple from trench A 13 inv. 89:17/1086, end of 9th century, fig. 10, 21. - No. 78, blank, pit 23, inv. 89:17/ 834, 10th century, fig. 10, 22. - No. 79, rivet-lamella, vaulted by knocking it from the rivet-bolt, inv. 89:17/464, pit of the 10th century, fig. 10, 23. - No. 80-82, small staple and fragments of 2 other ones, inv. 89:17/1080, pit of the 10th century, fig. 10, 24-26. - No. 83, staple inv. 89:17/676, trench E, layer of burnt remains, 10th century, fig. 10, 27. - No. 84, staple, inv. 89:17/787, layer of burnt remains, 10th century, fig. 11,1. - Nos. 85-96. Ditch of the 10th century, finds from the fill, containing settlement material from the vicinity, mainly pottery, bones, iron slags (among them smithy-slags, remains of melting-furnaces, etc.). The fill was rescued completely, to be treated separately by seeving and washing to extract the finds, but an unloyal collaborator threw away about two thirds of it. So we lost some 15 buckets of finds and the evidence remains quite incomplete: No. 85, staple and additional fragment of another one inv. 89:17/941, fig. 11, 2. - Nos. 86-89, 3 staples and 1 blanket inv. 89:17/829, fig. 11, 3-6. - Nos. 90-91, two staples inv. 89:17/553, fig. 11, 7-8. - No. 92, fragment of staple inv. 89:17/768, fig. 11, 9. - No. 93, staple Inv. 89:17/786, fig. 11, 10. - No. 94, fragment of staple inv. 89:17/806/7. - No. 95, staple inv. 89:17/910. - No. 96, corroded staple inv. 89:17/453. - Nos. 97-98, pit 5: No. 97, upper part of a nail of rivet inv. 89:17/454. No. 98, staple inv. 89:17/558, 13th/14th century, fig. 11, 11-12. No. 99, blank, pit 7, inv. 89:17/557, 13th/14th century, fig. 11, 13.

VI. Duisburg - *Niederstraße*, archaeological excavation, house no. 47, 1994/95 (fig. 2, VI; 4, VI).

The excavation was located directly at the fringe of the lower terrace to the extension area 3 (fig. 5, A). In spite of stone buildings from the 12th/13th century, the stratigraphy is much more complete than in the adjacent Niederstraße Block D. It is obvious that the use of this town quarter for trading activities, ship-landing and -repair continues through the 13th century as shown by the stone-buildings, blanks, staples and numerous iron slags. The youngest staples (nos. 103-104) even belong to the second half of the 14th or the 15th century. Peter Müller, who did most of the rescue work, restricted to very small trenches, drew my attention to the finds nos. 100-102 shortly before his sudden death, when the finds were still untreated. In the meantime, some dozens of staples and blanks have been identified which cover the 10th to 13th centuries. It was too late to include them in this article. Here a tower-like(?) tuffa-building provided with a cellar of 12th/13th-century date was found, joined by long extended buildings at street level (2 phases, 13th and 14th century, with foundations made of stone, later of brick, and walls of framework), partly following the slope of the terrace fringe and quite similar to the warehouses found next to the town-wall below the Niederstraße (see above and fig 7, 1). The large property was divided and rebuilt at the latest in the 15th century. At that time the earlier buildings had lost their function. Some had already been burned or had decayed (warehouses) or were incorporated in new houses (tower-like building). This probably happened to the whole former trader's quarter along the Niederstraße. The new structure of the plots and many of the new buildings in the Niederstraße survived the Second World War and were dismantled after 1950.

No. 100, staple inv. 94:3/674, 12th century, fig. 11, 15. - No. 101, fragment of staple inv. 94:3/673, 12th century, fig. 11, 14. - No. 102, blank inv. 94:3/675, beginning 13th century, fig. 11, 18. - Nos. 103-104, 2 staples, on top of the levelled burned remains of the presumed warehouses, inv. 94:3/580, 15th century, fig. 11, 16-17.

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Dr. Günter Krause
Jahnstraße 7
D-47228 Duisburg

J.P.C.A. Hendriks

The Harbour of Dordrecht. Aspects of Narrowing the Harbour between the 14th and the 20th Century

1 Introduction

Nowadays Dordrecht in the province of South-Holland, is accessible by water from four sides. From the south via the Dordtse Kil, from the west via the Oude Maas, from the east via the Beneden-Merwede and from the north via the Noord (fig. 1). This has not always been so. The present geographical situation is mainly the result of the combined effect of rivers flooding and dykes bursting a phenomenon generally known as the *St. Elisabethsvloed*, which was named after the major disaster which struck the Dordrecht hinterland following the breaching of a dyke during the night of November 18, 1421[1]. As a consequence, a Dutch Shallows-like area originated, full of deep streams and channels which led to a complete change of the landscape.

Before 1421, Dordrecht could also be reached by water from four sides. From the south-east and the west via the Dubbel, and from the north and the east via the Merwede. The success of Dordrecht in becoming the leading trading town of Holland was to a great extent dependent on these geographical conditions. Modern research into the historical behaviour of the rivers has shown that the river area was certainly not an inert area where little seemed to happen. On the contrary, before the first dykes were built, the rivers were rather erratic. One river bed was abandoned in favour of an other. The history of the big rivers in the Netherlands has played a decisive role in the strategic trading position of the city of Dordrecht and therefore the famous harbour of Dordrecht can be seen as the economic heart of the South-Holland river area.

A small part of the Old Harbour of Dordrecht was the subject of archaeological investigation in the autumn of 1995[2]. Before presenting the results of this research, I think it would make sense if an attempt were made to put the Dordrecht harbour in a broader context, in order to provide the heart with veins and arteries. To this end, a model has been chosen which commences with a large geographical unit and ends with the harbour itself. Thus the perspective is repeatedly reduced and attention is transferred from the periphery to the centre. Attention is paid to three aspects.

The first questions concern the course of the rivers: the way it might have been in the 11th, 12fth and 13th centuries, the period in which Dordrecht was emerging and developing into the most important town in Holland. At the centre of this are two river systems: to the north of Dordrecht there is the Merwede, a branch of the European river Rhine; to the south of Dordrecht, there is the Oude Maas and the Dubbel, branches of the European river Maas.

Fig. 1. - *The position of present-day Dordrecht in the Dutch riverine area, situated at the junction of important rivers.*

[1] Hendriks 1992a.
[2] Hendriks 1996b.

Secondly, the situation of the city itself is pursued in greater depth. In a charter of 1200 it is stated that at the time the settlement stretched out '*on both sides of the water*'[3]. Which water is meant here and what was its name? Was *Thuredriht* the name of a branch of the Dubbel or the name of the settlement on the banks of this river? The origin of the city is (again) questioned here.

Finally, the harbour of Dordrecht itself is given full consideration. The aforementioned archaeological investigation has clearly revealed that the size of the harbour entrance gradually became smaller between the 14th and the 20th century. When compared to Ghent (Belgium), for example, it is obvious that this was not something exclusive to Dordrecht[4]. Could one speak of a general trend?

2 The political background: the establishment and expansion of the counts' properties in the eleventh and twelfth century

The present province of South-Holland is much larger than the original medieval province was. At the time, this was understood to mean the economically attractive peatland of Holland, south of the banks of the Merwede. On the eastern side, this area adjoined the western sections of the former Carolingian '*gau*' of Teisterbant. In these regions – the later *Land van Altena* and the *Land van Aalburg* (from about 1200 also called the *Benedenland van Heusden*)[5] – a riverine landscape was clearly discernable, with low lying areas of riverclay basins, higher banks and sandy ridges deposited by former streams. On these strips, traces of settlements have been found dating as far back as the Merovingian period[6]. To the south the, area was bounded by the Oude Maas. In Roman times there must have been a Roman road to the north of this river[7]. Its exact location is not known, partly due to the lack of specific archaeological investigation.

West of this early inhabited area lay the fertile peat bog region of Holland, between the now barely recognizable banks of the big rivers. Tributaries, creeks, rivulets and peat brooks maintained the drainage. After the 3rd century human habitation of the area ceased. The soil had become too wet and too soggy[8]. The Roman road will have become redundant and was probably buried under the growing stratum of peat. Around the year 1000 this area was an almost inaccessible peat bog area[9].

From the beginning of the 11th century, the Gerulfingians or West-Frisian counts showed an interest in this peat area. After 1005, they started to exert considerable authority over the area behind the North Sea dunes, on the banks of the Oude Rijn. Attempts were made to extend their area of influence to the east – the Utrecht-Holland peat area – and to the south. This southern area in particular had much to offer. Not only would it provide stock breeding settlers with good grazing for their cattle once the peat had been reclaimed and cultivated but it also offered direct opportunities for lining the counts' pockets. Toll collections on the Merwede (from a stronghold in Vlaardingen) were the most conspicuous revenues collected by the counts of Holland. Of course such innovations were not received with great acclaim by the users of the waterways, such as the merchants going to Great Britain from Tiel. As they were protected by the German Emperor, they knew they were supported in their protests against the toll collections of Count Dirk III. The eventual imperial response was to ensure that the count had a more powerful opponent to contend with. In the period preceding the Investiture Contest, the bishop of Utrecht was to be this person. This imperial action marked the beginning of a long lasting feud between the count and the bishop.

The first big clash took place when after having annexed the islands of South-Holland, Count Dirk IV wanted to do the same with the areas east of these islands as well[10]. This area included the aforementioned peat bog area between the Merwede and the Oude Maas. All of this took place in the fourth decade of the 11th century. According to the *Annales Egmundenses*, recorded around 1120, Dirk IV was killed by the bishop's troops '*apud Thuredrech*' on 13 January 1049[11]. For a short time, the bishops were thought to have made the counts their vassals[12]. Dirk's brother Floris, however, continued this action started by the counts of Holland, as a result of which he also fell in the battle with the bishop (Nederhemert 1061). Only his successor, Robrecht de Fries, succeeded in breaking the power of the bishop of Utrecht

3 Koch 1970, No. 244.
4 Laleman & Stoops 1995.
5 Hendriks 1993a.
6 Hendriks 1990a, 1992b en 1993a.
7 Stolte 1959; Hendriks 1993b en 1994a.
8 Hendriks 1994c, 177-180.
9 Blok 1981.
10 Gosses 1946.
11 Dek 1969, 12; Renting translates the Latin text '*apud Thuredrech*' as '*bij de Thuredrecht*' (near the Thuredrecht). In my opinion, the text does not give any reason for the definite article that has slipped into the translation. The text is no other than '*bij Thuredrecht*' (near Thuredrecht)! Renting 1993, 12-14.
12 Van Eickels 1996, 40.

in 1076, in favour of Dirk V. Not until the last quarter of the 11th century did South-Holland finally succumb to the authority of the counts[13]. From that time onwards, the reclamation of the peat along the banks of the Oude Maas and the Merwede really got under way[14]. The counts were actually free of the bishops of Utrecht only after the first quarter of the 12th century[15]; so the extension of the power of Holland could only then become really effective. Although it is not absolutely clear to what extent the policy of the counts played a part in the foundation or even the origin of settlements in the reclaimed areas, some of these settlements must certainly date back to the 11th century[16].

At the beginning of the 12th century, the counts called themselves *Count of Holland* for the first time[17]. The founding period of the County of Holland was then definitely brought to an end when the expansion had reached the Oude Maas. The development of the county could start.

The further development of the 11th century settlement into the trading town of Dordrecht fits into this process. It is a development which clearly seems to have been directed by the counts of Holland, for this settlement had an absolutely central position in the area of South-Holland which was to be reclaimed[18]. Only after a radical change in the drainage system of the big rivers Merwede and Oude Maas in the latter half of the 12th century did Dordrecht also get the opportunity to develop into a riverside trading town. This opportunity the people of Dordrecht did not let slip by, supported and encouraged as they were by the counts of Holland who had their own courts in the city. The development into a trading town culminated during the first Golden Age of Holland: 1350-1450[19].

3 The geographical background: the rivers Merwede, Maas and Dubbel

Academics from various scientific disciplines have taken an interest in the Dordrecht region. From their investigations it has been proved that each good historical development analysis requires an extensive geographical and pedological foundation.

A lot more work remains to be done on the Island of Dordrecht, because over large areas of the island the level of the ground rose by accretion after the 15th and 16th centuries, as a result of which earlier geological strata became obscured having been covered with a new blanket of clay and sand[20]. In the former Biesbosch, an in-depth investigation also has yet to be started. All the same, a vast literature has already been written about the changes in the courses of the big rivers. It can, however, be said that we certainly have not heard the last of it yet, as it seems from geological and pedological investigation that the first unexpected changes in river courses date from as far back as the 3rd century[21], that all through the early Middle Ages there is evidence that new river beds were still being created[22] and that the last great breaches in river channels date from the 12th and 13th centuries. After that, however, the rivers seem to have been controlled with the building of dykes; the train of events can easily be traced through to the late 14th and early 15th century, with the calamitous high points of 1421, 1423 and 1424 when the dykes were breached and when there was disastrous flooding, as a result of which the reclaimed South-Holland peat bog region finally succumbed to the water. This is how the Biesbosch originated[23].

Archaeological investigations have also come up with interesting findings. Already a great deal is known about how, where and when the first Medieval settlements in the peat bog regions originated, while in the city of Dordrecht itself, a detailed and systematic investigation has been carried out into the historical development of the city since 1968. The city centre investigation has comprised several phases. Between 1968 and 1990, the archaeological research in Dordrecht was carried out under the theme of the ROB-project '*Urbanisation in riverside areas*' which yielded a lot of information, most of which unfortunately has not been published yet. Between 1990 and 1995, the archaeological fate of the city was in the hands of volunteer archaeologists who could not prevent an important part of the old city being lost, unseen and undocumented. Since 1995, the oldest city in Holland now has had its own municipal archaeologist who would confer upon the historic inner city and the surrounding areas equal historical significance[24].

[13] Blok 19969, 357; Kort 1981, 32.
[14] Jansen 1974; Hendriks 1990b, 3-5.
[15] Van Eickels 1996, 40.
[16] Hendriks 1990b, 3-16; Bos 1996.
[17] Koch 1970, No. 92.
[18] Pons in print.
[19] The oldest archaeological structures of Dordrecht date from the second half of the 12th century; Sarfatij 1996, 110-113.
[20] Hendriks 1996c.
[21] Berendsen 1990.
[22] Henderikx 1987.
[23] Hendriks 1992a.
[24] Hendriks 1996d and 1996e.

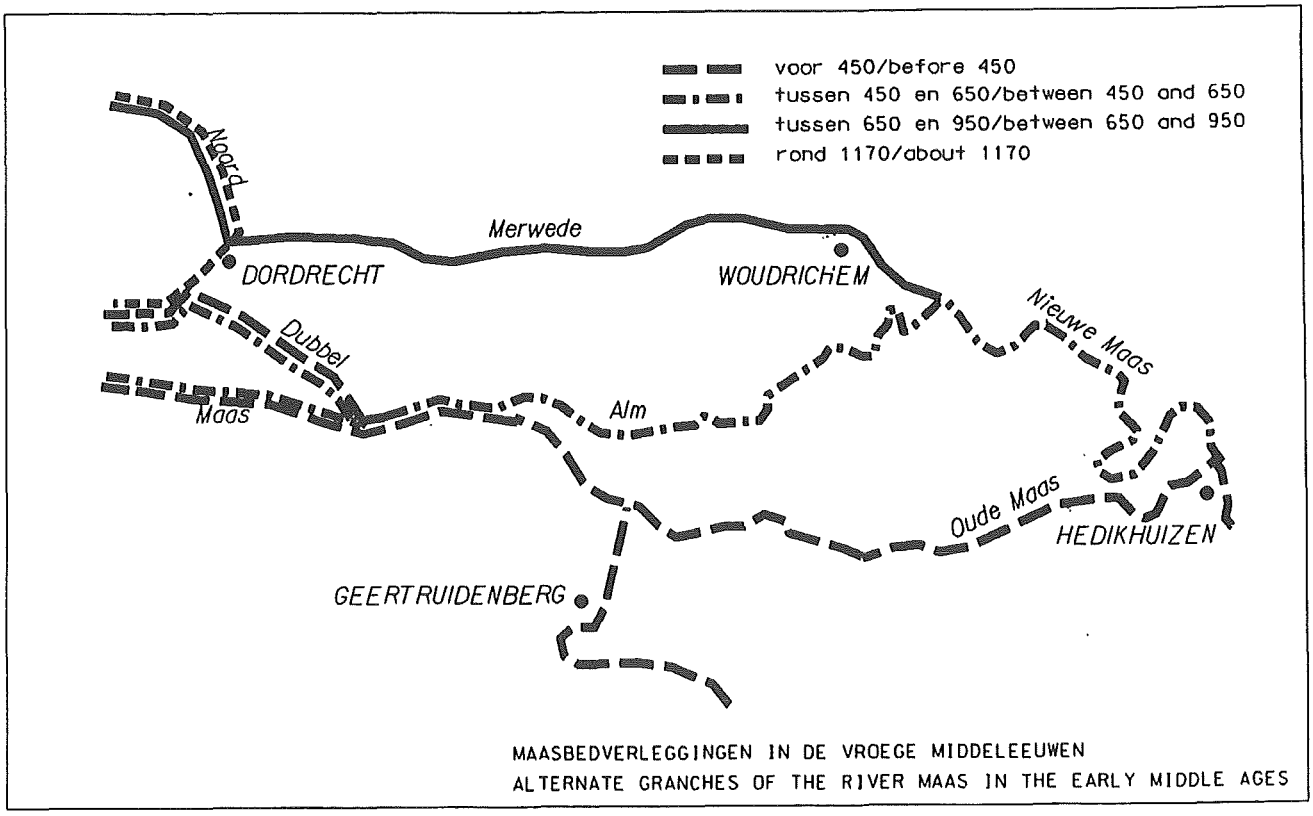

Fig. 2. - *Alternate branches of the river Maas in the Early Middle Ages. The map shows clearly that until the important break-through about 1170, the town of Dordrecht was only situated near the Merwede, with no connection to the river Maas (Map drawn by Joyce Prins-'t Hart).*

At the moment, history is the discipline which is lagging behind the most. As reliable historical sources prior to 1200 are in short supply, it is perhaps an impossible task for the historian to imagine how the city originated. Although the results of the archaeological survey are slowly but surely filtering through to the historical academic world, it seems that the geological and pedological results are proving to be much more problematic. For many historians, the role of the rivers continues to be underestimated. The more so, because it is precisely these rivers which form an important starting point for research into the earliest history of Dordrecht (fig. 2).

3.1 The Merwede

The Merwede is the name of one of the Rhine's tributaries in the Netherlands delta. To the east of Nijmegen, the Rhine enters the Low Countries and splits directly into two big branches: the Lower Rhine system of the Oude Rijn, Vecht, IJssel, Lek and Hollandse IJssel to the north, and the (Boven-)Waal to the west[25]. As far back as Roman times, this river Waal mingled with the water of the river Maas near Heerewaarden. It is quite possible that the present Waal originated around the middle of the 3rd century[26]. In the area around Gorinchem, the waters of the Waal united with those of the river Linge. From that point, where the riverine landscape changed into peat bog, the Waal was called Merwede (*swamp water*)[27] and remained so as far as Vlaardingen. Not until the late Carolingian period did this point shift further east because of the merging of the Waal and the Nieuwe Maas near Woudrichem[28].

The Merwede meandered to a considerable extent. There is geological sedimentation present on the south side[29], which indicates that the river must have flowed there at one time, while archaeological data from the late Middle Ages (although before 1421) presuppose a more northerly river bed[30]. Let us assume that this river had a wide winter bed within which it changed its course quite often. The Merwede flowed from Dordrecht northwards. Here too, various

25 Van de Ven 1993, 35.
26 Henderikx 1987, 24, 74; Berendsen 1990.
27 Pons 1994, 9.
28 Henderikx 1987, 25-28.
29 De Groot 1996.
30 Van der Esch 1989.

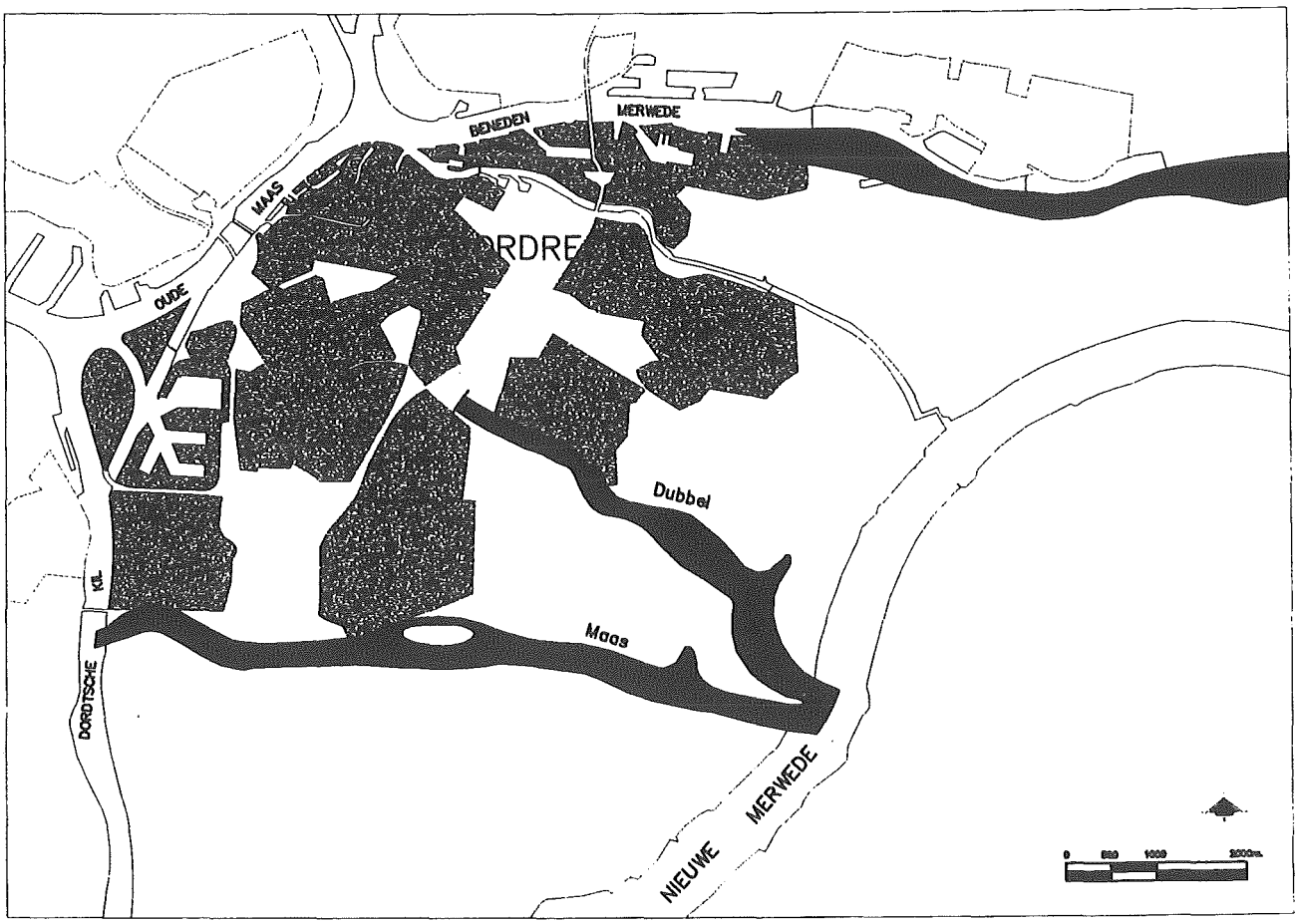

Fig. 3. - *New map concerning the rivers Merwede, Dubbel and Maas on the Island of Dordrecht just before 1421, based on geological data. No data are available from the built-up area (shaded). Consequently the course of the river Dubbel is not yet fully known (Map drawn by Joyce Prins-'t Hart).*

meanders are indicated of which the present river Noord is the last one[31], although this would just have been known as Merwede until well into the Middle Ages. This would have been the situation to the north of Dordrecht in the middle of the 12th century. It would appear that this picture did not change until 1421, with one crucial exception: during the Duinkerke-IIIb transgression around 1170, the Merwede is said to have effected a breach into the river Dubbel[32], straight across the peat bog area of the Zwijndrechtse Waard, possibly the river which Sarfatij discovered during his excavations in the Tolbrugstraat[33]. Furthermore, a forerunner of the present Oude Maas was formed on the south side of the Zwijndrechtse Waard[34]. The archaeological evidence for this fossilized river bed underneath the present inner city of Dordrecht, as well as the characteristics of a typical low lying peat bog in which Dordrecht was situated do not permit the assumption that there was ever a tideway present. This assumption which was nonetheless accepted by the authors of the *'History of Dordrecht'*[35] in my view justifiably has been consigned to the realms of fantasy by the pedologist Pons[36]. This is how Dordrecht, which was already established, was cut off from the rest of the Zwijndrechtse Waard and how the settlement suddenly found itself at the junction of rivers. It is therefore wrong to assume that Dordrecht would ever have become established as a powerful, mainport on the river because of the Counts of Holland.

3.2 The Maas

The history of the Maas is much more complicated than that of the Merwede. Here it is not a question of a river which, although periodically changing its course by meandering, flowed in an orderly

31 Pons 1994.
32 Hoek 1974; Henderikx 1987.
33 Pons 1994, 11-12.
34 Sarfatij 1972.
35 Van Herwaarden *et.al.* 1996, 16; See also: Renting 1993, 9-11.
36 Pons in print.

fashion from east to west. During the Middle Ages, the Maas was an erratic river[37]. In spite of this, it was already an important commercial waterway some time before the burgeoning function of Dordrecht as a port. Interesting evidence of Roman habitation in the Maas-region has been found not only in the Land van Heusden and Altena[38] but also in the Zwijndrechtse Waard[39] and particularly in the Hoeksche Waard. In the riverbed of the Maas, no traces *in situ* have so far been found on the Island of Dordrecht.

From the 5th century, it followed approximately the present river course as far as Hedikhuizen[40], with one important change: from Heerewaarden, the Maas carried considerably more water as a result of the river merging with the Waal[41]. This had repercussions on the Maas-region downstream. Till the 7th century, the Maas followed its old course to the west of Hedikhuizen. Possibly a small side stream already existed in the vicinity of this village; it joined the Alm near Giessen, and subsequently flowed via the original mouth into the Merwede[42]. However, Braams is of the opinion that Henderikx's argument is not watertight and points out that this streamlet nevertheless had to pass through the Dussen Ridge[43].

In the Merovingian period, the Maas took this new course. As a consequence of the great amount of Maas-water which the Alm had to cope with, a breach occurred in the vicinity of the future Almkerk and the new Alm flowed straight across the peat bog region back to the Maas. At this junction, the settlement of Almonde was later to develop. The original lower reaches of the Alm slowly but surely grew solid through peat formation; this section was called the Werken. At the junction of the Werken with the Merwede, the already mentioned but as yet unknown *Wirkenemunde* was established. Between Hedikhuizen and Almonde, the Maas was now called the Oude Maas.

A second shift in the course of the Maas must have occurred before the year 1000. It happened when the Nieuwe Maas broke the banks of the Alm at Giessen and from there flowed to and into the river Waal (which from this point was now called the Merwede) to the north of the Land van Altena. At the junction of both rivers the settlement of Woudrichem already existed, established on the left bank of the Waal[44]. The date of this breach is very debatable. Hardenberg placed it around 1200[45]. That would seem to be too late. Henderikx favoured a date before the year 1000[46], but in his argument he included a mistaken opinion about the structure of the settlement at Woudrichem. The Nieuwe Maas-tributary must have originated between the 7th and 10th century. Braams shortens this period to between the 9th or 10th century[47]. In my opinion and taking into account the position of Woudrichem, that seems quite acceptable.

3.3 The Dubbel

The Dubbel no longer exists. Only the name of the Dordrecht district of Dubbeldam is a reminder of this old tributary of the Maas which once flowed through the peat landscape of South-Holland. The river had that to thank for its name: *black water*[48]. The fact that the name no longer exists does not mean to say that the river no longer exists. The southern boundary of the present Zwijndrechterwaard is in fact an old river bed of the Dubbel, actually known as Oude Maas.

The Dubbel did exist in Roman times[49] but as yet only a few archaeological remains from that time have been found. This is largely due to the amount of sediment deposited following the St. Elisabethsvloed and any even trace of the course of the Dubbel on the Island of Dordrecht was entirely wiped out. It is only very recently that more light has been shed on the deposits of the Dubbel there (fig. 3)[50]. In this respect, all credit must be given to the amateur archaeologists in the Dordrecht municipality who – after a lot of drilling – discovered a significant meander of the Dubbel in the south of Dubbeldam[51]. At the end of the 11th century at the latest, the settlements of Erkentrudenkerke, Wolbrantskerke and Thiedradenskerke were established on the banks of the Dubbel[52].

In the south of the Zwijndrechterwaard is the river Devel and on its banks a great many Roman artefacts have been discovered, not covered with later sedi-

37 Henderikx 1987, 25-28, 76-77; Hendriks 1992b.
38 Hendriks 1990a, 1993b and 1994a.
39 H. Sarfatij 1976, 269 describes that a systematic field survey in this area has produced a relatively large number of Roman finds along the Waal and the Devel.
40 Henderikx 1987, 76-77.
41 *Ibid.*, 77.
42 *Ibid.*, 20.
43 Braams 1995, 26.
44 Hendriks 1994b, 15.
45 Hardenberg 1934, 191-93.
46 Henderikx 1987, 28.
47 Braams 1995, 28.
48 Pons 1994, 9.
49 Henderikx 1987, 79.
50 De Groot 1996.
51 Van der Esch & Koorevaar 1995; Hessing 1995.
52 Koch 1970, No. 92; Hendriks 1990b; Van der Esch & Koorevaar 1995; Van den Beemt 1994.

mentary deposits. Although Henderikx reports no relationship between the Devel and the Dubbel[53], the Dubbel flowed into the Devel[54] according to Pons. A new branch of the Dubbel to the south of the Devel did not exist earlier than the last quarter of the 12th century, at the same time as the union between the Merwede and the old Dubbel[55].

4 The location of the town of Dordrecht

At present, the origins and age of Dordrecht have still not been determined, despite comprehensive historical and archaeological investigation and despite the numerous theories which abound on the subject. It is certain, however, that the earliest houses of the town were situated on dwelling mounds on the banks along the central waterway.

4.1 The town on both sides of the water

From the charter of November 3, 1200, it is known that Dordrecht was at that time situated on the water, and on both sides of the water at that. This statement rules out the possibility that the town was on the Merwede. The settlement actually originated according to a familiar pattern: situated near a big river, not actually on that river but a little behind the mouth of a smaller tributary[56]. It often occurred that originally only one bank was inhabited. The habitation zone would virtually always be located on a riverbank along the smaller stream. On this bank, the first road would have been laid. If the circumstances demanded it, the river bank would have been raised and would to all intents and purposes have been a dyke. In streetnames, the element 'dyke' was maintained for a long time, in some cases up to the present day.

In Dordrecht, these 'dyke'-names have disappeared. From the history of streetnames, it would appear that the present Wijnstraat was originally known as Nieuwendijk (new dyke). In this respect, it is remarkable that in 1203 there was indeed a report of a *Novo Dicho*[57], and from the revenue raised on it Count Dirk VII of Holland presented an interest of five pounds a year to the Heisterbach curia which was to be built. How old the term Nieuwendijk/*Novo Dicho* was at that moment, is not known. It prompted the Dordrecht historian M. Balen (1611-1677) to contemplate naming the Voorstraat, the street lying parallel to the Wijnstraat, 'Oude dijk' (old dyke), although no written evidence exists for this view. Nevertheless, the antithesis Old dyke - New dyke actually raises an important question regarding the origins of the town. We have to ask ourselves if there is a chronological difference to consider between both terms, which would imply that initially Dordrecht originated along the Voorstraat. Possibly, the location of the oldest townhall is an indication of that possible original situation: it was situated between the Voorstraat and the tributary. There are many reasons to believe that the Voorstraat was indeed the oldest dyke[58] and this fits in well with the general pattern of river settlements; but there is as yet no historical or archaeological proof.

The only – if somewhat vague – indication is possibly to be found in the fact that in 1200 it was emphatically stated that Dordrecht lay on *both* sides of the water. Apparently, the authors of that charter (Duke Henry I of Brabant and Count Dirk VII of Holland) found that a simple mention of Dordrecht (*Durtreth* or *Durtrich*) was not sufficient. Dordrecht clearly existed in two parts (the Voorstraat side or Landzijde (Landside) and the Wijnstraat side or Poortzijde (Portside) and any suggestion that the water between the two sides served as a legitimate boundary for the regions of Holland offered to the Duke of Brabant must be discounted. Apparently, there was indeed a reason for such a suggestion and thus for a division of the town. From the religious angle for example, the Landzijde part comprised the parish of Erkentrudenkerke (south) and the parish of Sliedrecht (north), while the Poortzijde was part of the parish of the Grote Kerk (Big Church)[59]. It is possible that before 1170 this part of the town belonged to the Zwijndrechtse Waard[60]. Anyway, it was precisely on this side of the water that the Count of Holland also had his *pied-à-terre*. On the basis of this scant information, it would appear that the tributary was

[53] Henderikx 1987, 79.

[54] Pons 1994.

[55] Pons in print.

[56] E.g. Roermond on the Roer near its junction with the Maas, Dendermonde at the place where the Dender joins the Schelde, Dorestad on the Kromme Rijn near its junction with the Lek, Tiel on the Linge near its junction with the Waal, Gorinchem at the place where the Linge joins the Merwede, Werkendam at the place where the Werken joins the Merwede, Heusden on the Dove Maas near its junction with the Nieuwe Maas, Alblasserdam at the place where the Alblas joins the Merwede, Rotterdam at the place where the Rotte joins the Merwede, Amsterdam where the Amstel flows into the IJ.

[57] Koch 1970, No. 261.

[58] As I phrased this in my archaeological lexicon. Hendriks 1996a.

[59] Van Herwaarden *et al.* 1996, 301-311.

[60] Pons in print.

possibly seen as a boundary. In order to prevent this, the Duke of Brabant certainly would have insisted that there be no misunderstanding on this point. Wherever the boundary was, in 1200 Dordrecht was a settlement which lay on both sides of the water. The actual boundary was in fact farther to the west, where since about 1170 a stretch of water had divided the Zwijndrechtse Waard from the Poortzijde of Dordrecht. Nowadays, this stretch of water is called the Oude Maas (sic!).

4.2 Thuredriht

An old problem is the name used to the central tributary of Dordrecht. The charter of November 1200, already mentioned above, says only 'opidum Durtreth ex utraque parte *aque*'. Here, the tributary is just called *the water*. Due to the fact that each signatory of the charter was well aware which water was being referred to, there was no need to specifically name the watercourse. What was this central watercourse called?

Around 1121/1122 there was – possibly at the instigation of the bishop of Utrecht – a charter drawn up in which goods and titles which were in the hands of the Count of Holland, would have been 'returned' to the bishop of Utrecht by the German emperor. As the bishop of Utrecht wanted to bestow an atmosphere of tradition and antiquity, the charter was dated 1064 and was provided with the signature of the reigning monarch of the time, the German Emperor Hendrik IV. Whether the actual reigning emperor (Hendrik V) provided the charter with an authentic seal is not known. We only know of the charter's existence from a late 12th-century transcript from the episcopal archives in Utrecht. It is a *falsum*, but it is generally accepted that this did describe the situation which existed shortly after the middle of the 11th century[6161]. It means that the passage about Dordrecht possibly also refers back to this time.

The passage concerned provides a summary. This summary can be taken as a boundary description of the Zwijndrechtse Waard and is therefore of great importance to the question of whether only the Poortzijde or also the Landzijde belonged to this waard. The text reads as follows:

'item de Riede iuxta Merwewede usque Sclidreht; item iuxta Merewede in Thuredrit, inde in Duble, inde in Duuelhara, inde in Wal, inde iterum in Merewede usque Thuredrith cum capella noviter constructa: de Thuredrith ad orientem usque Godekineshofstat, quod est iuxta Wirkenemunde'.[62]

It is one of the earliest records of the name *Thuredrit(h)*. Only the already mentioned passage from the Chronicles of the Egmond Monastery written around 1120 and in which reference is made to the violent death of Dirk IV, Count of Holland, *apud Thuredrech* in 1049 is older.

The problem which faces us now is whether the name *Thuredrech/Thuredrit(h)* means the settlement of Dordrecht or is rather the name of the central watercourse in the town. For a better understanding, I have taken both the interpretations of the above fragment and put them side by side below.

town 'item from the Riede along the Merwede to Sliedrecht; onward along the Merwede to Dordrecht, from there to the Dubbel, subsequently to the Devel, from there to the Waal and from there again to the Merwede up to Dordrecht with its newly built chapel; from Dordrecht eastward to the farmstead of Godekin, that is past Wirkenemunde'

water 'item from the Riede along the Merwede to Sliedrecht; item along the Merwede to the Thuredrit, subsequently to the Dubbel, from there to the Devel, subsequently to the Waal and from there again to the Merwede up to the Thuredrith with its newly built chapel; from the Thuredrith eastward to the farmstead of Godekin, that is past Wirkenemunde'[63]

The question of whether the town or the water is being referred to has long been debated and usually with one's individual preconceived ideas as a frame of reference. The text itself does not *seem* to give any argument for or against any of the two alternatives. The authors of the recently published *History of Dordrecht up to 1572* think that the sequence in which the name is used justifies the supposition that with the name *Thuredrit(h)* a watercourse is meant[64]. Without much further ado, a few pages later they write about the Thuredrith as the name of the central watercourse and continue to do so for the remainder of the book[65]. By doing so they support an old theory[66]. An actual argument for this interpretation is not given. The 'justifiable supposition' seems to be a bit far-fetched. In any case, in the summarized passage there is not only mention of watercourse names (Riede, Merwede, Dubbel, Devel and Waal), but also of place names (Sliedrecht, Wirkenemunde) and

61 Renting 1993, 7.
62 Koch 1970, No. 86.
63 Van Herwaarden *et al.*, 17.
64 *Ibid.*, 17.
65 *Ibid.*, 19-20, 74-75, 77 and 309.
66 Renting 1993, 12-14.

even of another topographical feature (the farmstead of Godekin). I suggest that an unnamed and unproved premise guided the hand of the authors. In any case we are denied a genuine watertight argument.

However, Pons is of the opinion that the first *Thuredrit* must be read as the name of the water and the second *Thuredrith* as the name of the settlement, 'otherwise there would not be the word: *with*'[67]. In my opinion, we have here the classic Procrustean Greek theme: stretching and curtailing as much as necessary so that the object fits in a previously prepared vehicle. Sarfatij ultimately thinks that the settlement had the name *Thuredrith*, but that that was also the name of the central watercourse.[68]

4.3 The 'capella noviter constructa"

Are there then clues for equating the name *Thuredrit(h)* with the settlement of Dordrecht? I want to beware of any prejudged impression which could be made by what follows. In spite of this I actually think that the text itself sheds a little light on the subject. There is after all mention of a recently built chapel. The bishop of Utrecht would certainly have wanted to have this chapel under his control. In the choir of the church at a depth of about 2.5 metres (8 feet), remains were found of the apse of an earlier Romanesque tuff church[69]. The date of this stonework is uncertain, but is thought to be the second half of the 12th century. Also in the vicinity of the church late 12th-century potsherds have been found[70], which indicate that the south-western area of the town was already in use before 1200.

It must also have been this tufa stone church which is mentioned in a charter of 1203. In that year, Count Dirk VII and his spouse Aleida presented a number of goods and titles to a new curia of the Heisterbach monastery. The titles included one relating to the church of Dordrecht 'as soon as it becomes available' (*item ecclesiam in Durdrecht cum primum vacabit)*[71]. From that moment we also know the chaplain of this chapel, *Henrici capellani*, who regularly appeared as the author of records belonging to the nobility[72]. The historical data thus makes it possible that Dordrecht had its own house of worship in the second half of the 12th century.

However, if the date of the excavated church is really correct, it is impossible that a chapel from 1122 was being referred to, while a place of worship from around 1065 would appear to be completely out of the question. Whether the proposed date will be adjusted in the future remains to be seen. It is possible that under the tufa stone church an even earlier wooden predecessor could be found. That is quite possible because the 'newly built chapel' appears to lie in the Zwijndrechtse Waard according to the records, and thus it must date prior to around 1170[73].

There is yet another possibility. Close to the place where the tributary flows into the Merwede, the Nieuwkerk (New church) can be found, dedicated to St. Nicholas. St. Nicholas was the patron saint of merchants and traders and for this reason is often to be found in old commercial districts. Although the earliest raising of the ground on which the Nieuwkerk stands dates from the middle of the 14th century[74] and the first written records of the church date from 1284, it has been suggested on the basis of the *Kalendarium van Pieter Michielszoon* that the Nicholas chapel was elevated to parish church in 1175. In other words, perhaps a chapel also stood here before the last quarter of the 12th century[75]. Now, what if this Nieuwkerk is the same as the *capella noviter constructa*? The Nieuwkerk does not stand directly on the central watercourse, but was it then the Grote Kerk which did? The beautiful Brabant-gothic stonework is reflected in the Voorstraatshaven, but it is exactly this part of the central watercourse which, according to most authors, was first dug out by human labour around 1282[76]! Also the water on the other side of the Grote Kerk is the forerunner of the present Oude Maas and cannot be what is referred to, because pedological investigations revealed that this breakthrough only occurred in the last quarter of the 12th century and the water acquired the present channel around 1270/1280.

Thus, in the 12th century Dordrecht had probably two chapels, but there are reasons to suppose that neither of them was actually situated on the banks of the central watercourse. If in the records of 1121/1122 there is mention of *Thuredrith* with the newly built chapel, we can only conclude that it is unclear which chapel was being referred to and that the name *Thuredrith* denoted the town rather than the water.

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67 Pons in print. See also: Jensma & Molendijk 1987, 12.
68 Sarfatij 1996, 111.
69 Kistemaker 1987.
70 Sarfatij 1979, 328-329.
71 Koch 1970, No. 261.
72 Koch 1970, No. 262 (1203), No. 270 (1204), No. 370 (1216).
73 Pons 1994, 10.
74 Sarfatij 1977, 258-264; Sarfatij 1978, 306-310.
75 Though a limited archaeological survey around the Nieuwkerk has not produced any traces of a church dating farther back than the 15th century.
76 Van Herwaarden *et al.* 1996, 74-75. Pons leaves open the possibility that this excavated part was constructed before the floods of 1170-1200, but he is not able to give a more exact date.

4.4 Petrus de Thuridrith et alii

A second argument arises over the naming of people. In records of the Middle Ages the people who are mentioned, sometimes belonging to the established nobility, sometimes to the nobility risen from the ranks of ministers, were regularly named after their domains. Although these domains have sometimes disappeared without trace, it would appear that they all had one thing in common. Members of the nobility who were named after water which was part of their domain, were clearly linked with the insert *van der* in the records drawn up in the mother tongue.

Hence there are the gentlemen Jacobus de la Mase[77], Van der Dussen, Van der Leck, Van der Merwede as distinct from those gentlemen with names such as Van Altena, Van Arkel, Van Heusden, Van Cuijk, Van Brederode, Van Polanen, Van Haerlem or Van Egmont[78]. Although the (earlier) Van Amstels can quickly contradict this argument, it is still an interesting fact. Hence we know among others, a Martinus de Durthric (1198)[79], a Petrus de Thuridrith (1232)[80] and a Henricus Thurdrich (1275)[81] a Jan van Dordrecht (1282-1301)[82], Boudewijn van Dordrecht (1315)[83], Claes van Dordrecht (1346)[84], Pieter van Dordrecht (1305-1306)[85] and Bartholomeus van Dordrecht (1382)[86]. Thanks to the change in the style of writing in the last quarter of the 13th century (from Latin to the national language) it is clear that all these individuals mentioned were named after the town. The mention of one *Martinus de Durthric* is, after the records of 1120 and 1121/1122, the earliest mention of the town, even before that of 1200! In short, I think that the Thuredrech (1120), Thuredrih(t) (1121/1122), Durthric (1198), Durdreth (1200), Durtrich (1200), Thurdrecht (1200), Durdrecht (1203), Dhurdreght (1203), Durtrich (1204), Durdrech (1213), Dvrtricht (1216), Durdrecht (1217), Thuridrith (1232) and Thurdrich (1275) all mean the same: the town of Dordrecht. Of a Van *der* Thuredrih(t) there is no mention.

4.5 'Drecht' - names

A third line of argument can be followed in comparison with other *-drecht* names. The suffix *-drecht* (meaning ferry, crossing place or navigable water) seems to be used, at least in the opinion of Van Berkel and Samplonius, in combination with two other prefixes, namely personal names and watercourse names[87]. From the first group come the names Barendrecht (1265 *Berendrech:* personal name Bero with ferry/navigable water), Duivendrecht (1308 *Doevendrecht:* Doeve etc.), Katendrecht (1199 *Catendreth:* Cate etc.), Ossendrecht (1187 *Ossendrecht:* Osse etc.), Papendrecht (1105 *Papendreht:* Papo etc.), and Pendrecht (1114-1127 *Pahindrecht:* Pago or Paye etc.). It has been suggested that a settlement on navigable or traversable water is named after a certain founder. From the second group comes Mijdrecht (circa 1200 *Midreth:* with the water name Mije), Moordrecht (1250 *Mordreth:* with Mor meaning swamp or moory water), Sliedrecht (1203 *Overslydrecht:* with the watername Sli), Wieldrecht (1187 *Wildreht*: where 'Wil' means a deep pool (or eddy) and Zwijndrecht (1028 *Zvindrecht*, where 'Zvin' could be a tideway, channel or creek)[88]. Only with Dordrecht do they have a deviation and translate the prefix *thure* as 'door' (through), which can mean that Dordrecht is a 'settlement on navigable water'.

Also in the *Lexicon van Nederlandse toponiemen tot 1200* (Lexicon of Dutch toponyms up to 1200), a division is made between personal names and watercourse names, whereby Pendrecht (1105-1120 *Pahindrecht)* can include the personal name Pagin and also denote a waterway. According to the compilers, Ossendrecht is derived from the plural of '*os*' (ox). The prefix '*Caten*' in Katendrecht is not known to them and therefore cannot be ascribed to a personal name. According to these compilers, Mijdrecht, Sliedrecht and Wieldrecht are likewise derived from watercourse names. Also Künzel and others wrestle with the name Dordrecht. For them the prefix '*thure*' is not known. They at any rate do not venture to give any derivation[89].

To summarize it seems logical to see in the prefix '*thure*' a personal name or a watercourse name. My preference is for a watercourse name. Consequently I think that the central watercourse in Dordrecht was called the *Thure*. In any case the truth eludes us and we are left only with possible interpretations.

4.6 A branch of the Dubbel or a peat bog stream?

Quite a separate problem arises with the question as to whether the Thure is a tributary of the Dubbel

77 *Ibid.*, 35.
78 Hendriks 1982.
79 Van Herwaarden *et al.* 1996, 276.
80 *Ibid.*, 28.
81 *Ibid.*, 35.
82 *Ibid.*, 46-47.
83 *Ibid.*, 21.
84 *Ibid.*, 91.
85 *Ibid.*, 276.
86 *Ibid.*, 353.
87 Van Berkel & Samplonius 1995.
88 This view is however contested by Pons in print.
89 Künzel, Blok & Verhoeff 1989.

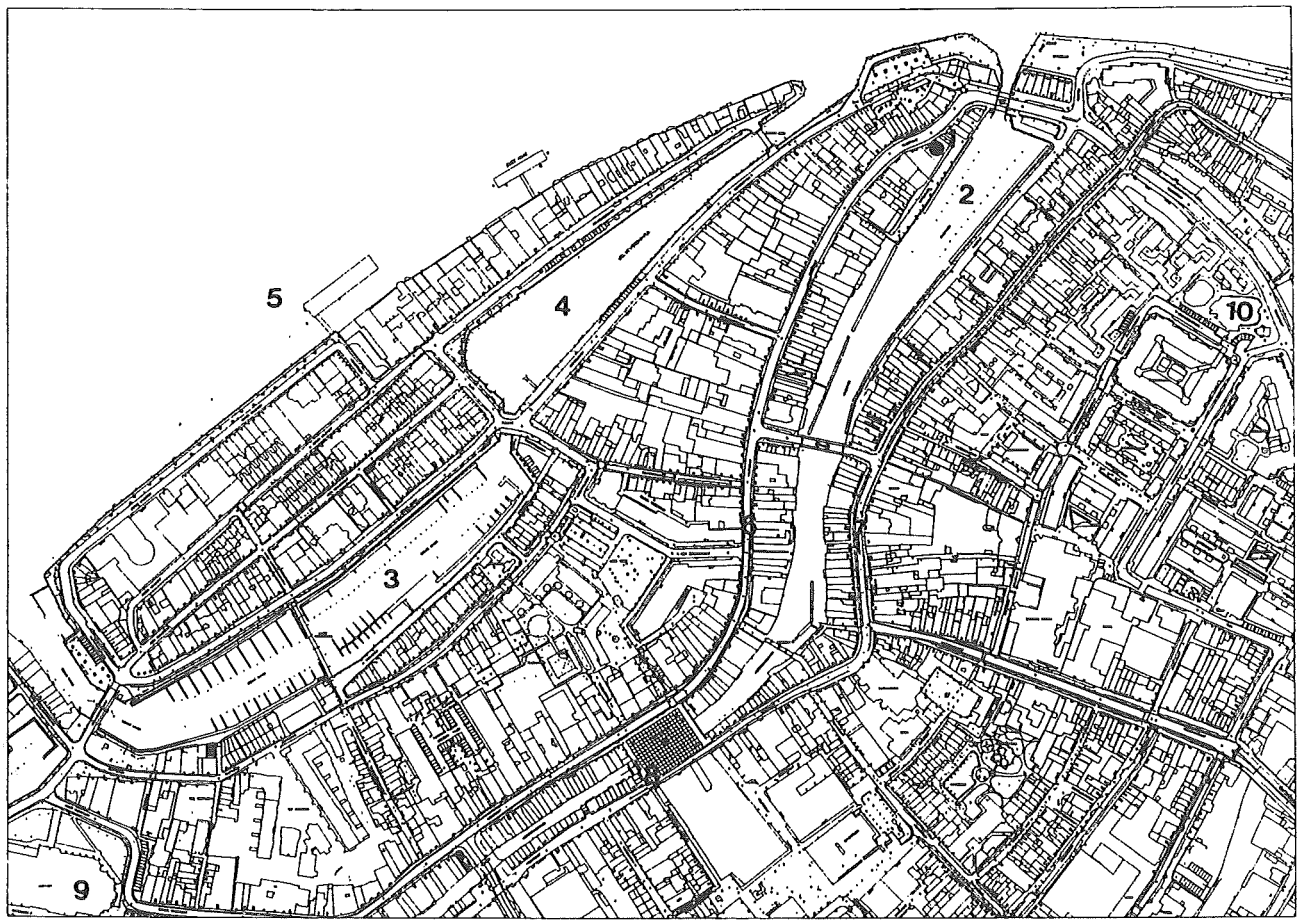

Fig. 4. - *Northern part of the medieval town of Dordrecht, indicating some of the elements mentioned*: 1. Excavation area in 1995; 2. The mouth of the Thure or Old Harbour of Dordrecht; 3. New harbour; 4. Wolwevershaven (Woolweaverharbour); 5. The present 'Oude Maas', actually the connection between the rivers Merwede and Dubbel, dating from about 1170, but the present branch dates from a century later; 6. The Wijnstraat (Winestreet) or New dyke; 7. The Voorstraat or 'Old dyke'; 8. The place where the first townhall stood; 9. The Grote Kerk (Big church); 10. The Nieuwkerk (New church).

or not. Various authors have come to the conclusion that somewhere to the west of Dubbeldam, possibly near the Dubbelmonde Park, this Thure linked up with the Dubbel. Beenhakker proposes that this water actually, 'with its narrow winding course (...) is difficult to fit into the river system of the Maas and the Merwede. The stream could never have contained a great amount of water, because it is too narrow and too winding. Neither does it appear to be a normal tributary of the Maas or the Merwede; it rather gives the distinct impression of being a peat bog streamlet that originally only carried peat bog water from the Grote Waard. The wide mouth (...) also indicates this'[90]. Beenhakker does not rule out the possibility that in the second instance a connection with the Dubbel could have originated. Pons is of the opinion that it was not a natural connection but a man-made channel. That makes the connection in the Dubbelmonde Park of great historical value with three possibilities: 1) it is certainly the natural Thure; 2) it is a man-made connecting channel between the Dubbel and the Thure; 3) it is the link of an other watercourse, namely the Graaf, which crossed the Dordtse Waard east of Dordrecht.

5 The Old Harbour entrance

In the autumn of 1995 a small part of the Old Harbour of Dordrecht at the head of the Wijnstraat was excavated. The survey was carried out at a site not far from the Groothoofd-gate directly to the north-east of Wijnstraat 12-14, premises which had been demolished in September 1995. At the time this site was used partly as a roadway, partly as a parking lot. Subsequently, a block of apartments was built here (fig. 4).

[90] Beenhakker 1992, 69.

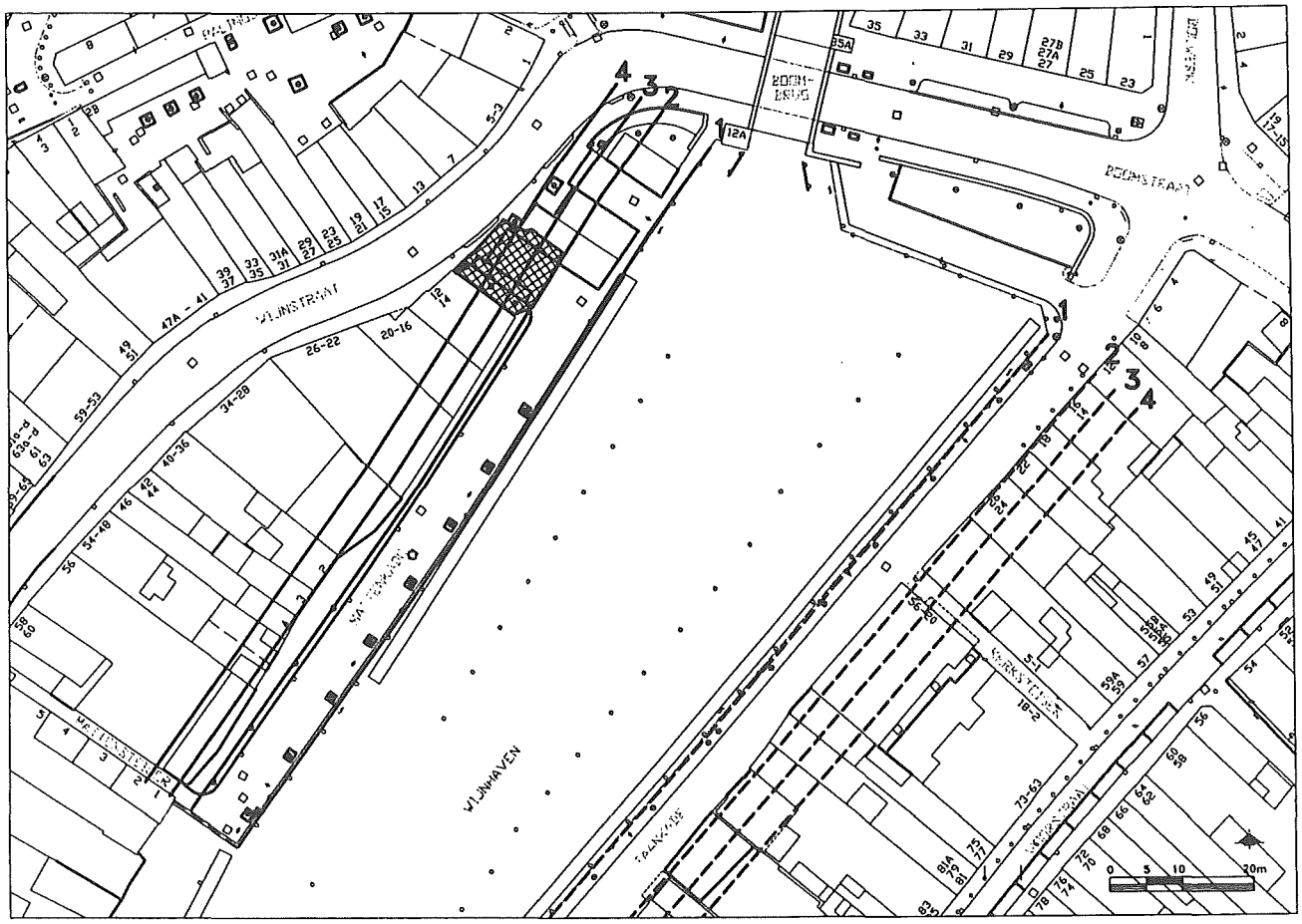

Fig. 5. - *Excavation area in 1995 (hatched) near the mouth of the Thure/entrance of the Old Harbour of Dordrecht. The lines 1 to 4 indicate the width of the harbour at a certain time, based on the data derived from the excavated area. The interrupted lines on the eastern side of the water are consequently drawn, although no proof exists for it at the moment. 1. The quay in the 20th century; 2. The quai of 1617; 3. The quai of the first half of the 14th century; 4. Possible shore of the Thure before the first half of the 14th century (Map drawn by Joyce Prins-'t Hart).*

5.1 First phase

Originally the mouth of the Thure was not protected by dykes, nor did it have any quay-walls. The mouth was a wide one, which could indicate that the flow of the water must have been marginal. That determined why it was an ideal site to create a harbour. The original centre of the old Dordrecht harbour must have been situated between the Visbrug and the Wijnbrug. During the excavations no clues were found to indicate the use of the harbour entrance in the 11th and 12th centuries. The dozens of '*sintels*' found in the original slope of the embankment all date from the 13th century, making them the oldest findings produced by this excavation. In those days there may have been a wharf or mooring place at the entrance of the harbour. The entrance of the old harbour is thought to have been about 80 metres wide at this time (fig. 5).

5.2 Second phase

This situation changed before the middle of the 14th century. The most important discovery made in the excavation pit of only 100 m² was that of a brick quay-wall faced on the outside with white limestone, probably originating from the stone quarries in the Belgian-Brabant Gobertange (fig. 6). The bottom of this quay-wall extended as far as approximately 7.50 m under groundlevel and it was probably built on wooden piles. At the bottom, the width of the foundation was increased to almost three metres. On the landside huge oak beams were in-built to prevent the quay-wall from keeling over into the harbour entrance. In this they were only partly successful, as during the excavation the quay-wall appeared to be 1 to 1.5 m out of plumb. Between the quay-walls on either side of the water, the old harbour must have had a width of 73 metres.

Between the quay-wall and the Wijnstraat, dating from shortly after the harbour construction, there was

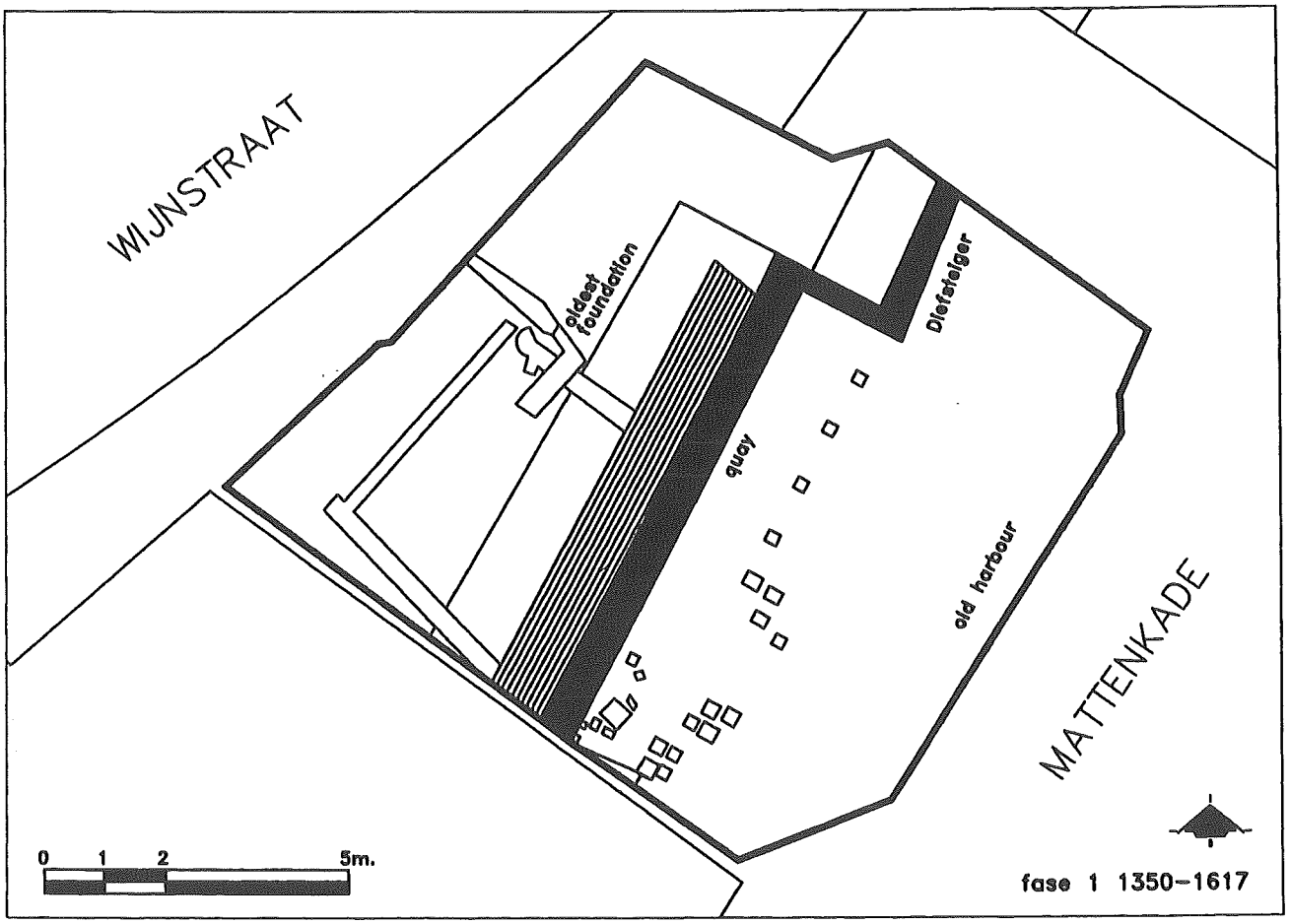

Fig. 6. - *Excavation 'Kop van de Wijnstraat' (October 1995), phase 2 with the 14th-century quay wall (black), the wooden posts in the Old Harbour and a part of the oldest foundation near the Wijnstraat (Map drawn by Joyce Prins-'t Hart).*

at least one dwelling; a small part of the cellar could be excavated. The greater part of the dwelling must lie under the present road. On the waterside in front of the quay-wall, there was a large number of wooden piles which were part of a landing stage. Other piles functioned as mooring posts. On the oldest town plan of Dordrecht, drawn up by Jacob van Deventer (1545), this harbour quay makes up part of the *Dievenstigert*. Although Van Deventer, the famous 16th-century cartographer, drew at that time a more or less triangular harbour extension, we notice on Braun & Hogenberg's 1572 plan that it was in fact a rectangular unit. The latter coincides precisely with the remains discovered. The harbour landing stage was 10 metres long and 1.40 to 1.90 metres wide. Whether the old harbour entrance retained its function for any length of time is not certain, as in 1409 the Nieuwe Haven (New harbour) was constructed. The major trading activities must have been transferred to the new harbour basin. It is possible that the wine trade continued to be concentrated in the old harbour along the Wijnstraat for some time.

5.3 Third phase

The situation changed in about 1617, after the construction of the Wolwevershaven in 1609. The Wijnhaven was narrowed and a new quay-wall was built about 4 metres from the earlier one, which resulted in the harbour entrance being reduced to a width of 66 metres. Only the back of this second quay-wall could be excavated (fig. 7). Its front lies under the present Mattenkade. The new quay-wall was built of small '*ijssel*'-bricks and in various places it was joined to the earlier quay-wall with transverse walls. Within the compartments thus created, various forms of support for the quay have been found. In the southern part three buttresses resting on oak boards, beams and piles were discovered. In the northern part, no buttresses were found but here the wall was held in check by heavy, slanting, oak timbers fixed to horizontal beams. This was not effective either. The quay-wall caved in and tilted towards the harbour, in some places being ripped from its cross joints. Attempts were made to prevent this by securing oak wall-ties in various places. According to old town

plans, a wooden landing stage – the Mattensteiger – was constructed in front of this quay wall.

The space between the old quay-wall and the new one was filled up with town refuse from the period around 1600. As a consequence, the construction of houses in the Wijnstraat underwent a drastic change. Not only did the positioning of the buildings change with respect to the Wijnstraat, the houses, too, were extended. The back walls of the houses or the rear boundaries of the premises were placed on the second quay-wall. On top of the oldest quay-wall a new wall was constructed in the 17th century, only 75 cm wide. This wall had a structural function in the new dwellings. Cellars were discovered in each of the houses. The transverse walls obviously served as property boundaries. A total of 2½ blocks of houses of this type were excavated.

5.4 Fourth phase

This complete block of houses was demolished at the beginning of the 19th century. Only a few fragments of these buildings fell into the caved-in cellars. From these fragments we can conclude that the facades had hardly changed since the beginning of the 17th century. Two blocks of houses made way for one big house with a cellar which was mainly used for activities in connection with the shipping trade. Finally, in the second half of the 20th century, the former wooden Mattensteiger on the waterfront was replaced by the present Mattenkade, and consequently the width of the Wijnhaven, the old harbour of Dordrecht, was reduced again by several metres. The eventual width of the old harbour was now just 49 metres, nearly half the size of the original harbour entrance[91].

6 Summary and conclusion

It is not beyond the realms of possibility that Dordrecht originally came into existence in the 11th century as a settlement on the banks of a peat stream, a tributary of the Merwede in the peat bog region. Although archaeological data on origin of Dordrecht are still lacking, it can be taken that the settlement initially originated on just one bank of this stream. In the 11th century, it seems out of the question that Dordrecht was situated on a river junction[92]. It is more likely to have been a pioneer farming settlement, in the middle of a productive peat bog area, possibly under the leadership of a *locator*.

One can suppose that the Westfrisian counts knew that once these peat bog areas had been reclaimed, very fertile soil would be produced[93]. The reclamation of these areas is thought to have started as early as the late-Carolingian period. The counts and the bishops disputed this territory. Not until the last quarter of the 11th century or even the first quarter of the 12th century could the counts of Holland actually devote themselves to the development of the area between the Merwede and the Maas. They did so with fervour, for the areas reclaimed and cultivated during the 12th century were assessed at their true value by the dukes of Brabant and subsequently claimed by them (1200-1282).

It is not impossible that shortly before or after 1100 the counts chose the already existing settlement of *Thuredriht* as the reclamation centre of the area. From earliest times there was a count's court here and its presence may indicate such enterprises by the counts. This does not mean that Dordrecht was originally a stronghold established by the count from which to launch the reclamation activities of this potentially fertile area, as has been suggested[94]. Even though the settlement was situated at the centre of the area to be reclaimed, there is no reason to believe a military force was involved. Jorissen hypothesized that a square military camp measuring 70 by 70 roods existed between the Vuilpoort and the Tolbrug. A separation between north and south was supposed to have been created by the digging of the Voorstraatshaven. By the Pelserbrug (-bridge), a north-south axis would ultimately have divided this square into four quarters, with the north-west quarter not only containing the church, but also a count's *pied-à-terre*. Jorissen dated this phase between 1020 and 1100. It is quite possible that the Westfrisian counts had a *pied-à-terre* or even a stronghold in their Dordrecht, yet it is absolutely impossible that such a stronghold had a regular, square ground plan, divided into quarters. The oldest stronghold of the counts we know of is the *Burcht van Leiden*, the initial phase of which goes back to the beginning of the 11th century[95]. Here we find a round type of fortress, not a square one. Apart from that, report has it that there was a motte, a man-made mound with a wooden tower on top and at the foot possibly a somewhat elevated forecourt or baily. It is puzzling to me how people in the early 11th century were able to create an artificial hill in the middle of a peat bog area. It is therefore unlikely that this was the case in Dordrecht. It is not the period

91 Hendriks 1996b.
92 Contrary to, among others, Renting 1993, 13.
93 Pons in print.
94 *Ibid.*
95 Janssen 1990, 230.

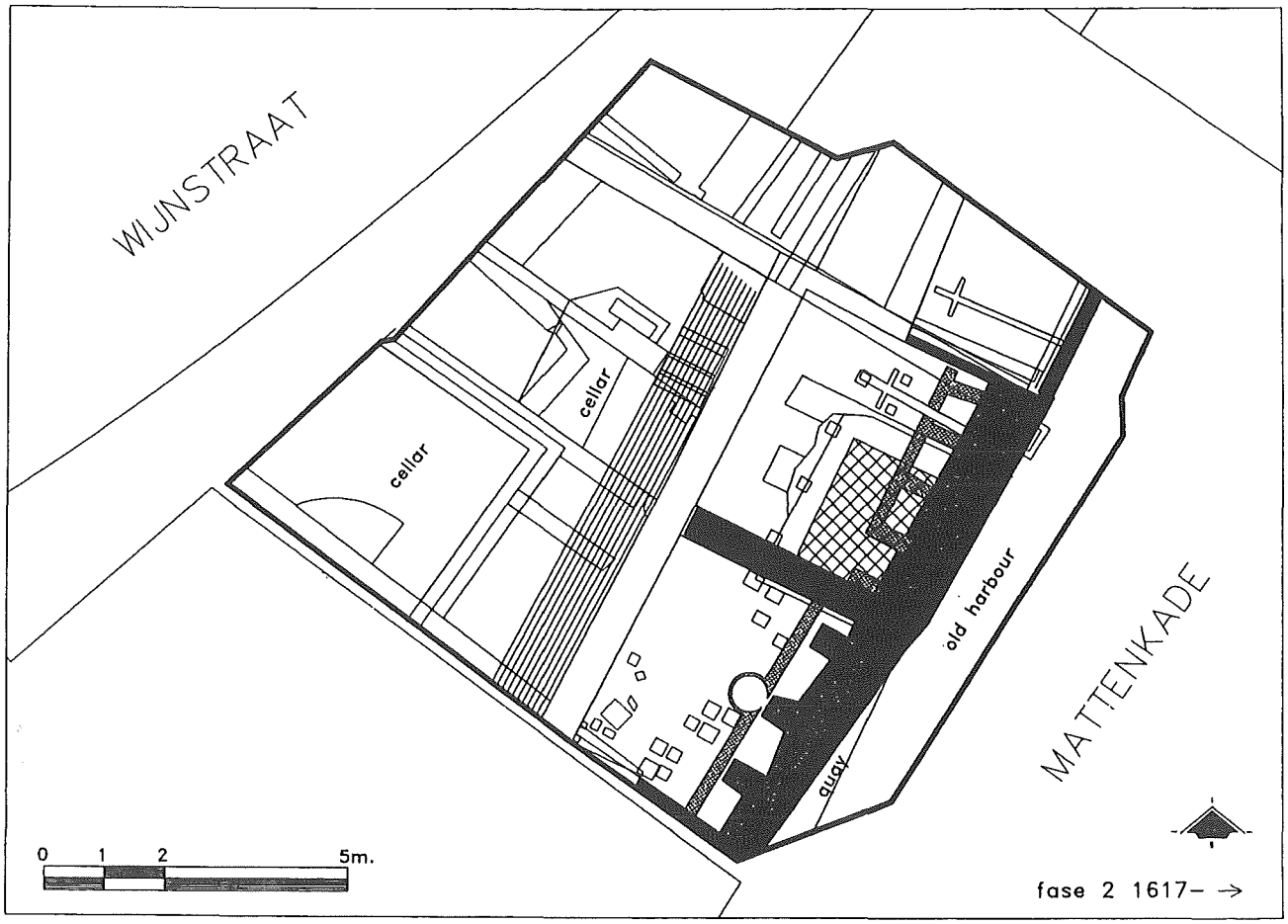

Fig. 7. - *Excavation 'Kop van de Wijnstraat' (October 1995), phase 3 with the backside of the 17th-century quay wall and the transverse walls connecting the old and the new quays, thus forming plots with a width of four metres (Map drawn by Joyce Prins-'t Hart).*

of square strongholds, which strongly reminds us of the lay-out of Roman *castella*. Besides, in Dordrecht not a speck of evidence has been found yet to support this proposition. An archaeological investigation of the former site of the Roman Catholic Hospital (RKZ) could have shed some light on this matter, but unfortunately such an investigation was never carried out.

In my opinion Dordrecht was not established to be a stronghold of the count, but as a settlement along a peat bog creek flowing into the Merwede. The name of this bog creek would not have been Thuredriht but simply Thure. At the earliest, during the last quarter of the 11th century the Westfrisian counts must have had the idea to take the already existing settlement of Thuredrith under their protection and to use it as an operating base, from where the peat bog area could be (further) reclaimed.

It is quite possible that Dordrecht was not situated on a river junction until the last quarter of the 12th century. Pedological research has produced convincing evidence to support the view that the connection between the Merwede and Dubbel occurred around 1170/1180. In those days, the Dubbel was already an important branch of the Maas with various settlements on its banks. I think that the origin of these settlements is similar to that of the original settlement of Dordrecht. Not until the connection between the Merwede and Dubbel had been established did Dordrecht also gain a strategic position as regards commercial trading. In this period, at the end of the 12th century, the count of Holland had already gained a firm foothold in Dordrecht. In those days it would have already become the most important settlement in all South-Holland. That is why the counts would have willingly made every effort to support the further development (of Dordrecht) from settlement to town and to favour it with privileges.

This background may shed an entirely different light on the nature of the water on whose banks the town eventually originated. It is not impossible that this *Thure* was originally a bog stream flowing into the Merwede and not a branch of the Dubbel[96]. At one

[96] Pons in print; Beenhakker 1992.

time the Thure might have been connected to the Vaart in the Zwijndrechtse Waard and thus formed a link between the Devel and the Merwede[97]. A connecting channel between the Dubbel and the Thure would not have been the original situation, but such a channel was dug later on.

Not until the end of the 12th century could the Thure also attain the function of a significant harbour. It is striking that in those days Christian churches were located in the north and the south of the town. Excavations in the Grote Kerk have shown that a church made of tufa stone once stood on the site. One can revert to historical sources to accept such a dating for the Nieuwkerk as well. Artefacts from the 12th century in the vicinity of the Grote Kerk indicate that in this period the settlement actually spread out along both sides of the water. The Nieuwkerk, dedicated to St. Nicholas, (the patron saint of merchants) could be an indication of a trading settlement at the mouth of the Thure. The dug-up 13th-century *'sintels'* lead one to assume that various activities connected with the shipping trade could have been carried out at the mouth of the Thure. If all this was indeed the case, the late 12th-/early 13th-century Dordrecht looked completely different from what Jensma, for example, had in mind[98] Instead of a trading centre, a count's household and a civilian settlement developing side by side, it would rather have been a long ribbon settlement, with its centre based along the Thure.

In the 13th century, Dordrecht must have developed further under the protection of the counts[99]. Here the first brick houses were built, the first in Holland (!)[100]. The prosperity of the town increased enormously when Count Jan I granted the town the staple right in 1299 (the right to levy duty on staple goods). Because of this the old harbour had to be modernized and the first quay-wall must have been built. After the trading activities had been moved to the new outer harbour from the beginning of the 15th century onwards, the capacity of the old harbour was probably no longer necessary. The first major town reconstruction, at the beginning of the 17th century, led to more space being allocated for the building of houses at the entrance of the old harbour. Eventually the entrance of that old harbour was reduced to half its original width.

97 Pons 1994, 18.
98 Jensma 1991.
99 Sarfatij 1996.
100 Sarfatij 1993 and 1994.

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J.P.C.A. Hendriks
Dienst Stadsontwikkeling, afd. Ruimtelijk Beheer
(Town Planning Service, Environmental Planning Department)
Postbus 360
3300 AJ Dordrecht
The Netherlands

Alexander Zanesco

Stadtarchäologie in Hall in Tirol - ein bedeutender Handelsplatz des 14. bis 17. Jahrhunderts

Nord-Süd-Nord gerichteten Kulturströmungen eine natürliche Barriere, erfüllten die Ostalpen als mehr oder weniger eigenständiger Kulturraum seit jeher auch eine Vermittlerfunktion zwischen den angrenzenden Landschaften. Nirgends tritt diese so stark in Erscheinung, wie beim Handel, der seit Jahrtausenden die von der Natur vorgegebenen Wege benützt, um nicht nur Güter und Geld auszutauschen, sondern auch Elemente fremder Lebensformen. So ist denn Tirol nach wie vor Transitland zwischen bedeutenden Wirtschaftsräumen, hat aber heute seine wirtschaftliche Tätigkeit wesentlich weniger als in den vergangenen Jahrhunderten auf diese Situation hin ausgerichtet. Handel, Transport- und Gastgewerbe und alles was damit verbunden gewesen sein mag, haben – neben Bergbau und Landwirtschaft – einen wichtigen Teil seiner Wirtschaftskraft ausgemacht. Die Transitwege folgten den verkehrsgeographisch günstigsten Gebirgstälern, um auf möglichst kurzer Strecke nicht nur die Alpen zu überqueren, sondern auch die dort wichtigsten Handelsplätze und Kreuzungspunkte zu erreichen, so auch die Stadt Hall. Hierbei hatte das mittlere Inntal eine besondere Stellung inne: Während die Ausrichtung der meisten Täler den Nord-Süd-orientierten Verkehrsströmungen zugute kam, bildete im Innsbrucker Becken der Ost-West fließende Inn ein nur mittels Fähren oder aufwendigen Brückenbauten zu überwindendes Hindernis. Schon 46/47 n.Chr. wurde die später so genannte "obere Straße" (Etschtal - Vinschgau - Reschenpaß - Landeck - Imst - Fernpaß - Reutte - Füssen - Augsburg), damals "*via claudia augusta*", als Staatsstraße ausgebaut und war der römischen Besatzungsmacht offenbar wichtiger als die Route über den Brenner („untere Straße", Bozen - Brenner - Innsbruck - Zirl - Mittenwald - Augsburg), die wohl erst in der zweiten Hälfte des 2. Jh. zur *via publica* erhoben wurde und im 3. Jh. den Großteil des Nord-Süd-Verkehrs über die Alpen an sich zog[1]. Jetzt mag sich schon die besondere Funktion des späteren Innsbruck (oder der näheren Umgebung) eben als Brückenort am Inn und Kreuzungspunkt zwischen Nord, Süd, West und Ost bemerkbar machen, denn hier teilten sich die Verkehrsströme nach allen Richtungen. Für deutsche Könige und Kaiser war diese Verbindung über die Alpen von entscheidender Bedeutung zur Durchsetzung ihrer Italienpolitik. Im 14. Jh. wurde jedoch das nur wenige Kilometer flußabwärts gelegene Hall zur zentralen Handelsstadt im nördlichen Tirol und behielt seine Bedeutung bis in das 17. Jh. hinein. Die Gründe für diese Entwicklung werden vielschichtig gewesen sein, aber es lassen sich einige wichtige Punkte herausstellen:

Seine besondere verkehrsgeographische Lage war – wie im Falle Innsbrucks – gegeben durch die Kreuzungssituation von Inn und Brennerroute. Der Transport von Massengütern (und Personen) erfolgte wesentlich kostengünstiger (und schneller, je nach Bestimmungsort) auf dem Wasserweg durch das Unterinntal als auf dem Landweg. Der Inn erhält unterhalb Innsbrucks einen deutlichen Zuwachs an Wassermenge durch den Zufluß der Sill, wodurch er leichter schiffbar war. In der Nähe des heutigen Hall i.T. wurde spätestens im 13. Jh. Salz gewonnen und in der landesfürstlichen Saline verarbeitet[2]. Die für das Sudhaus erforderlichen großen Mengen an Brennholz wurden auf dem Inn herabgetriftet,

[1] P.W. HAIDER, Antike und frühes Mittelalter, in: Fontana u.a. 1990, 161-167.

[2] Haller Salz wurde außerhalb des tirolischen Eigenbedarfs hauptsächlich nach Schwaben und in die Schweiz exportiert. Vgl. z.B. Gritsch 1987, 56. - Die Anfangs des 16. Jahrhunderts zu Tirol geschlagenen Gerichte Rattenberg, Kufstein und Kitzbühel wurden dem Haller Salz erst Mitte des 18. Jh. erschlossen. F. MATHIS, Struktur und Entwicklung der bayerisch-tirolischen Wirtschaftsbeziehungen vom Frühmittelalter bis zur Gegenwart, in: *Bayerisch-tirolische G,schichten ... eine Nachbarschaft. Tiroler Landesausstellung 1993*, Bd. 2, Innsbruck, 1993, 191. - Neben der „Salzschiffahrt" den Inn aufwärts bis Telfs dienten dafür die Straßen durch das Oberinntal, über das Mieminger Plateau, den Fernpaß und den Brenner. Vgl. z.B. Stolz 1932, 98, 102.

weshalb man 1307[3] quer über den Fluß einen Rechen erbaute, um es abzufangen. Hall wurde durch dieses Hindernis zur Kopfstation der Innschiffahrt. Der Landverkehr von und nach dem Brenner benutzte die östliche Seite des Silltales – unter Umgehung von Innsbruck. Diese "Ellbögener Straße" wurde, neben der westlichen Trasse, die bereits durch römische Meilensteine belegt ist[4], spätestens ab dem 14. bis gegen Ende des 18. Jh. viel befahren[5]. Hall (ab 1303 Stadt und Brückenort) wurde von den Tiroler Landesfürsten, primär wohl aufgrund der Salzproduktion, mit zahlreichen gewichtigen Privilegien[6] ausgestattet, die sie in der Folge zur größten Handelsmetropole des nördlichen Tirol werden ließen. Die Haller Bürger verstanden es, ihre wirtschaftliche Macht mit viel Verhandlungsgeschick – und politisch/militärischem Engagement für den Landesfürsten – für den weiteren Ausbau ihrer Rechte und Möglichkeiten zu nützen. Mit dem Abbau des Schwazer Silbers im 15./16. Jh. wurde die Münzstätte der Tiroler Herrscher nach Hall verlegt. Ab 1356 konnten zweimal jährlich freie Jahrmärkte von je acht Tagen abgehalten werden. Neben den Bozner Jahrmärkten waren sie die bedeutendsten in Tirol. Ihre Hauptfunktion lag in der regionalen Verteilung der von weit herbeitransportierten Güter. Die Internationalität war insbesondere durch süddeutsche Händler gegeben[7], deren Aktionsradius teilweise noch weit größer war[8]. Besonders die Städte Augsburg, Nürnberg, Regensburg und München waren stark vertreten. Die Stadt war hierbei vor allem Vermittler zwischen Süddeutschland und Tirol[9]. Die schriftlichen Quellen geben Auskunft über eine Vielzahl von Gütern, die auf den Jahrmärkten verhandelt wurden. Wichtig war Hall für den Handel von Wein, Stoffen, Gewürzen, Büchern, Vieh (bes. ab 1648), Handwerksgütern und Luxuswaren, um nur einige Beispiele zu nennen. Wie vollständig und detailliert die Liste ist, sowohl in Bezug auf die Waren selbst als auch auf die damit aufzeigbaren Handelsverbindungen, läßt sich nicht endgültig entscheiden. Durch die kürzlich und hoffentlich auch in Zukunft durchgeführten archäologischen Untersuchungen im Altstadtbereich und den daraus gewonnenen Funden besteht aber die Möglichkeit, sie zu ergänzen bzw. zu konkretisieren. Den wichtigsten Beitrag leisten sie aber sicherlich für die Siedlungsgeschichte. Wie die schriftliche Überlieferung wird auch die archäologische durch verschiedene Mechanismen selektiert. Nicht alle menschlichen Alltagsreste und – gegenstände gelangten in den Boden, nur weniges davon blieb dort bis auf den heutigen Tag erhalten und noch viel weniger wurde archäologisch untersucht. Die meisten der oben angeführten Gruppen von Waren sind im Boden nur mit viel Glück und/oder großem technischen Einsatz (bzw. finanziellen) nachweisbar.

Hall liegt auf einem Schwemmkegel des vom nördlich gelegenen Karwendelgebirge herabfließenden Baches aus dem Halltal. Der Inn hat diesen Fächer im Laufe der Jahrtausende bearbeitet und eine deutliche Geländestufe erzeugt, die die Stadt in eine obere und untere teilt. Im Jahre 1996 wurden zwei Ausgrabungen im Altstadtbereich durchgeführt, je eine in der Ober- und Unterstadt. Eine Untersuchung im Hinterhof des Hauses Mustergasse 11 (Oberstadt) erbrachte erstmals eine deutliche Stratigraphie, die für weitere Grabungen wichtige Anhaltspunkte geben wird[10]. Unter etwa einen Meter starken Auffüllschichten mit Bauschutt – und zahlreichen auswertbaren Funden –, die mit Hilfe von Mörtelabrissen an einem "Erdbebenpfeiler"[11] zu differenzieren sind, wurde eine bis zu 30 cm starke Brandschuttschicht freigelegt. Nach der genaueren Auswertung der Funde ergibt sich vielleicht die Möglichkeit, diese Schicht mit dem großen Stadtbrand von 1447 zu verknüpfen[12]. Darunter anschließend wurde unter einer schwach ausgeprägten Kulturschicht Flußschotter angetroffen und abermals ein Paket von Kulturschichten, die in das 13. bis 14. Jh. gehören. Innerhalb der Grabungsfläche konnte auch ein Entsorgungs(?)graben untersucht werden, der entlang einer

[3] H. HOCHENEGG, Abriß der Stadtgeschichte, in: *Stadtbuch Hall in Tirol*, Innsbruck, 1981, 9. - Das Datum wäre archäologisch zu überprüfen.

[4] Haider (Anm. 1) 165, Taf. XV. - Es gibt noch keine archäologischen Belege für eine antike oder ältere Nutzung der „Ellbögener Straße". Vgl. Pöll 1995, 56-63.

[5] Die Straße auf der linken Talseite nach Innsbruck wurde erst gegen Ende des 16. Jh. verstärkt als Transitstrecke benutzt. Vgl. Gritsch (Anm. 2) 59-60.

[6] Z.B. Niederlagsrecht (1303), freie Jahrmärkte (1356), Zollfreiheit in Schärding, Neuburg am Inn, Linz, Stein und Krems (1363 bis 1372), Zolleinnahmen von Innsbruck und Hall (1372), Handelsprivileg in Steiermark, Kärnten, Krain, Bruck a.M. (1421), Stapelrecht für Getreide (1452).

[7] Im Gegensatz zu Bozen waren italienische Kaufleute (im 15. Jh.) kaum zugegen. Vgl. Noflatscher-Posch 1992, 28.

[8] Die Orte der Tätigkeit des Augsburger Händlers Joachim Jennisch im 16. Jh. waren neben Hall: Grafschaft Tirol, Bistümer Brixen und Trient, Frankfurt, Nürnberg, Venedig, Köln und Antwerpen. Ebd. 52.

[9] Ebd. 48. Marktfieranten aus der Zeit von 1500 bis 1700 kamen weiters aus Franken, Friaul, Sachsen, Salzburg, Savoyen, Schwaben, Steiermark und Thüringen: ebd. 150.

[10] Der Anlaß der Untersuchung waren geplante Umbaumaßnahmen im Hofbereich.

[11] Es ist bekann, daß nach dem Erdbeben von 1670 zahlreiche Haller Häuser nachträglich mit solchen Stützpfeilern oder -mauern abgesichert wurden. Vgl. Moser 1989, 45.

bereits in den darüber liegenden Schichten durch Pfostenlöcher gekennzeichneten Linie verlief. Möglicherweise wurde hier eine mittelalterliche Parzellengrenze dokumentiert, die ihre Bedeutung nach dem Stadtbrand von 1447 verloren hat. Eine wesentlich umfangreichere Untersuchung erfolgte im Bereich des am Unteren Stadtplatz gelegenen ehemaligen Gasthauses "Goldener Engel", dessen südliche Außenmauer einen Teil der Stadtmauer bildet. Das Gebäude wurde durch das Bundesdenkmalamt bauanalytisch untersucht und im Vorfeld der Generalsanierung durch Ausgrabungen an insgesamt vier ausgewählten Stellen auch untertägig erforscht. Nach den Ergebnissen der Bauforschung stammt der älteste Teil aus dem 14. Jh. Wichtige Ausbauphasen erfolgten im 15. bis 16. Jh. Zwei Schnitte wurden außerhalb des Hauses senkrecht zur Stadtmauer eingetieft. Der erste, 2 x 8m groß und letztlich über 4m tief, sollte Fragen nach der ehemaligen Stadtbefestigung beantworten (der zweite Schnitt wurde nur maschinell durchgeführt und diente der Festlegung des weiteren Verlaufs einer Zwingermauer). Es stellte sich heraus, daß in diesem Bereich, entgegen allen Vermutungen kein Stadtgraben bestand. Möglicherweise war das Gelände hier so sumpfig, daß die Errichtung einer Zwingermauer vor der (älteren) Stadtmauer einen ausreichenden Schutz bot. Nach Norden anschließend wurde der Schnitt im romanischen Keller fortgeführt. U.a. war die Frage zu klären, ab wann es möglich war, an die Stadtmauer anzubauen. Es zeigten sich mehrere Bodenniveaus, die durch Aufschüttungen mit Bauschutt o.ä., Steinrollierungen, Estrich und Einschwemmungen entstanden und teilweise mit Münzen zu datieren sind. Die Stadtmauer wurde knapp über der Fundamentunterkante von einer Kulturschicht direkt berührt. Diese Schicht läuft jedoch unter einem parallel zur Stadtmauer, etwa 1,5 - 2m nördlich derselben errichteten Blockbaues durch, in den später jene Mauer gesetzt wurde, die mit der Überbauung des Freiraums zwischen dem damaligen Gebäude und der Stadtmauer errichtet worden ist. Falls es gelingt, diesen Holzbau dendrochronologisch zu datieren, kann damit auch ein Datum für die Stadtmauer und den Anbau an dieselbe gewonnen werden. Auf diese Weise wären wichtige und umstrittene historische Fragen zu klären.

Eine weitere Grabungsfläche wurde in einem ehemaligen Hinterhof eröffnet und ergab eine ummauerte und ehemals überwölbte Latrine aus der Zeit um 1500. Aus der Verfüllung konnten u.a. zahlreiche Glas- und Keramikfunde geborgen werden sowie die Reste eines doppelten Toiletten-Sitzbrettes wie es von Abbildungen dieser Zeit bekannt ist[13]. Diese Funde geben einige Hinweise auf die Handelstätigkeit der Haller Bürger. Bisher konnte u.a. "Mährisches Steinzeug" (Loschitzer Becher), "Siegburger Steinzeug" (oder Umgebung) und Passauer Graphittonkeramik identifiziert werden und nach Abschluß der Arbeiten wird sich ein wesentlich größeres Spektrum ergeben. Gläser vor 1534 etwa stammen nicht aus Hall selbst, Perlmutt weist auf weite Transportwege und botanische wie zoologische Untersuchungen des Latrineninhalts könnten Hinweise auf Ernährungsgewohnheiten und eingehandelte Nahrungs- und Gewürzmittel geben.

Falls auch in der Zukunft eine archäologische Betreuung der Stadt Hall i.T. möglich ist, könnte nicht nur ein für die Wirtschaftsgeschichte Europas wichtiger Ort weiterhin genauer untersucht werden. Das Bild von der Entwicklung einer Stadt und der städtischen Alltagskultur in Tirol würde dadurch sicherlich entscheidend bereichert werden.

[12] Ebd. 27-30.

[13] Z.B. aus der „Wickiana" um 1564, Zentralbibliothek Zürich. Vgl. Illi 1987, Umschlagbild.

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Alexander Zanesco
Institut für Ur- und Frühgeschichte
Leopold-Franzens Universität Innsbruck
Innrain 52
6020 Innsbruck
Österreich

K.A.C. Depuydt & Karina H. van Dalen-Oskam

Archaeology and Lexicography

There are basically two ways to get to know something about reality: through images and through words. When Jacob van Maerlant translated Thomas of Cantimpré's *De Natura Rerum* into Medieval Dutch, he did not only describe humans, animals, plants and stones that were very familiar to him, but also (usually) very exotic species he had never seen or heard of before. We can safely make this assumption because whenever possible, Maerlant gives the Medieval Dutch equivalent of the species he translates and he does not always do that. He sometimes even adds information from personal experience. The unfamiliarity with certain plants and animals becomes also apparent when we look at the illustrations that are present in a number of manuscripts of *Der naturen bloeme*. Take for instance the animal *monachus maris*: based on our knowledge now, we can identify the animal as being a monk seal, the description in the 13th-century text however lead illustrators to believe it was a kind of fish with a monk's head. As editors of the *Vroegmiddelnederlands Woordenboek* (Dictionary of Early Middle Dutch [1200-1301]),[1] of which *Der naturen bloeme* is part of the source material, we often find ourselves in the same predicament, meaning we sometimes have to describe words referring to objects we do not have a clue as to what they will have looked like. We can imagine archaeologists having experienced the opposite, namely discovering objects without knowing their name. What happens when an archaeologist tries to find back the name of an object in texts and uses a dictionary to check the definitions of a particular word he suspects to be related to the object? If through lack of knowledge of the lexicographer those words in the dictionary are not adequately described, word and object might never meet.

[1] For a more detailed description of the project, we would like to refer to the *Forschungsbericht* that will appear in a volume on dictionaries of medieval languages in *Dictionaries of Medieval Languages*, to be published by Brepols in 1997.
The *Vroegmiddelnederlands Woordenboek* is a scientific, diachronic period-dictionary, based on a closed corpus of early Middle Dutch texts written between 1200 and 1301 and passed down in 13th century manuscripts.
Approximately 1.650.000 tokens will eventually be described in ca. 28.000 entries. The majority of the texts have been edited diplomatically by M. Gysseling. They were published between 1977 and 1987 in the two series of the *Corpus van Middelnederlandse teksten (tot en met het jaar 1300)* (Corpus of Early Middle Dutch Texts up to and including the year 1300), with word indexes to the texts. The first series contains 9 volumes with official documents, such as charters, guidelines, testaments etc. and the second series 6 volumes with literary texts and a few artes texts. To Gysseling's material a couple of already published texts have been added, like the *Glossarium Bernense*, an early-13th-century glossary and the *Diatessaron Leodiense*.
The 13th-century Dutch-speaking area differs slightly from the present-day Dutch-speaking area, which is the Netherlands and Flanders (Belgium). Medieval Dutch was spoken in the Dutch provinces of North- and South-Holland, Utrecht, Sealand, parts of Guelderland, the Lower Rhine area (Cleves and surroundings; partly belonging to Germany now), Limburg (now divided between The Netherlands and Belgium; without the extreme south-eastern part where the language was Middle High German), Brabant and Flanders (now divided between The Netherlands, Belgium and France). In the Lower Rhine Dutch was spoken until the middle of the last century, in some parts of French Flanders (e.g. Dunkirk) until the first half of this century. Not included are the Frisian-speaking areas in The Netherlands (now the province of Friesland) and the Middle Low German-speaking areas in The Netherlands (now Groningen, Drente, Overijsel, parts of Guelderland).
The dictionary is scheduled to be available in the year 2000 and will only be published when the description of the entire material is completed, which gives us plenty of time to elaborately consult specialists in various domains of research to improve or correct our findings.
The *Vroegmiddelnederlands Woordenboek* will be published both in print and on CD-ROM. Meanwhile, it is already possible to consult the dictionary in progress, since finished articles have already been printed in preliminary issues (some 22.000 in total on december the 31st, 1996) and are stored in a database. The source material is also stored in a database providing elaborate retrieval possibilities. The editors do not work in strict alphabetical order but more or less thematically, whenever possible, so none of the letters of the alphabet have already been completed.

We are convinced that in a dictionary based on 13th century material there is far more need for social and historical background information than the existing Dutch historical dictionaries have provided up to now. The described period is so far away from the present that a substantial amount of ordinary words and also specialist terminolgy is now out of use. We aim for our dictionary to provide enough information for any user to be able to have full understanding of the text(s) he or she is reading without having to consult further reference works.

Since publication of the dictionary will only take place after the description of the entire material is completed, there is a lot of room for extensive consultation with specialists whenever the editors feel they need to improve or correct their findings. It goes without saying that to be able to give accurate definitions of more technical vocabulary, specialist help is more than once necessary.

What could archaeologists mean to us? To illustrate what we are up against, I would like to present you three entries related to ships, each posing their problems.

The first entry is *"kiel"*, which occurs three times in our literary material and is now defined as "certain large boat", a definition we would like to be more accurate. The citations however talk about people being tied and kept prisoner in a 'kiel'. We would like to know from archaeologists whether in the 13th century, there were also ships without a keel. *Kiel* might have been a name, used for ships in general but it might also have referred to a type of ship in particular.

kiel znw.m.

groot schip [3]

(kiel 1e art.) 0/0/3 Wbra 1291-1300. kiel(e); *ds.*
I 1. Kiel, bep. groot schip. ½ Gi selt uwe*n* kimpe*n* late*n* stae*n* Gebonde*n* in den kiele, *Wiss. 534,17-18 (Wbra 1291-1300).* doe was gernout bedacht en*de* sprac vele sciere je hebbe sier bruder viere Gebonden inden kiele, *Wiss. 534,33-36 (Wbra 1291-1300).*

The second entry, *"iever"*, is slightly more complicated. Unlike the first entry, we are not a 100 % certain that the entry has the right form. We interprete the forms *yeuere* and *yuere* in the Dordrecht accounts as a dialectal variant in Holland of the word *ever*, which we believe to be a type of freighter, but we are not able to be more specific. We base our assumption mainly on the first citation we translate as "Idem (paid) for the 'ever' that brought the fish up here, 7 shillings". Burgers and Dijkhof however[2] suggest an interpretation 'work, workers', with a questionmark. We do not find this very convincing. We need archaeologists – maybe with ship types as their speciality? – to hopefully confirm our interpretation, but also to help us to give a more accurate definition. What kind of freighter was used in Dordrecht around 1286? Were there more types and was there a particular type of freighter used for the transportation of fish?

iever znw.m./o.

ever (bep. vrachtschip) [2]

(ever znw.m.) 0/2/0 Dordrecht 1286. y(e)uere; *ds. Wsch. hetz. als* ever *(MNW II, 755) 'bep. vrachtschip' met Hollands* -ie- *voor* -e- *(Van Loey II, §48c,3).*
I 1. Ever, bep. vrachtschip. ½ *(In een rekening:)* Jt*em* vanden yue*r*e die vorde van hene den visch op wart vii sol, *Corp.I 1178,30 (Dordrecht 1286). (In een rekening:)* Jtem hauix *(of:* hanix*)* sone xv sol van sire hure die die spyse vorde Jt*em* vanden brode dat men ghescep hadde en*de* wijn bijr vlech tedraghene xx d Jt*em* lone van sine*n* yeue*r*e iij sol Jt*em* ene*n* cnape xv d die met hem soude gheuaren hebben, *Corp.I 1183,13-17 (Dordrecht 1286).*

The third entry, *"bon(ne)"* is even more obscure. There is one attestation saying "Idem for two 'bonne' and a peddle 10 pennies sterling". We are in serious doubt as to whether to interprete the word as Medieval Dutch *bonne*, meaning 'stall' or as Medieval Dutch *boene* 'a type of small closet, corf (on a ship)'. Burgers and Dijkhof[3] suggest yet another interpretation – with questionmark –, namely another Medieval Dutch word *bonne* 'a kind of stopper for barrels'. Once again for the lexicographer there is that sigh for illustrated accounts, or maybe even better a time-travelling machine, since illustrations were not always flawless, as we hope to have illustrated in the beginning of this paper. It is an understatement to say it would be nice to know what word (object) was attested here, since for potential researchers, it would mean evidence for the existence of one word or the other.

[2] *De oudste stadsrekeningen van Dordrecht 1283-1287*, edited by J.W.J. BURGERS & E.C. DIJKHOF, Apparaat voor de geschiedenis van Holland 11, Hilversum, 1995 (indices p. 102).
[3] *Op.cit.*, indices p. 98.

bon(ne) znw.

kraam(?); bun(?) [1]

(bonne) 0/1/0 Dordrecht 1285. bonnen; *dp.*
I 1. Kraam(?); bun(?). *Het is niet duidelijk welk woord bedoeld is; Mnl.* bonne *betekent (markt) kraam, Mnl.* boene, bonne, bunne *betekent 'kastje, bun (op een schip)'; andere betekenissen zijn echter niet uitgesloten.* ½ Jtem van spade ysere .viij. sol ende Jtem van tveen bonnen ende ene ryeme x d sterlinc, *Corp.I 1020,3-4 (Dordrecht 1285).*

To resolve the above mentioned problems, we decided to go to Ketelhaven, to the *Centrum voor Scheepsarcheologie* (centre for marine archaeology) to see whether someone there could help us any further. Unfortunately, they could not resolve the three above mentioned cases – which is why we are presenting them here – but we received some useful suggestions as to the interpretation of some other cases.

It was, for instance, through finding out that moss was used as a caulking method for ships that we understood what the verb *tinghelen* must have referred to in the material described here below: 'caulking the seams of sluices and of wooden quaysides', usually by using moss. This was something we could not solely derive from the context since it only gives a description of material (wood and moss) used for *tinghelen* and the object undergoing the *tinghelen.*

tinghelen zw.ww.intr.

opvullen [13]

0/13/0 Brugge? 1286. tingelen; *inf.* tingelen; *gerund.* tinghelne *(eenmaal met proclise van het vz.* te*)*; *part.perf.* ghetingelt. *Wsch. denominatief van een (niet overgeleverd) znw.* tenghel, tinghel *'verbindingslat' (vgl. MNW VII, 239 s.v.* tengenagel*).*
I 1. Opvullen van naden tussen planken bij sluizen en houten walkanten. *Alleen aangetroffen in drie rekeningen van de Watering van Blankenberge.* ½ de lingno propter tingelen (...) *(aan hout om (naden) op te vullen...), Corp.I 1115,12 (Brugge? 1286).* item van zaghene balken dar mede ghetingelt was xiii lib, *Corp.I 1115,20 (Brugge? 1286).* Van outghanc ende hoest tote medewinter ande statbome tetinghelne ende .ij. varssche dueren te makene Contra. wilsin. snacgard vij^{c}. barde mede te tinghelne .C. iiij lib somma xxviij. lib, *Corp.I 2397,25-28 (Brugge 1297).* Jtem .ccc.lxxv. mos dat was ibeseght ter sluis mede te tinghelne pro hondert xx d summe. vi iii d, *Corp.I 2499,17-18 (Brugge 1298).*

Mr. K. Vlierman also made a suggestion to us concerning the word combination *enen hondert borde* as found in the examples cited below, one of which says "Idem (paid to) Arnout de Vries for 'enen hondert borde', 3,5 pounds" In his opinion it could be a kind of raft, made of a hundred beams or boards, a way in which, in the beginning of the 20th century, wood was transported from Germany to Holland (Dordrecht). Burgers and Dijkhof [4] suggest – with questionmark – that it could be a wooden part of a cog. Up to now we have assumed it should be read as "an amount of 100 boards". What is the correct interpretation or at least the safest assumption?

Jtem arnoude den vriesen van enen hondert borde *(m.b.t. een honderdtal planken)* iii½ lb Jtem willame elseneghods, ii½, lb van enen hondert borde Jtem heren janne putocke van, dertich, poste x , *Corp.I 1157,26-28 (Dordrecht 1286).*

Like we mentioned in our introduction, we do not think that a high degree of accuracy only serves the general public using our dictionary. Experience has already proven the expertise of the lexicographer to be useful for specialists as well, even archaeologists. An example is the word *sintelnaghele* which is correctly analysed as *sintel* derived from a verb *sintelen* 'to caulk' and *naghele* 'nail' and not as *sintel* 'type of nail' and *naghele* derived from a verb *to nail.* The correct analysis offered the archaeologist more certainty to identify it as a kind of clamp. Since we could also provide an attestation with date, the word could be connected to the corresponding object which resulted in its turn to be more accurately dated.

Up to now, our contact with archaeologists has been rather limited and was a result from our own initiative. We suspect that so far our dictionary project was not generally known among archaeologists. We would therefore like to thank Mr. K. Vlierman who asked us to take part in this session so as to enable us to present ourselves, and our problems. We believe that besides Mr. Vlierman, there are still other archaeologists specialised in other domains that could help us. But up to now, we have found no efficient way to get in touch with the right people or to get hold of the most suitable reference works.

[4] *Op.cit.*, indices p. 101.

We are not only convinced that we can improve our own work, but we also believe we have something to offer to the archaeologist, since only a combination of word and image (object) provides a complete "picture". Our experience is that people generally expect the dictionary to provide all answers. They sometimes forget that a lexicographer needs to be a *homo universalis*, something that in this day and age he cannot even attempt to become without the help of specialists. Appropriate aid from specialists is also a guarantee for the quality of the dictionary we hope they eventually will use to their satisfaction.

Appendix

Here are some other entries which we believe could be rendered more accurate with the help of specialists. We added a translation in English of some of the attestations in the entry.

"Slovelinc" is now defined as "probably a type of beam (in bridges of sluices)". We would like a more accurate definition.

slovelinc znw.m.

bep. balk [2]

0/2/0 Brugge 1297. slouelinghe(n); *dp* -linghen; *ap* -linghe. *Van het znw.* slove *'bindbalk, gording' met het suffix* -(e)linc *(vgl. ook* sloving *'dekbalk, sloof' (WNT XIV, 1925)).*
I 1. Wsch. bep. balk (in bruggen of sluizen). ½ Jtem. ii. saghen van den ouden slouelinghen te saghene ende die ghebesecht waren te somighen van. desen voerseiden brucghen iiij dies pro die vi s somma xxiiij s *(Idem two saws used to saw the old 'slouelinghen' and that were used for some of the above mentioned bridges, four days, 6 shillings a day, in total 24 shillings), Corp.I 2396,39-41 (Brugge 1297).* van. der. sluis te. boetene oude. slouelinghe of. te doene en*de* niewe der up te doene En*de*. dit. hout. was ghenomen van. den balken die daer bouen laghen upten dijch, *Corp.I 2397,11-13 (Brugge 1297).*

The first definition of the entry *"Ghewat"* now says "canal, leat". Here also, we would like to be able to be more specific.

ghewat znw.o.

gracht; rivier; voorde [5]

(gewat) 0/3/2 Wvla 1285. (t)g(h)ewat *(1x met procl. lidw.),* ywad- *(met Wvla* i- *voor* ghe-*);* *ds* -wade; *as* -wat. *Deverbatief van de stam van het ww.* waden *'waden; vloeien' met het prefix* ghe-.
I 1. (Sluisb.) **Gracht, watering, wetering.** *Vgl. Stallaert I, p. 512-513 s.v.* gewat. ½ *(In een rekening van de Watering van Blankenberge:)* van xlij r*oeden* lands daer of. dat. ghewat was. imaect pro r*oede* somma iiij lb iiij s, *(for 42 rood of land whereof 'ghewat' was made, in total 4 pounds, 4 shillings) Corp.I 2401,13-14 (Brugge 1297).*
2. Rivier, beek. ½ *(Babilon moest vallen,)* Want dor den mur liep die effrate. Eene grote flume vt*er*mate. Die ondal *(l.* ondalf*)* cirus in andren beken. Dat so els waer es ghestreken. So dat hi tghewat maecte ondiep. Dat dor babilonien liep. *(vervolg: en daarna de stad gemakkelijk kon binnentrekken.), Rijmb. 401,42-402, 5 (Wvla 1285).* Alse Ihesus dese wart gesproken hadde, so ghinc hi met sinen ijongren in een dorp, dat hit Gethsemani, ouer dat gewat dat heett Cedron. *Diat. 246,33-35 (Wbra 1291-1300).*
3. Doorwaadbare plaats, voorde. *Mog. ook meer bep.: oversteekplaats, veer (vgl. MNW II, 1870)?*½ *(Wij, schepenen van het Sijseelse, oorkonden)* dat cam vor ons. ionvrouwe agniete meestericghe vanden wijngaerde. ende heschede enen hofwech streckende van haren ywade suudwaerd vte toter viestrate. ouer heine .f. maben lant. (...), *Corp.I 2409,34-37 (Brugge 1297). (In een renteboek:)* Jtem .i. line. en*de* .xciii½ R. die ghecocht waren ieghen boudine hoeuenaghel. die lighen hupt ghewat. *Corp.I 2856,30-32 (Maldegem 1301-1310).*

As far as the entry *"Hantboom"* is concerned, we would like to know how this "supporting beam, used in the lower part of a sluice" exactly looked like, so to be able to explain the first part of the noun 'hant-' (hand).

hantboom znw.m.

draagbalk [5]

(hantboom) 0/5/0 Brugge? 1286. handbomen; *dp* -bomen; *ap* -bomen. *Uit het znw.* hant *'id.' en het znw.* boom *'steunbalk'; het eerste lid geeft wellicht aan dat de uiteinden van deze balken zodanig gevormd waren dat ze ergens in konden grijpen/vallen (vgl. WNT V, 1855 sub* hand *III, 1 en 3). Alleen aangetroffen in drie oorkonden uit Wvla (Brugge) met rekeningen van de Watering van Blankenberge.*
I 1. (Sluisb.) **(Houten) draagbalk, gebruikt in het**

onderste deel van een sluis. ½ .vi. houte te handbomen .vi. / .xv. houte. mede te vangene den stetbom iii lib xv , *Corp.I 1114,13-14 (Brugge? 1286)*. en*de*. dit. vors*eide* hout. was ibesecht. onder te. windase en*de*. heien of te makene en*de* stellinc. hout of te makene en*de* handbomen. of. te makene en*de*. in. darde te. legghene voer. de pile *(and that wood was used .... to make supporting beams to be put into the earth in front of the piles)*, *Corp.I 2400,13-16 (Brugge 1297)*.

- *Eenmaal is sprake van een ijzeren* hantboom. ½ J*tem* handwerclieden die den timm*er*mans holpen die hoelebrucghen breken .vi. man dachwerc pro die xii d s*umme* vi / J*tem* vanden iserinen handbomen die sie hadden costen te v*er*makene xvii½ d, *Corp.I 2500,43-46 (Brugge 1298)*.

K.A.C. Depuydt
K.H. van Dalen-Oskam
Instituut voor Nederlandse Lexicologie
Postbus 9515
NL-2300 RA Leiden
The Netherlands

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