DORESTAD AND ITS NETWORKS

Communities, Contact and Conflict in Early Medieval Europe

edited by
Annemarieke Willemsen & Hanneke Kik

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PAPERS ON ARCHAEOLOGY OF THE LEIDEN MUSEUM OF ANTIQUITIES

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Proceedings of the Third 'Dorestad Congress' held at the National Museum of Antiquities, Leiden, the Netherlands, 12-15 June, 2019

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Gaming set for Hnefatafl from Dorestad. RMO Leiden inv.no. WD72 371.3.1. Photo: RMO.

Dorestad and its networks

An introduction

Annemarieke Willemsen, congress director

The 2019 Congress 'Dorestad and its Networks' (Figure 1) in the National Museum of Antiquities in Leiden was the third in a quinquennial series, after 'Dorestad in a international Framework' in 2009 and 'Golden Middle Ages in Europe' in 2014, of which the proceedings were published in 2010 and 2015.[1] This Third Dorestad Congress coincided with the fiftieth birthday of finding the famous Dorestad brooch in July 1969 (Figure 2), and with what would have been the hundredth birthday of prof.dr. Ina Isings, who sadly passed away in 2018. For the latter reason, a special congress session devoted to early medieval glass was dedicated to her.

Dorestad and Vikings

The keynote lecture, presented by prof.dr. Dagfinn Skre, professor of Iron Age and Viking Age Archaeology at the Museum of Cultural History of the University of Oslo, dealt with 'The Beginning of the Viking Age in the West'. Recent provenancing of whetstones from Ribe, that were not items of luxury or gift exchange, makes them a suitable proxy for trade in other communities. The long distance trading of these whetstones from the late eighth century AD was made possible by the rise of royal power in Scandinavia. His recent excavations in Avaldsnes (Norway)[2] revealed one of the bases of these 'sea kings'. Only in the coastal and sea king areas, insular loot and trade goods are found already from the 790s. This coincides with Viking raids across the North Sea. Skre proposes that those who were not part of this trade, began preying on these ships, but could be held back because of the sea kings' cooperation. The Vikings then started looking for other hunting grounds, for instance near the British Isles. But on return, they could be punished by those in power. When from c.835 trade from Scandinavia focused more on the Baltic area, there was more room for Viking activity in the North Sea area. This made attacks on the large, defended towns of Francia possible, like those on Dorestad. Wintering on the continent had the advantage that the Vikings stayed out of reach of the Scandinavian kings and their possible punishment.[3]

In this lecture, as in the paper by Christian Cooijmans, we were reminded again that there is no such thing as '*the* Vikings', but rather all kinds of groups of Vikings, with

Opposite page: Badorf ware sherds from Dorestad. RMO Leiden, box 9101. Photo: RMO.

1 Willemsen and Kik 2010; Willemsen and Kik 2015.
2 Skre *et al.* 2018.
3 Skre 2018.

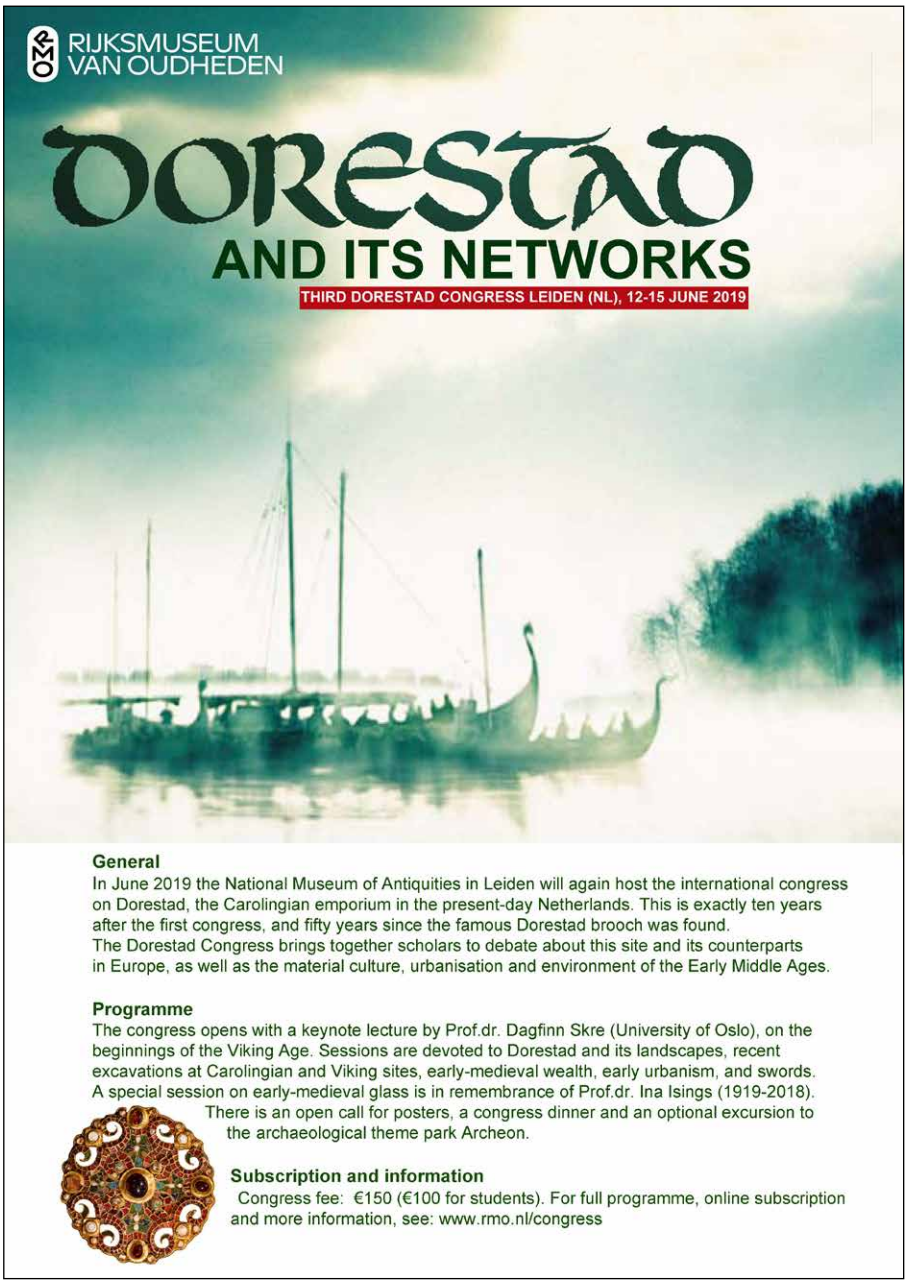

Figure 1. Congress Poster 2019.

various backgrounds, social bonds, aims, tactics and destinations. Dagfinn Skre stressed that these Vikings and their *modus operandi* were exceptional in Scandinavia as well, and that Vikings were as much of a threat to the powers and politics of Scandinvia itself as it was to those of the Frankish Empire. The role of the Vikings at Dorestad continues to fascinate, as this volume shows. Once only viewed as the destroyers of a great christian town, the violent and heretic 'others', we are now especially interested in their role in the success of the settlement and their inside political agenda for this town (see Cooijmans in this volume). How 'Viking' was Dorestad halfway the ninth century AD? What changed when Dorestad was not longer a target on the horizon, but they found themselves inside it, looking out? On the other hand, there is a contrast between the many written sources mentioning Dorestad in connection with Vikings, and the mere absence of recognizable Viking material culture from its soil (IJssennagger-van der

Figure 2. Dorestad Brooch on the day of its excavation, July 18, 1969. Photo: J. Schuyf.

Pluijm in this volume). So, how 'Viking' has Dorestad ever really been?

A related issue is the nature of the trade between Scandinavia and Dorestad. Up till now, that has mostly been characterised in terms of goods travelling to and fro, supposedly in comparable quantities. But we see much more material that came from Dorestad in Scandinavia than vice versa. Moreover, it is known from toll lists that many other goods were exported from Dorestad, that do not show up clearly in the archaeological record, like textiles, manuscripts, honey and slaves. Scandinavian material is quite hard to find in Dorestad: there are not many Norwegian whetstones, very little soap stone, the amber might well be Baltic, and the typical 'Ribe beads' did not make it to Dorestad often either (see Langbroek in this volume). We may want to start looking at this trade not in terms of exchange, but as a dominantly south-northern trade, a flow of goods towards Scandinavia that were bought at Dorestad and paid for with money. The amount of coins, weights, scales and touch stones from the harbour area of Dorestad definitely show a lot of monetary transactions going on there.

Water and wood

The 2019 Congress was much concerned with the infrastructure of Dorestad and the early medieval Netherlands, especially waterways and waterworks. At the 2014 Congress, this had been prompted as a desire of the research agenda: "As the world-wide trade network of these centuries has become evident, we feel more and more uncomfortable by mainly knowing where objects and materials ended up and, thanks to modern technical analysis, where they originated. We now have to try to reconstruct the routes these raw materials, half-products and finished objects travelled".[4] Dorestad owed much of its fame and fortune to its riverine setting. Studies of the import of wood to the Dutch river area by Rowin van Lanen[5] show peaks in Roman and Carolingian times. Much of this wood was used in extensive quay works, that are famously impressive at Dorestad, but were also found at Oegstgeest in the Rhine delta and at Zuilen neat Utrecht, both Merovingian sites, and recently at Leiderdorp (see Dijkstra in this volume) as well. Where in Roman times a south-north trade system based on the Meuse river was dominant, in the Early Middle Ages wood and other commodities were transported mostly via the Rhine, travelling from southeast to northwest. This made Dorestad an ideal hub, for instance for the import of glass vessels and beads from German areas to Dorestad and further on towards Scandinavia and the British Isles (see Dodt, Kronz and Simon and Langbroek in this volume). The norouriously meandering and sometimes overflowing river Rhine did not scare people away from living right next to it; it seems not to have been viewed as a threat or a problem, but mainly as an opportunity. A lot of time, effort and money was dedicated to making and keeping the riversides accessible. This is visible throughout the Early Middle Ages. The waterworks at Oegstgeest and Zuilen were mostly from the seventh century AD, while work on the extensive quaysides at Dorestad spans the periode of c.675 to c.800 AD and the revetments at Leiderdorp were left untended before 850 AD. But jetties were also found at Tiel, in many ways a successor of Dorestad, at least as a tolling station and pre-eminent importer from the Rhineland, as presented at the Congress by Arno Verhoeven of the University of Amsterdam. At Tiel, the jetties date from the end of the ninth century to c.1100 AD.

Rural and urban

The congress included a set of presentations on the ongoing ERC project 'Rural riches' headed by prof.dr. Frans Theuws of Leiden University. As the rural population of the Netherlands before c.700 AD had substantial amounts of material culture, they clearly had access to local, regional and long distance networks, that were mainly river based. As Theuws calculated, no one in this area lived more than 50 kilometers from a river. In the central part, the Dutch river area, many lived within 500 meters from shore. At Dutch Merovingian sites like Oegstgeest and Utrecht, along the shores large storage facilities were excavated, barns on heavy piles, that may well have contained grain. These towns were river-oriented for their supplies and imported both wood and food. The same thing is found by Arjan den Braven (see Den Braven in this volume) for the Carolingian

4 Willemsen and Kik 2015, 146.

5 Jansma and Van Lanen 2015.

Figure 3. Houses of 'Dorestad' in theme park Archeon. Photo: Nicolevanas (www.nivas.nl).

palaces in the Netherlands, like the *palts* at Nijmegen, that were dependent on import from towns like Dorestad. Even when these palaces had large surrounding woodlands that were used as hunting grounds, written sources show that they imported wood and charcoal via the rivers, as well as many foodstuffs. These palaces could not provide for themselves and thus needed granaries.

This also re-opens the question what to call rural and what urban in thise early medieval period. This was approached in a new way by Marcel IJsselstein (see IJsselstein in this volume), who showed how the layout of a medieval town like Utrecht was neither planned nor grown organically, but influenced by various agents like clergy, politicians, merchants and even civil servants, who needed different things from the town and made their mark on various parts of it. This system seems to apply very well to the early medieval town of Dorestad. It underlines that these emporia were not one track minded trading centers, but complex settlements shaped by political, economical and religious agendas. Change in one of these, like the presence or absence of a bishop, or toll rights, or domination by a Viking instead of a Frankish elite, changed the town. The structure of Dorestad, with its various strongholds as power bases, churches and cemeteries as religious focal points, and its outstretched harbour with jetties, warehouses and workshops as a trading hub, can never be fully understood as only an economical institution. As stressed elsewhere, both the success and the decline of Dorestad can only be explained as the result a combination of political, economical, cultural and geographical factors. Carolingian societies are unfortunately not less complex than late medieval ones.

The congress excursion in 2019 took some participants to the archaeological theme park Archeon at Alphen aan den Rijn, where a small portion of a 'Dorestad' has been recreated (Figure 3). Although labeled 'Dorestad c.800 AD', it consists of three buildings based on excavations elsewhere: "A merchant's house with thatched roof after those excavated at Hedeby, a sunken hut, used as a workshop, like was found at Rijnsburg, and a half open two-aisled house with barn as excavated at Valkenburg-De Woerd".[6] Recently, a small shallow boat was added to the cluster of buildings, moored between two jetties (Figure 4). Visitors can ride the boat across a small pond,

6 Information panel in the Archeon park.

Figure 4. 'Viking' boat and jetties in theme park Archeon, 'late medieval' houses in the background. Photo: A. Willemsen, June 2020.

allowing them a view on this corner of 'Dorestad' from the water, which certainly gives a more early medieval feel to the experience. Here too, it seemed that Dorestad was neither really urban but certainly not really rural. Towns, like people, don't have one fixed identity, but multiple identities and identifications, that may differ from one context to another, can be dominant or regressent in a given situation, and change over time.

Future work on Dorestad

In the past ten years, since the First and Second Dorestad Congress, the National Museum of Antiquities has continued to work on the Dorestad Collection, as the assemblage of finds from the site at Wijk bij Duurstede is called. This collection holds all finds from the site from the earliest excavations in the 1840s[7] until the excavations of the so-called 'Veilingterrein' in 2007-2008. This extremly large and rich assemblage still holds large groups of finds that await research, as really only its ceramics were studied closely by the excavators. The collection provided the basic material for new and exciting studies on specific find groups presented in this volume, like Hall's close look at the gaming pieces or Langbroek's intricate cataloguing of the glass beads, that shows Dorestad's pivotal position in a world-wide trading network, but also its absence from a specific Noth Sea trade between Scandinavia and the British Isles. Also in these material studies, Dorestad betrays itself as primary a Carolingian town.

In recent years, the Dorestad Collection has increasinly been used a source for master thesis studies as well, by students of the Saxion Academy and the Universities of Amsterdam and Leiden, who for instance focused on skeletons and grave goods of the various cemeteries of Dorestad (with Raphaël Panhuijsen) or animal bones (with Kinie Esser). Again and again, the problem is the amount of context information on the level of details, layers and dates, that can be supplied. The National Museum of Antiquities keeps working, with the Cultural Heritage Agency (especially Menne Kosian) to make plans, field drawings and datings of almost two centuries of large-scale exvavations at Dorestad as accessible as possible. The Congress organization was happy to see many early career researchers taking part in the Congress and using the Dorestad material for their own investigations, even without us knowing. That is good. Dorestad will live on.

7 Willemsen 2010.

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Vikings and Luxury at Dorestad

Beads from Dorestad. RMO Leiden various WD-nos. Photo: RMO.

Viking Dorestad

A haven for hydrarchy?

Christian Cooijmans

For over a century and a half, the assorted activities of viking[1] hosts in and around the site of Dorestad have been subject to careful deliberation and debate, increasingly illuminating the early Scandinavian influence on this regional riverine landscape.[2] Yet despite this overall progress, the material evidence for a ninth-century viking presence inside the settlement itself remains restricted, a shortfall which continues to tempt scholars to speculation when broaching the broader concept of a "viking Dorestad". Likewise, even though a notable corpus of documentary evidence affirms the local attendance and influence of Scandinavian agents in Dorestad, it is still largely unclear what this presence would have entailed in practice. To what degree, for example, was institutional and infrastructural continuity upheld during the decades of viking rule? Did Scandinavian elites reside locally, or did they coordinate their affairs from elsewhere? And what politico-economic repercussions did their presence have for the emporium and its environment? To answer these and similar questions, novel comparative methodologies are called for, furnishing fresh perspectives on Dorestad's role within this far-reaching waterborne movement of people, property, and perceptions. Accordingly, as well as reiterating the documented and otherwise attested viking endeavour in Dorestad and its immediate catchment area, this chapter will examine these developments against a wider conceptual canvas of Franco-Scandinavian interaction, wherein viking fleets operated as adaptable, ambulant polities – or "hydrarchies". In doing so, it will allow these events to be more easily juxtaposed and judged against analogous processes of external encroachment across the European mainland, whilst providing greater insight into the strategies and motivations that governed them.

Viking hydrarchy

Throughout the ninth and early tenth centuries, various authors throughout the Frankish realm documented and decried the activities of regionally operative viking hosts. To many of them, it was readily apparent that their kingdoms were not being persecuted by a

1 Although predominantly associated with Scandinavian endeavour, the term 'viking' is here used as an occupational rather than ethnic label (as 'mariner' and 'pirate' are, for instance). As such, it is rendered as a common noun, with a lowercase initial, as opposed to its capitalisation elsewhere in this volume (which follows the preferred spelling of names, ed.).

2 Willemsen 2010, 7-16.

single, unified force, but by various autonomous groups of assailants, some of which were noted to actively obstruct each other's interests.[3] Present-day academic consensus continues to favour the notion that most viking hosts would have been self-contained units, harbouring their own appetites and aspirations, whilst being unbeholden to any overarching authority – Scandinavian or otherwise.

A more recent approach to conceptualising these companies has been to consider them as so-called hydrarchies. Although first conceived by seventeenth-century author Richard Braithwaite apropos the social organisation of the contemporary maritime state, the term would gradually come to signify much more specific and subversive shipboard processes, including mutiny and piracy.[4] This "hydrarchy from below", as characterised by Peter Linebaugh and Marcus Rediker, was made manifest by various groups of mariners across the Revolutionary Atlantic, whose self-governing shipborne societies contravened the traditional power structures of contemporary navies and merchant shipping industries.[5] In recent years, Neil Price has proposed to superimpose this hydrarchic framework onto the viking phenomenon, thereby positing individual viking ships and fleets as adaptive political spaces in their own right.[6] Thought to have been composed of distinct vocational "companionships" (Latin *sodalitates*, akin to Old Norse *lið*),[7] hosts like these seem to have been socially and structurally adaptive to sudden changes in circumstance, strategically joining and disbanding their forces as deemed necessary. In accordance, even when considering much more sizeable viking forces like the ninth-century "Great Army" in England, as well as its continental counterparts, these would effectively still have been larger conglomerates of smaller contingents, temporarily tied together to pursue a shared objective – such as an otherwise prohibitive inland campaign.[8] Broadly speaking, the longer-term sustainability of these hydrarchies would have been contingent on a combination of collective experience, opportunism, and regionally prevailing circumstances.[9]

Building on this hydrarchic body of thought, an assessment of the attested viking activity within the boundaries of the Frankish realm reveals this endeavour to have been remarkably constant and measurable – with analogous patterns of behaviour visible from northern Frisia to southern Aquitaine. These findings have been assembled into an overarching conceptual development model of Franco-Scandinavian interaction – an abstract paradigm of archetypal activity which has been validated and calibrated using a series of distinct regional case studies, comprising the Loire, Seine, and lower Rhine-Meuse-Scheldt river basins, respectively. All in all, this model (Figure 1) identifies four distinct phases of hydrarchic conduct and consequence, which, at their core, affirm that most viking campaigns across the Frankish realm would have represented carefully calculated, orchestrated, and risk-assessed operations – underpinned by the sustained exchange of intelligence and ongoing desire for socioeconomic enrichment.[10]

The inaugural, **pre-viking phase** of this conceptual model accentuates various amicable interactions across and beyond the North Sea littorals, including commerce and diplomacy, which would have gradually familiarised Scandinavian parties with the physical and politico-economic layout of the Frankish realm. The subsequent, **second phase** encompasses the earliest viking endeavours along the Frankish frontier, covering the late eighth to early ninth century. During these decades, emergent hydrarchies – attuned to the local availability of moveable wealth – fell upon vulnerable, liminal communities in sudden acts of antagonism. At the same time, Frankish elites first established an assorted – albeit ineffectual – series of countermeasures, whilst pursuing limited political liaisons with their viking counterparts (*i.e.* "hydrarchs"). The **third phase** of the model (mid-ninth to early tenth century) witnesses a sizeable increase in the operational scale and complexity of regional viking movement, culminating in substantial upstream expeditions focused on prominent centres of population near navigable rivers. In addition, vikings began to establish longer-lasting encampments along these waterways, which served as stations of security, assembly, and commercial activity. Political bonds likewise continued to be formed, as various viking leaders were granted liminal land in benefice in order to subdue them. The **final phase** of the model (late ninth century onwards) sees these benefices develop in one of two directions: some of them would have reverted to Frankish control within a few decades, often following military intervention – this is what seems to have occurred in the lower Loire valley during the 930s, for example.[11] Other benefices, however, would prove much more politically resilient, playing host to sizeable groups of Scandinavian immigrants, which assimilated into their host society at a rapid rate – Normandy being the foremost example here.[12]

Considered collectively, the four phases of the conceptual model typify two centuries of regional viking influence as a period of pronounced contrasts.

3 See, for example, Waitz 1883, 56, 57-58; Brett 1989, 214-215.
4 Braithwaite 1631, 144; Price 2016, 156-157.
5 Linebaugh and Rediker 2000, 154-167.
6 Price 2014, 56-59; Price 2016, 156-171.
7 Raffield 2016, 310-311, 324-326.
8 Raffield 2016, 332-333.
9 Cooijmans 2020, 235.
10 Cooijmans 2020, 209-214.
11 Pertz 1839, 384.
12 Renaud 2008, 456.

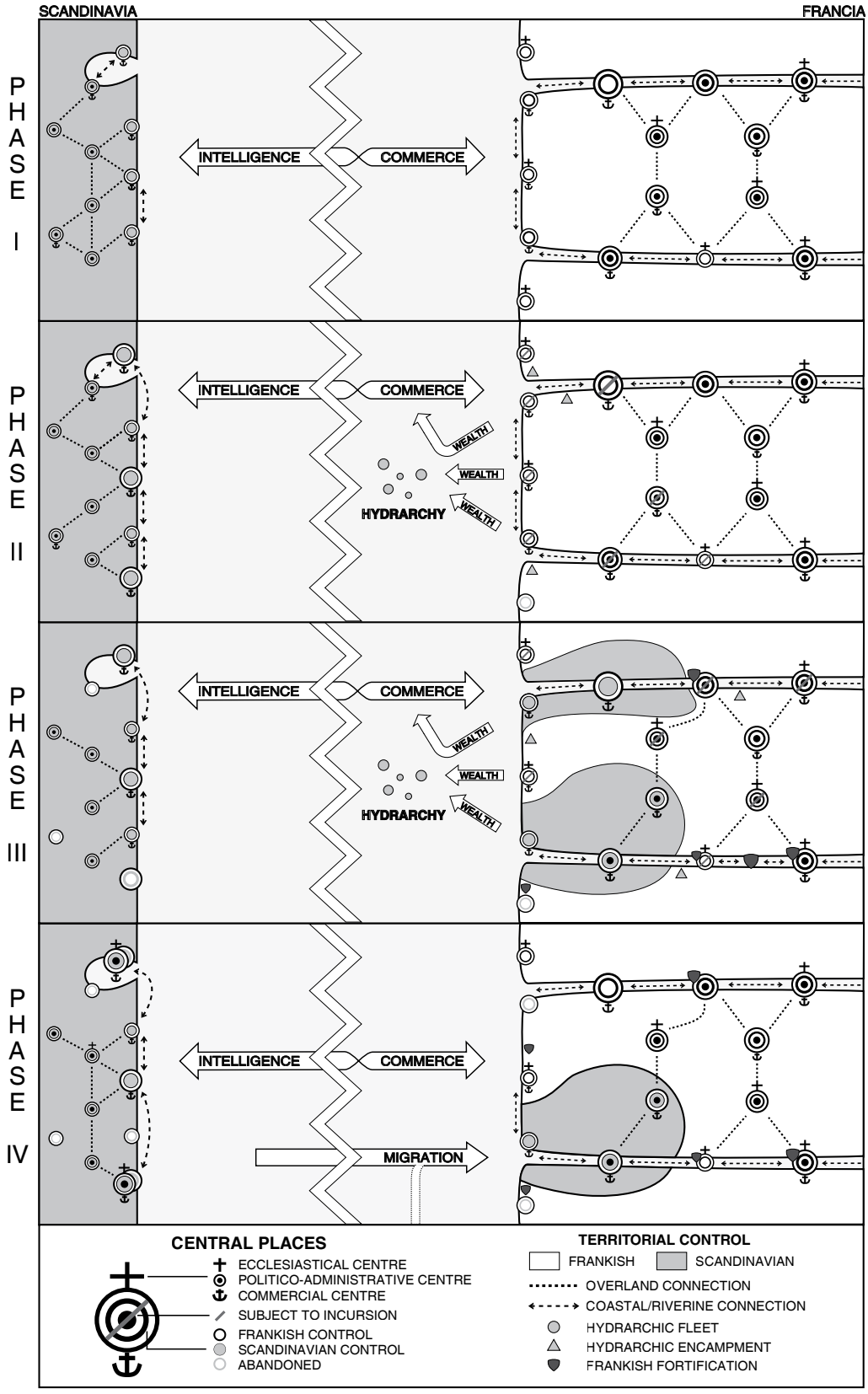

Figure 1. Composite spatial schematic of the conceptual development model for Franco-Scandinavian interaction (c. 750-940). Figure: after Cooijmans 2020, 214.

As hydrarchies formed and flourished – developing in size, resourcefulness, and resilience – their focus of attention steadily shifted to more substantial, inland nuclei of moveable wealth. By appropriating and, in part, reintroducing this affluence through trade, vikings are seen to have readily moved between militant and mercantile modes of interaction, constituting opposite sides of the same opportunistic coin.[13] Likewise, far from being faceless and unapproachable, hydrarchs were diplomatically susceptive, and were engaged by Frankish elites as mercenaries, momentary allies, and even entrenched political clients.

Vikings in Dorestad

Before attempting to correlate the above model to specific events in Dorestad, a brief review of known viking activity around the emporium is merited. On the cusp of the Viking Age, Dorestad was already a well-recognised way station for merchant mariners to and from Scandinavia, its peripheral position enabling it to bridge a gap between established domestic economies and the neighbouring North Sea trade network. In accordance, various north- and westbound goods are seen to have made their way through the entrepôt, including Frankish quernstones, ceramics, glassware, and metalware – all of which have likewise been attested in Scandinavian assemblages.[14] Although luxury staples such as antlers and furs are thought to have been shipped southward in exchange, local evidence for these commodities is much less prevalent due to their relatively poor preservation in the material record.[15] Even still, the abundance of amber found in Dorestad's earlier stratigraphy – presumably introduced from the Baltic region – goes some way towards substantiating these reciprocal contacts.[16] Textual evidence, including Rimbert's *Vita sancti Anskarii*, also emphatically depicts Scandinavian merchants as having habitually travelled to Dorestad during the first half of the ninth century.[17]

The first reported viking attack on Dorestad occurred in 834, followed by further annual incursions for three consecutive years.[18] Whereas the severity of these early acts of aggression remains a matter of debate, no compelling evidence exists for them to have been perpetrated by especially large or otherwise formidable armed forces. Due to Dorestad's significant riverside sprawl, mounting an effective defence would have been arduous at the best of times, allowing even elementary hosts to inflict significant damage simply by being agile and acquainted with the target. The hyperbolic nature of these early annalistic accounts – bemoaning the wholesale demolition of the emporium – should likewise be met with scepticism, as a complete cessation of local activity would have defeated the purpose of periodic return visits to the site. Instead, this recurrent attendance suggests that incoming Scandinavians would have relied on premeditation and restraint as a deliberate, sustainable strategy, thereby keeping Dorestad's economic integrity and agency intact over the course of multiple seasons. This is supported by the notion that local tribute payments were likewise being exacted (such as in 837), which would have curtailed the need to resort to violence to begin with.[19] Carried out in the immediate wake of an unsuccessful revolt of Emperor Louis' sons against their father,[20] the timeliness of these initial incursions is also unlikely to have been accidental; by taking advantage of ongoing political strife and its associated military weaknesses, vikings would have greatly reduced the risk of encountering an effectively organised resistance along the inland rivers.

The opening round of antagonism against Dorestad seems to have prefaced a more sustained period of local viking activity, which witnessed no less than five additional attacks on the emporium up to 863, with further hostilities potentially unrecorded.[21] Across the Low Countries as a whole, a more profuse viking presence was likewise in evidence, exemplified by the hundreds of alleged ships and combatants arriving in Frisia in 852 and 873, respectively, as well as the "many thousands" purportedly killed at Louvain in 891.[22] Even though the credibility of such figures remains contested – particularly towards the higher end of the scale – overall participation rates should not be underestimated either, especially as a growing range of countermeasures indicate that regional authorities were taking the threat of Scandinavian encroachment increasingly seriously. Indeed, on top of their continued reliance on armies, fortifications, and tribute payments, Frankish rulers more and more commonly sought to establish direct political ties with regionally-active viking leaders – aiming not just to suspend ongoing hostilities, but to bind these external agents to themselves in a formal, institutional capacity.[23] This strategy seems to have actively anchored vikings to an administrative apparatus with inherent sociopolitical safeguards, which monitored

13 Coupland 2001, 174n70; Willemsen 2004, 81-82.
14 Willemsen 2016, 114-115; Skre 2010, 138-141; Feveile 2010, 145-146.
15 Van Riel 2017, 168-169; McCormick 2001, 654.
16 Melkert 2012, 361-363, 383, 389; Van Es and Verwers 2015, 318.
17 Waitz 1884, 58.
18 Waitz 1883, 9, 11-13; Pertz 1829, 226; Kurze 1891, 27-28.
19 Waitz 1883, 13.
20 Costambeys, Innes, and MacLean 2011, 217-219.
21 Pertz 1829, 228-229; Waitz 1883, 35, 38, 48, 61; Kurze 1891, 36, 39.
22 Waitz 1883, 41, 124; Kurze 1891, 120-121.
23 Coupland 1998, 96, 109.

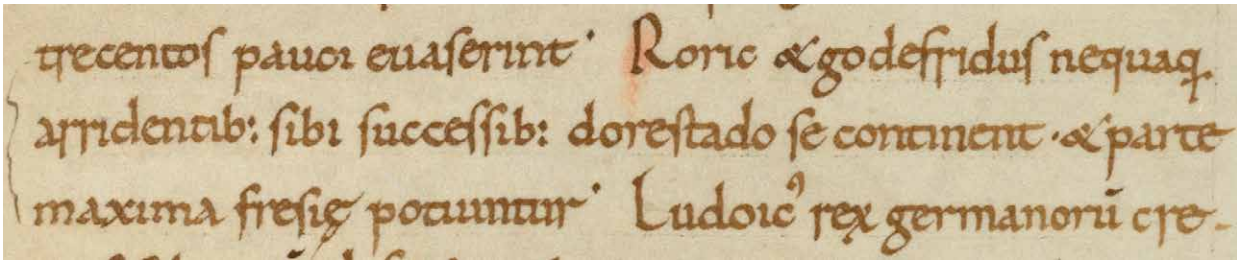

Figure 2. Excerpt from the ninth-century *Annales Bertiniani,* noting the presence of Rorik and Godfrid in Dorestad in 855. Photo: Brussels, Royal Library, MS 6439-51, f. 98r; ©KBR.

and mollified them, whilst subjecting them to secular and ecclesiastical law. In exchange, viking elites were offered a rung on the political ladder of the Frankish realm, affording them the status and security that accompanied their allegiance and (military) aid. Some Scandinavians even received regional lands in benefice, granting them a more desirable and reliable source of personal wealth and esteem. This latter scenario seems to have played out in Dorestad, when Lothar – in 850 – granted it (and other *comitatus*) to the viking leader Rorik "on condition that he would faithfully handle the taxes and other matters pertaining to the royal fisc, and would resist the piratical attacks of the Danes".[24]

By presiding over Dorestad, Rorik would have exerted a significant degree of influence on its socioeconomic stability, whilst seemingly reaping the benefits of local rents and taxes.[25] In these circumstances, it would have been in his best interest to safeguard the emporium from any destabilising influences, including viking attacks. To his detriment, however, Dorestad was already experiencing economic recession when granted to the viking leader[26] – a decline his custodianship may have exacerbated, as (inter)regional merchants conceivably opted to market their goods beyond his immediate sphere of influence.[27] Nevertheless, Rorik seems to have retained his benefice into the 870s before fading from the historical record. By 882, Charles the Fat granted "Frisia and the other regions that Rorik had held" to another viking leader, Godfrid, who would oversee them until his death, only three years later.[28] At that point, Dorestad and its environs were seemingly restored to a more direct Frankish control, with no additional reports of viking activity at the site.

Viking residents

As Scandinavian elites and their respective entourages were granted custody of Dorestad's established economic infrastructure, their newfound prerogative may have encouraged them to embrace a less itinerant, locally ensconced way of life. Even though no unequivocal evidence exists for vikings to have dwelt in Dorestad on a (semi-)permanent basis, there are nevertheless credible grounds to assume that they did. First of all, a number of contemporary annalistic accounts allude to such an established presence: in 855, for example, Rorik and a kinsman – another viking named Godfrid – were noted to "sustain themselves in Dorestad" (*dorestado se continent*) as they presided over the surrounding region (see Figure 2).[29] Two years later, Rorik was again reported to have "ruled in Dorestad" (*praeerat Dorestado*) when he led a fleet northward into the Danish kingdom – at least part of which may have been moored at the emporium until then.[30]

Potential material traces for this viking occupancy are also manifest: as Dorestad's economic decline accelerated into the second half of the ninth century, its lattermost coinage – issued with debased renditions of Lothar's name and title – is suggested to have been the result of a slipshod Scandinavian management of local minting.[31] As such, these proceedings call to mind the proposed striking of coins at ninth-century viking encampments like Torksey (Lincolnshire, England), from which a lead trial piece for imitation *solidi* of Louis the Pious has likewise been recovered.[32] Returning to Dorestad, the remains of a ninth-century ship – excavated from Hoogstraat II (see Figure 3) – have also been noted to approximate those from the Skuldelev assemblage found in Roskilde Fjord, Denmark.[33] As dendrochronological analysis suggests its

24 Waitz 1883, 38; Kurze 1891, 39. Translation from Reuter 1992, 30.
25 Reynolds 1994, 92-93, 98-101; Innes 2000, 73; Costambeys, Innes, and MacLean 2011, 316-318.
26 Coupland 2010, 101-103.
27 Cooijmans 2015, 39-40.
28 Waitz 1883, 153. Translation from Nelson 1991, 225.
29 Waitz 1883, 46.
30 Kurze 1891, 47.
31 Coupland 2001, 173-175; Coupland 2010, 102.
32 Hadley and Richards 2016, 50; Blackburn 2002, 93-94.
33 Van Es and Verwers 2009, 36-38, 244-247, 250-256; Willemsen 2016, 116-118.

Figure 3. The *in situ* remains of a ninth-century ship during the 1970s excavations in the harbour zone of Dorestad. Photo: RCE.

wood to originate around the coastal Low Countries, the vessel is considered to have been manufactured by Frisians using an imported design.[34] There is, however, no reason to discard the possibility that the ship was instead constructed by Scandinavian shipwrights based in Dorestad, utilising the regional resources available to them.

When observed from a broader regional vantage point, ninth-century Dorestad seems to have been centrally positioned within an intricate, interconnected landscape of recurrent viking encampment (see Figure 4). In accordance, any enduring Scandinavian control over the emporium would have offered strategic advantages to vikings seeking safe passage along the Rhine delta. Evidence exists for Rorik himself to have encouraged these types of journeys during his tenure, as one Scandinavian force seemingly acted "on [his] advice" (*consilio Rorici*) during an expedition into the Rhineland in 863.[35] Around the same time, bishop Hincmar of Rheims – in his correspondence to Rorik – warned the latter against furnishing "advice or aid to the heathens" (*paganis aut consilium aut adiutorium prestet*).[36] In light of these accounts, the notion that Dorestad – as (part of) a Scandinavian benefice – would have represented an occasional staging post for upstream viking endeavour cannot be altogether discarded.

Hydrarchy in Dorestad?

Having re-examined the development and overall dynamics of viking endeavour in and around Dorestad, consideration may be given to whether these events were commensurate with the wider (inter)regional emergence of Scandinavian-led hydrarchy. At first glance, a number of associated hallmarks are manifest, including a prolonged presence of autonomous and adaptable viking hosts, a continued pursuit of moveable wealth and social capital, and an active affiliation with domestic networks and mechanisms of politico-economic power. When collating this evidence, an appreciable sequence of regional viking interaction emerges, broadly corresponding to the respective phases of the conceptual development model.

34 Vlierman 2002, 141.

35 Waitz 1883, 61.

36 Perels 1939, 120.

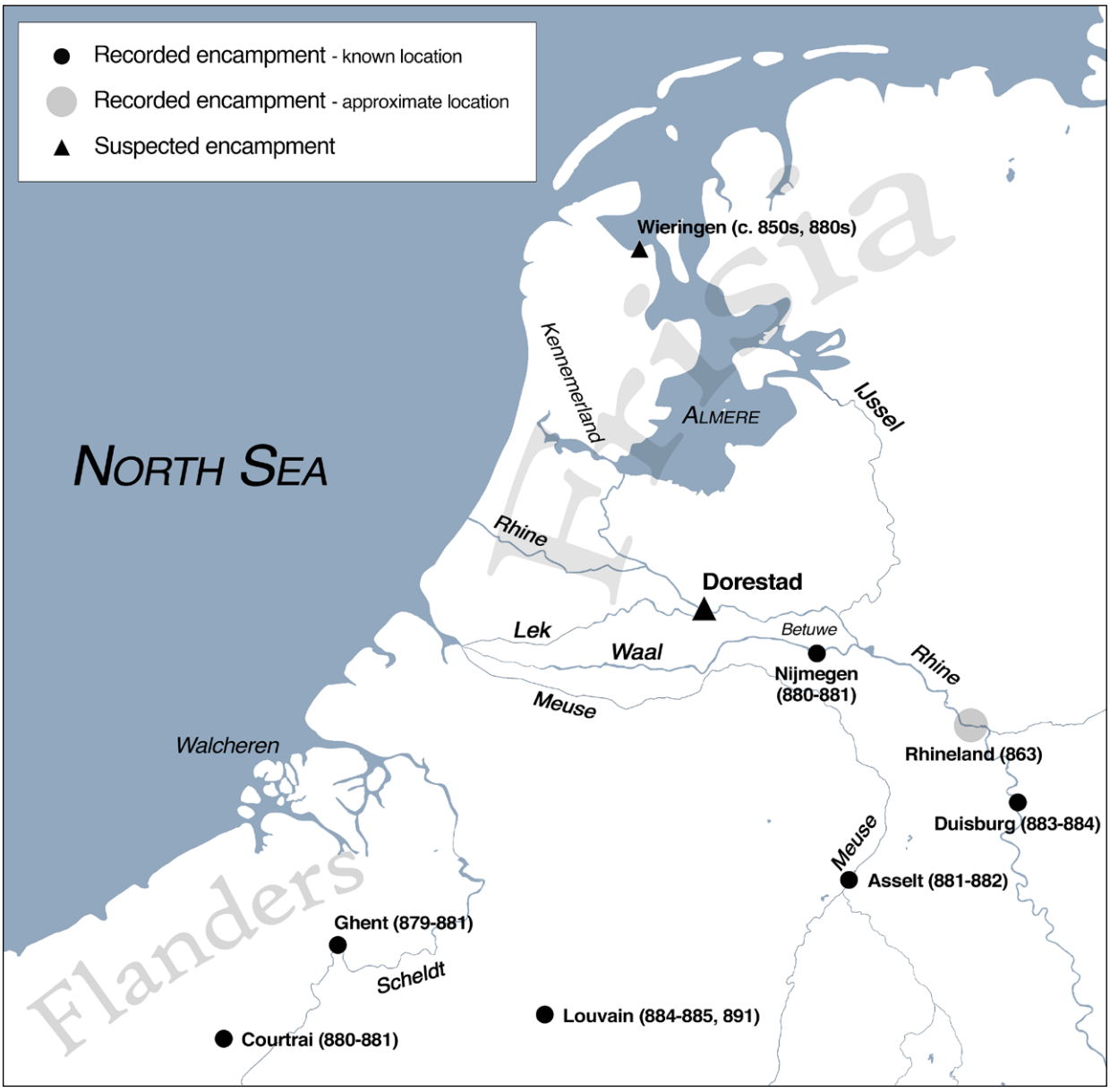

Figure 4. Recorded and suspected locations of viking encampment across the Low Countries. Base map: AWMC (CC BY 4.0), with amended coastline.

First of all – preceding the onset of Viking Age hostilities – long-standing communication links across the North Sea enabled intelligence on Dorestad's whereabouts, worth, and weaknesses to be disseminated into the Scandinavian north by merchant middlemen, missionaries, and other assorted mariners. Thereafter, during the early decades of the ninth century, hydrarchic entities first began to manifest themselves through local wealth extraction, as the emporium was repeatedly attacked by (seemingly) small-scale viking companies. In response, initial domestic countermeasures – both operational and remedial in nature – were deployed (*e.g.* military force, coastal defences, and local tribute payments).[37] Thirdly, towards and beyond the middle of the ninth century, hydrarchic encroachment greatly intensified, as increasingly resourceful viking hosts traversed the assorted waterways of the Low Countries and their hinterlands. Whilst expanding their military and political foothold, Dorestad and its surroundings were granted to Scandinavian elites in benefice (and usufruct) in order to safeguard regional stability and security. This

37 Waitz 1883, 13-14.

tenure was ultimately cut short after only a few decades, whilst the presence and influence of hydrarchy seems to have gradually abated across the region. Franco-Scandinavian trade nevertheless continued – albeit no longer through Dorestad – as merchandise from across the Low Countries and the upstream Frankish interior continued to find its way overseas.[38]

All things considered, events in Dorestad appear to have conformed to a much broader continental paradigm of viking endeavour, brought about and facilitated by hydrarchic traits of self-sufficiency, itinerancy, expediency, and adaptability. In accordance, any recurrent ninth-century Scandinavian antagonism towards the emporium is unlikely to have been haphazard, capricious, or uncontrolled in character, despite contemporary allusions to the contrary. Instead, these efforts would have been the result of a substantial amount of strategic coordination, risk assessment, and contingency planning, which not only deemed Dorestad to be an appealing aggregate of moveable wealth, but a potential long-term livelihood – a sustainable source of socioeconomic enrichment. Against the backdrop of the conceptual model, this ambition parallels procedures adopted elsewhere across the European mainland, where viking groups likewise targeted prosperous, downstream population centres along major riverine thoroughfares – only to subsequently receive them and their surrounding territories in benefice (*e.g.* Rouen in the 910s, Nantes in the 920s).[39] With this in mind, the ninth-century Scandinavian stewardship of Dorestad cannot be regarded as an altogether singular occurrence, but, rather, as an early instance of a calculated approach which, in due course, would find further expression along the coasts and rivers of western continental Europe. On no account, however, does this entail that the study of Dorestad's decline is of lesser importance to ongoing efforts to uncover and understand the conduct of viking forces across the Frankish realm. On the contrary, their recurrent presence in and around the emporium remains a principal piece of a much larger, interregional puzzle, whose overall outline is only just beginning to take shape.

About the author

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38 Cooijmans 2020, 218.

39 Lauer 1949, 211; Pertz 1839, 369, 377.

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Vikings beyond Dorestad

Rethinking some metal finds in, around and after the emporium

Nelleke IJssennagger-van der Pluijm

Dorestad and Vikings seem inextricably connected. That Vikings, both in the narrow sense of seafaring warriors and in more general sense of people from the Viking world that stretched across Scandinavia, parts of the British Isles, into the Baltics and beyond, are in our perception so closely linked with the early medieval trading site is not without reason. As the only "*vicus nominatissimus*" in the Carolingian realm, Dorestad was closely connected to emporia in the Viking world. Since the nineteenth century, research therefore not only focussed intensely on the site itself, but on trade with the north especially.[1] Moreover, the contemporary textual records from throughout the Carolingian realm known collectively as the Frankish Annals refer to frequent Viking attacks on Dorestad and the coastal area known as Frisia. These sources also indicate the role of prominent, Danish warlords in Carolingian politics, resulting in their temporary control of the trading centre and neighbouring Frisian areas.[2] Subsequently, Dorestad has been one of the most looked-at places in relation to the question of Vikings in the Low Countries, often benchmarked against Viking impact in England. Particularly 'Viking finds' such as dress-accessory and jewellery, often from the early excavations with little recorded context, are seen as a Viking footprint in the site of former Dorestad.

Although it is beyond doubt that Dorestad up to its decline in the 860s played an important role in the trade network that fundamentally shaped relations between the Carolingian and northern world from the Merovingian period into the Viking Age,[3] we must also recognise that the textual references and archaeological research traditions have created an incredible focus on this one place and its life-span, that surpasses the attention to most other sites in the Low Countries. This long and strong research tradition has framed our thinking around the question of the Viking phenomenon in this area, which with new research across the Viking, Frisian and Carolingian worlds can be reassessed. By embracing the increased number, primarily through metal-detecting, and increased understanding of finds related to the cultural sphere of the Vikings more generally, we can inform, test and nuance long-held perceptions of Viking finds in Dorestad and look beyond.

1 Willemsen 2010, 177.

2 See Coupland 1998; Cooijmans 2015.

3 Baug, Skre, Heldal and Jansen 2019, especially 47-48, 72-74.

This article aims to address the potential Viking footprint in a selection of small metal objects from both in and outside of Dorestad. We will first review two older finds of dress-accessory that are often quoted as local interpretations of Viking objects, displaying strong Viking influence in the trading site itself. Subsequently, we will briefly consider more recent metal-detected finds from the coastal area and from after Dorestad's decline. In doing so, it will be argued that the perceived, and sometimes looked-for, Viking influence in the emporium through imitations of dress-accessories can be nuanced. Furthermore, we will highlight that impact of the relation with the Viking sphere can be found in the wider coastal area in the later ninth and tenth centuries, reflecting a different phase and scale of the Viking phenomenon.

Defining finds and Vikings

A discussion of any type of find and phenomenon, especially so multi-faceted as 'Viking', is heavily dependent on definitions. In an article on Viking finds from the Dutch river area, Willemsen explains Viking finds to encompass "those finds that indicate the presence and influence of the Vikings in the river delta of the Netherlands, whether those objects were traded, raided, left or lost by the Norsemen."[4] This understanding of Viking finds in the context of the Low Countries helpfully focusses on the influence of, and an affiliation with, a recognizable cultural sphere, rather than on items from a specific location such as Scandinavia. To this, local imitations, local variations and hybridised objects can be added as the idea of an object, or its style of decoration, in those cases stem from or are strongly related to the Viking sphere. Finally, also specific ways of hoarding or using can be named, as through treatment, objects can display influence from the Viking world.[5] Talking specifically about small metal finds of personal adornment, these are generally considered primarily personal possessions, not trade goods.[6]

This leaves us with the need to define Viking sphere more clearly. As a recognised period in European history and archaeology, the Viking Age, traditionally demarcated from a British perspective of Viking impact, runs from the late eighth to the mid-eleventh century.

Starting with a phase of Viking raids, a period of longer and more intense impact and eventually establishment of power-bases and influence to varying degrees, Scandinavian seafarers created a connected world from Ireland and the Atlantic in the west to Russia in the east and an extensive cultural sphere with regional variations. The cultural elements are perhaps most clearly articulated in styles of dress and jewellery and ways of dealing with silver in a bullion-based exchange system. Of dress accessories, jewellery and other metal finds, there are recognizable styles of decoration, types of objects and ways of using that we associate with Viking Age Scandinavia and the Viking areas beyond it, where regional adaptations and hybridization often occurred. This means that different areas of the Viking sphere over time had different material footprints. It is important to bear in mind that any item found in the Low Countries and seen as related to the Viking sphere is identified and usually dated based on parallels from primarily the core Viking areas of Scandinavia and the British Isles. Using the growing body of finds from those areas, and an ever-increasing understanding of the material, there is an opportunity to reassess finds in the Low Countries.

Viking footprint?

Over the last decades, our knowledge of Dorestad has greatly increased through excavations, research in many disciplines and new techniques.[7] But interestingly, this has not resulted in a greater number of Viking metal finds. In fact, it is the increase in finds elsewhere that tells us more about the 'Viking finds' in Dorestad. For some precious, personal objects that have been identified as clear Viking finds, such as an arm-ring of twisted golden rods (Figure 1), the identification as Viking find stays solid.[8] For two key finds interpreted as local imitations of Viking finds, however, the status of local take on Viking finds on closer inspection is more problematic, for different reasons.[9]

A decorated silver ring-pin (Figure 2), recorded as from Dorestad, has a ring of which the lower part is sub-triangular in shape and decorated with interwoven animal motifs.[10] Two animals in profile with gaping heads face each other around a central ribbon knot. It is an untypical find for the Low Countries and as such, it has been interpreted as a local translation of the better-known penannular ring brooches of the Viking Age, and as a sign of Viking influence in Dorestad.[11] Ring-pins and penannular brooches are related, and the above suggestion was based on the assumption that the object, like penannular brooches, could only function if the pin can move on the ring to fasten onto fabric. Instead, being a ring-pin, there is no need for the pin to slide on the ring as it would be fastened through the weight of the ring pushing the pin down. The misinterpretation may also have been prompted by the strikingly short pin, making it look more like a penannular brooch in scale. Usually, the pin is

4 Willemsen 2004, 65-66.
5 Besteman 2004; Coupland 2006; Kilger 2007.
6 Wamers 2011, 76.
7 See Willemsen and Kik 2010.
8 National Museum of Antiquities, Leiden, f 1928/12.1.
9 IJssennagger 2017, 198-201; 205-211.
10 National Museum of Antiquities, Leiden, f 1940/12.2.
11 Willemsen 2009, 165.

Figure 1. Arm-ring of twisted golden rods from Dorestad, 800-850 AD, 8.4 x 9.6 cm. RMO Leiden inv. no. f 1928/12.1. Photo: RMO.

Figure 2. The silver ring-pin allegedly from Dorestad, 6.8 x 4 cm. RMO Leiden inv. no. f 1940/12.2. Photo: RMO.

Figure 3. Bronze ring-pin of Petersen type 215 from Øvre Eiker, 10.3 x 4.5 cm. UiO Oslo inv. no. C21730. Photo: UiO (CC BY-SA 4.0).

more than twice the length of the diameter of the ring to ensure the right balance, so the short pin indeed raises the question whether our ring-pin could function optimally.[12]

Perhaps mostly known from Insular contexts, where many types developed over time, ring-pins also regularly occurred in Viking Age Scandinavia.[13] Some ring-pins found in Scandinavia are direct imports from the Insular world, others are contemporary Scandinavian copies or newly developed types based on inspiration from Insular examples. It is in the typology for these finds that we find a close parallel for the Dorestad ring-pin: Petersen type 215.[14] Petersen's type 215 is a later ninth-century (ca. 850-900) type of ring-pin that is based on insular inspiration, but believed to have been made in Norway. The find Petersen depicts as the type example is from Øvre Eiker, Buskerud (Figure 3).[15] Another find of the same type was found in Våga, Oppland.[16]

Looking closely at the parallels that at first sight seem identical to the Dorestad ring-pin, we notice some striking differences. As mentioned above, the pin on this example is strikingly short and the parallels, although one is missing part of the pin, both appear to have pins more than twice the diameter of the ring, therefore being perfectly balanced and useable. Secondly, whilst our ring-pin is of silver, the Norwegian finds are of a copper-alloy or bronze, and do not have a small loop attached at the back which our silver one does. These differences may simply reflect local variations and different choices in the process of making, but they add to the overall impression that the Dorestad pin is slightly unusual. This becomes particularly clear when one looks closely at the execution of the decoration. On the Norwegian examples, the lines are sharper and slimmer, there is more space between the lines and the individual elements of the decoration. Particularly slimmer and more protruding are the snouts of the animal at the lowest edge of the ring. On the gaping animals there is a distinct tongue and tooth, whilst on the Dorestad find these seem to merge into one. Here, the lines and shapes are more rounded, thick and overall more crudely exercised, giving a different effect and sitting slightly uncomfortably with the choice for more precious metal.

Another parallel that was identified a few years ago by Willemsen in Museum Boijmans Van Beuningen, Rotterdam, is on comparison an exact copy of the Dorestad ring-pin. The ring-pin has the same dimensions, including the short pin, the loop on the back and the decorations are equally rounded and crude. Again, this find is said to have been found in Wijk bij Duurstede, the site of Dorestad.[17] The only difference is that it is made from an untested alloy, and so are a whole range of objects in the Frederiks collection 'from Dorestad' that have exact parallels in the collections in Leiden in different materials, but whose interrelation is uncertain.

When we try to ascertain the site provenance for both alledged Dorestad ring-pins, it becomes clear that this

12 Thunmark-Nylén 1984, 5.
13 Laing 1993, 73-75; Thunmark-Nylén 1984, 5.
14 Petersen 1928, 179-181.
15 Museum of Cultural History, Oslo, C21730.
16 British Museum, London, 1891,1021.100.
17 Ypey 1967, 124-125.

is impossible. The Rotterdam finds stems from a large collection of early medieval and late medieval finds that was donated to the Museum by collector J.W. Frederiks in the 1960s, whist the Leiden ring-pin together with two other Dorestad finds were partially gifted by a mr. Spyer from the Amsterdam art dealer Mogrobi in December 1940. In 1941, these three Dorestad finds were depicted in the catalogue "*Wat de aarde bewaarde*" by a national-socialist publisher, aiming to showcase Germanic traits and influences.[18]

Although not leading to a conclusive judgement on the nature of our ring-pin, or ring-pins, the above at least emphasises the caution we need to take. We must embrace the possibility that the ring-pins are not from Dorestad and not from the ninth century, as well as keeping the contemporary local imitation theory in mind. Without metallurgical analysis we cannot understand their composition and relation, so until then, we must be careful about using this find as a prime example of Viking influence in Dorestad.

Scandinavian before Viking?

As a characteristic part of Viking female dress in particularly Scandinavia, oval brooches, sometimes called tortoise brooches, are well-studied. Typologies show their development from domed oblong brooches of the Vendel period to elaborate Viking age tortoise brooches, as well as highlight the great variety of individual designs within said development.[19] With few finds from the Continent, through publications we are most familiar with the big and elaborate tortoise brooches of the later Viking Age.

The oval brooch from Dorestad 'De Geer' (Figure 4), found just outside the Roman but within the Carolingian complex on De Geer, [20] is humbler in its appearance. It has been dated between 750 and 800, yet it has been classified as a peculiar local copy of the elaborate Viking tortoise brooch, which in fact are later.[21] This suggestion is based on the idea that a period of interaction with or influence from Viking Scandinavia in a multicultural site like Dorestad prompted the 'translation' of the Viking dress-accessory to this locally-made find.[22] This is primarily based on the small size and the incised decoration, differing from the relief on the heavy tortoise brooches, but these characteristics instead indicate that the Dorestad oval brooch can be classified as an earlier domed oblong brooch.

The Dorestad brooch has decoration in four medallions, probably containing stylised quadrupeds, and measures 90 x 55 mm. It seems to particularly fit with the Norwegian

Figure 4. The oval brooch from Dorestad De Geer, 750-800 AD, 9 x 5.5 cm. RMO Leiden inv. no. WD 771.2.38. Photo: RMO.

domed oblong brooches of the late eighth century. The two type-groups it seems most closely related to are the Transitional Types (TT) and R643-types, but as the main difference between them is the type of pin-attachment, which is completely lacking on the Dorestad brooch, it is impossible to say which it fits best.[23] As stressed by Rundkvist, there also is no merit in trying to fit strict categories or subtypes due to the level of variety, but his typology gives a good direction of development in time and space.[24] On that basis it can be said that our brooch is a TT, R643, mixed or related type from indeed the late eighth century, dating between 750 and 800 or 840 at the very latest.[25] Being Norwegian in type and an unusual object for our region, we can suggest the oval brooch is Norwegian at least in spirit, but we cannot draw firm conclusions on where the object was made.

So, rather than seeing the Dorestad oval brooch as a local interpretation of the elaborate later Viking Age tortoise brooches, it is an earlier development of the oval brooch, namely a domed oblong brooch. This forces us to reverse our thinking, which in fact fits better with the suggested dating of 750-800 and the chronology of Dorestad and De Geer.[26]

Dorestad versus the long Viking Age

It may not be surprising that the objects in Dorestad that could be Viking, or sometimes rather Scandinavian, are from the earlier phases of the Viking Age or even pre-Viking Age. For the same reason of chronology, it may also not be surprising that contemporary local copies of characteristic Viking finds through longer interaction are not yet identified. Clearly, Dorestad was embedded in the international trading network of the early Viking Age, suffered multiple Viking attacks and became an area

18 Van Heemskerck-Düker and Felix 1941.
19 Rundkvist 2010, 127-128.
20 Thanks to M. Kosian and A Willemsen; Van Es and Verwers 2010, 17.
21 National Museum of Antiquities, Leiden, WD 771.2.38.
22 Heeren and Willemsen 2017, 68.
23 Rundkvist 2010, 143-144. See for example type R643e for comparison on p. 153.
24 Rundkvist 2010, 128.
25 IJssennagger 2017, 200.
26 Van Es and Verwers 2010, 7-8.

where Danish warlords were able to establish a temporary powerbase with the blessing of the Carolingian rulers. But by the 860s, Dorestad had outplayed its role.[27] Trade became more dispersed in the coastal and river lands beyond the trading site in the later ninth and into the tenth centuries, when the Viking sphere of influence and distribution of Viking objects were at its peak.[28]

The last couple of years have seen an increasing number of finds connected to the Great Army that roamed England from 865 onwards, and through its activities established the Danelaw, come to light.[29] Finds from such contexts, typically including weights, hack-silver, dirhams and disc brooches from the established Danelaw, have become a frame of reference for Viking objects and Viking impact. For this phase of activity, Dorestad as a trading centre was too early and as a benefice perhaps too different. Turning our view to the wider coastal and riverine area beyond Dorestad, we know activity happened simultaneously as in Dorestad but also continued through the later ninth century onwards. Albeit on a much smaller scale and not suggesting anything like the impact in England, finds of weights, hacksilver and disc brooches that can be classified as Viking are starting to appear in historic Frisia. With internal regional differences, there seem to be a few core areas where these are found such as around the Vlie, around Walcheren and in Central Frisia, not always necessarily relating to Danish power-bases.[30] They particularly date to the late ninth and early tenth century, showing links with South Scandinavia, the Danelaw, and the Irish Sea region.[31]

These finds can be added to the established picture of how the Viking way of dealing with silver, seen through practices of hoarding, hacking and using dirhams, is present in the Frisian coastal area. It coincides with the dispersal of exchange after the decline of Dorestad and indicates that the coastal area is closely connected to the North, whist equally connected to the Carolingian south and its coin-based exchange.[32] Together, these finds and various textual traditions from throughout the North Sea world and from the Migration period into the thirteenth century, indicate a strong relationship with the coasts and people of the North Sea area over time. Although this relationship changed in the ninth century, it did not cease but found a new dynamic, resulting in the specific and light-touch local material footprint of the Viking phenomenon. Whilst Dorestad played the major role in this relation between Frisia and the Northern world as a hub of exchange in the first half of the ninth century, at the time of the later ninth and tenth-century Viking activity that left most of the traces throughout Frisia, Dorestad had already vanished.

Conclusion

Within the long and complex story of the Viking Age, it can be argued that finds from Dorestad and the Frisian coastal area represent two different sides, scales and phases of the Viking phenomenon in the Low Countries. The trading site, which undoubtedly was a multicultural and dynamic location, is connected to the northern world through trade and exchange in first phases of the Viking Age. It saw a shorter-term but undoubtedly intensive phase of Viking activity and exercise of power. Precious Viking and Scandinavian objects from the pre-Viking into the early Viking Period, such as the oblong brooch and the braided gold bracelet, fit well within this context. The Frisian coastal area more widely, on the other hand, had a long-standing relationship with the North Sea neighbours and besides being victim to Viking attacks simultaneously with and after Dorestad, developed a position connected to both the Viking and the Carolingian world.

To understand the Viking element in Dorestad's material, there is real merit in object analysis, typology and contextualisation. Combining detailed stylistic analysis, as done in this paper, with material analysis and further analysis of find-contexts would in the future give us more insights into the individual objects and their place in the story of Dorestad and the Viking Age. But is important to recognise that we cannot understand the story of a long, varied, widespread and multi-phased phenomenon as that of the Viking world and its relationship with the Low Countries solely through Dorestad.[33] If we want to understand the long Viking Age and how people and material were adapted to a local Viking footprint in the Low Countries, we need to also look beyond Dorestad in both time and space.

About the author

Dr. Nelleke IJssennagger-van der Pluijm received her PhD from the University of Groningen in 2017 for her thesis *Central because Liminal. Frisia in a Viking Age North Sea World,* in which she studied Frisia's connectivity with the Viking sphere in an interdisciplinary and long-term perspective. She was curator of archaeological and medieval collections at the Museum of Friesland (*Fries Museum*) in Leeuwarden, and Regional Curator for Cornwall for the National Trust (UK). In 2021 she became Director of the Fryske Akademy in Leeuwarden.

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27 Willemsen 2010, 177-179.

28 Besteman 2004, 25, 33-35.

29 For example Kershaw 2013; Hadley and Richards, 2016.

30 IJssennagger 2017, 250.

31 IJssennagger 2015.

32 Besteman 2004; Coupland 2006.

33 See for example Baug, Skre, Heldal and Jansen 2019, 64-74.

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Trading games?

Playing with/without the Vikings in Dorestad

Mark A. Hall

Introduction

There is a long history of discovery connected to gaming equipment from Dorestad, beginning with a glass conical piece (see Figure 7), discovered in 1842, in the De Heul cemetery area of central Dorestad and first published by Janssen in 1843.[1] It is within a pattern of distribution that encompasses all the main areas of Dorestad and spans the entire medieval period. This contribution outlines the evidence for playing board games (including the reuse of Roman gaming pieces) in early medieval Dorestad. Adopting a material, biographical approach, the paper ranges across aspects of reuse, materiality, context and the nature of the games being played, also pointing to other relevant examples of gaming equipment from across Europe in time and space. This will also enable, in line with the congress theme of 'Networks', the exploration of the role of board games in cultural transfer. In particular consideration is given as to whether the evidence for play in Dorestad signals cultural contacts with the Scandinavian world.

Opening the box

The general distribution of the pieces across Dorestad and Wijk bij Duurstede is shown in Figure 1. Not everything is included, as some of the objects have been poorly recorded, making it difficult to conclude where they were found precisely. There are four broad groupings of gaming material (Table 1): Roman, early medieval, later medieval and post medieval. There is some fluidity and ambiguity between these groups, again partly due to the poor historic recording of context. All pieces are in the catalogue at the end of this article, to which the D-numbers refer.

Roman (Catalogue D1-D9)

This group of originally Roman gaming pieces comprises four differently coloured glass paste counters and a sherd of *terra sigillata* or samian ware, recut into a small disc (Figure 2). Further sherds of *terra sigillata* have been found in the harbour area and dated to the second to early third century AD.[2] There are a number of Roman sites in the vicinity, most critically the fort and a cemetery at De Horden, both partially occupied

1 Janssen 1843, Plate II, 1; Willemsen 2009, 52.

2 Prummel 1983, 126.

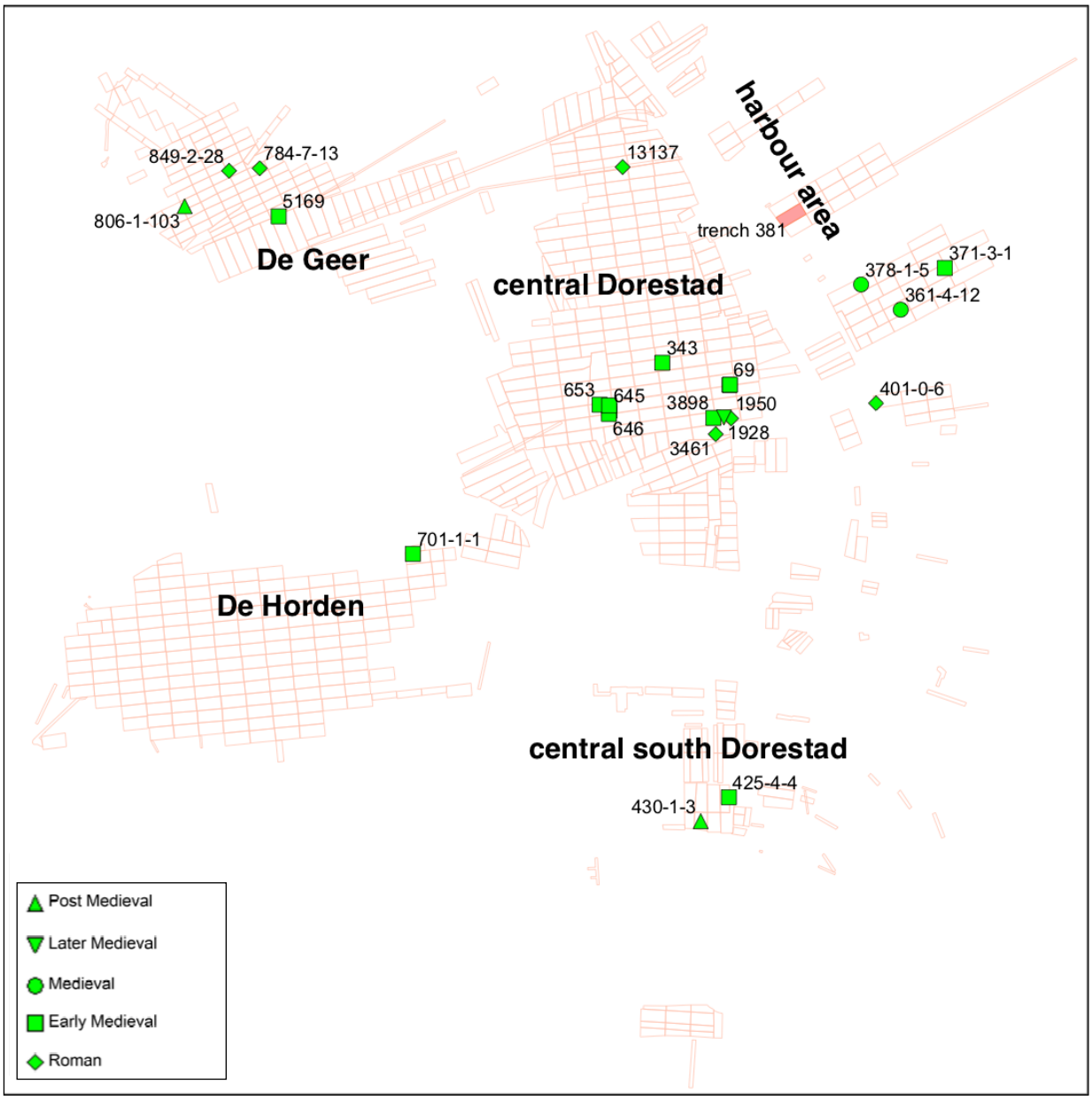

Figure 1. Map plot showing the general distribution of the gaming assemblage as found in Dorestad. Map: M. Kosian/RCE.

MATERIALS and TYPES	CONTEXT	PERIODS
Counters of ceramic (1) and glass (4)	De Geer (2) Central Dorestad (2) Harbour (1)	Roman in origin and reused in the early medieval period
Animal bone plaques (4)	Central Dorestad (3) South Dorestad (1)	Late Roman/early medieval
Disc/counter forms of animal skeletal material (8) and ceramic (1); conical pieces of animal skeletal material (31 including a set of 27) and glass (1)	De Geer (1) Central Dorestad (6) Harbour (29) De Horden (1) Uncertain (4)	Early medieval
Astragali of animal bone (2)	Harbour (2)	Early/late medieval
Animal skeletal material tablesman (1)	Central Dorestad (1)	Late medieval (c. 1100-1400)
Animal skeletal material domino (1)	South Dorestad (1)	Post medieval

Table 1. Dorestad gaming kit: chronology and context.

Figure 2. The Roman originating gaming pieces from Dorestad. Photo: M.A. Hall.

by early Dorestad. Written sources show that this fort ("Castrum Dorestat") was still standing in Merovingian times, at the turn of the seventh and eight centuries. Such reuse is seen as part of a wider pattern of adopting Roman forts as royal property by both Franks and Frisians.[3]

The Roman pieces are all essentially from the first/second centuries AD and appear to be examples of Late Antique and early medieval reuse of Roman objects. The fort and the cemetery are the most obvious candidates for where this material may have been found, collected and taken back to Dorestad, but origins further afield cannot be ruled out. Van Es and Verwers[4] outlined the complexity of the reuse issues around Roman ceramics and other materials in Dorestad. Large numbers of glass paste gaming pieces arrived on the Roman frontiers of Northern Europe in the second and third centuries, to be later committed to the burial record as prestige gifts and the Dorestad pieces may represent the outcome of disturbing such graves.[5] The four bone plaques from Dorestad are catalogued here (D6-D9) as they are probably early medieval, but it is not impossible for them to have originally been Roman.

Early medieval (catalogue D6-D53)

The first element of the early medieval gaming kit is the Roman pieces described above. Their distribution suggests later reuse in non-Roman contexts, but their finding as individual pieces broadens their interpretation – are they being reused as gaming pieces or curated curios and magical stones? Ursula Koch's discussion of the gaming pieces from the seventh century Frankish boy's grave at Herbolzheim, Heilbronn (Germany) notes the inclusion of some Roman glass playing pieces within a small number of Merovingian era graves.[6] The larger, non-Roman part of the Dorestad early medieval gaming assemblage provides the core of all the gaming finds. It exhibits a range of materials – bone, glass and ceramic – and although the contexts for some of the material are not well documented, notably for the plaques or tiles and the knucklebones, the significance of a potentially complete set, possible elements of a board and of a single glass piece are very high.

Knucklebones are a staple of the gaming record from ancient times and in Europe are known from ancient Rome and its outposts to post-medieval towns and cities across the continent. They are used as a form of lot or dice, sometimes associated with divination, and also as elements in games of dexterity played by children.[7]

Later medieval and post medieval (catalogue D52-D56)

The knucklebones could be both early or late medieval, but the most definitive late medieval piece is a single tablesman – a common form of disc used in playing a range of games known as tables, the best known examples being trictrac and backgammon. These are derived from the Roman games *Duodecim Scripta* – 'the game of twelve lines' – and *Alea*. They continued to be played in early medieval times, according to several observers, including Isidore of Seville,[8] but this type of ring and dot decorated piece does not become popular until the twelfth century. Dominoes are at least as early as the thirteenth century in China, but not known in Europe until the eighteenth century, when they spread northwards from Italy. This later material is not the main interest of this discussion and this paper now turns to address its main theme, aspects of play in early medieval Dorestad.

Board games in early medieval Dorestad

Piece D51 (Figure 3) is a sherd of Badorf ware, with its typical buff-cream fabric and rouletting decoration. This pottery type was produced in Badorf in the Cologne area and traded throughout the Rhine Valley and beyond. It was a key component of Dorestad's network, both at that regional Rhine Valley level and reflecting Dorestad's role as a transit point for longer distance trade and exchange. Sherds of at least 23,000 vessels of Badorf ware have been excavated from Dorestad.[9] When the jar, pitcher or bowl this sherd was originally part of was broken, this sherd had its edges lightly trimmed and smoothed to serve as a playing piece. It is perhaps the most clearly biographical aspect of the gaming assemblage from Dorestad, and one that is comparable to the well-recognised phenomenon of

3 Van Es and Verwers 2015, 375-378.
4 Van Es and Verwers 2015, 419-422.
5 For an overview see Hall and Forsyth 2011, 1325-1338.
6 Koch 1982, 387-474.
7 Bertelli, Malnati and Montevecchi 2008, 123, 150.; various contributions in Gläser 2012; Dasen 2019, 92-7, 104-13.
8 Isidore of Seville 2006, 371, lx-lxviii; Murray 1941, 57-69.
9 Willemsen 2009, 130.

Figure 3. Sherd of Badorf ware re-cut as a gaming counter. RMO Leiden, inv. no. WD 5169. Photo: RMO.

the reuse of Roman pottery as gaming pieces, constituting a formally recognised potential stage in the biographical trajectory of such pottery.[10] It represents perhaps a casual, ephemeral reuse of materials in plentiful supply – it would have needed companion pieces to make a full set or sets. It would have contrasted sharply with a set made from *terra sigillata* (Samian ware) or bone or indeed of plain Badorf sherds. Its improvisational qualities suggest board games were played across Dorestad's social hierarchy. The likely games played with such pieces would certainly include mill/merels and conceivably variants of both tables and *Tafl*. This is the only early medieval gaming piece from the De Geer area.

The remainder, and the more substantial, elements of the early medieval gaming assemblage from Dorestad are all composed of animal skeletal material. The larger proportion comprises a seemingly complete set for *Hnefatafl* (D10-D37), to be discussed below, with the remainder falling into three distinct forms: rounded conical forms (D38 and D39), pointed conical forms (D45-D47) and flattened hemispherical/plano-convex counters (D40-D45).

Their relatively small numbers and their spread across Dorestad suggest there were many sets available in the town. Three pieces (D41-D43) appear to have been in a fire. There is no evidence for cremation in Dorestad, so perhaps they were disposed in a domestic fire or lost in a house conflagration. They bear comparison with contemporary pieces from Birka (Sweden), *e.g.* those from Grave 917 and also a wider distribution from the seventh century such as the mixed stone and bone sets from the Frankish burial at Herbolzheim, Bavaria (Gemany), the pieces from Speyer, Pfalz (Germany), the 57 planoconvex counters (with two cubic dice) from Prittlewell, Southend, Essex (England), and the various set elements from Spong Hill, Norfolk (England).[11] The typological description just given does not include the two unstudied pieces from Dorestad (D48 and D49), which in form are more like the tablesmen, though less well finished – possibly unfinished? – that is seen in the seventh century and earlier from Anglo-Saxon England, Southern Germany and Italy.[12]

A full set

Undoubtedly one of the most significant elements of the Dorestad assemblage is the complete set of playing pieces plus a die, almost certainly for *Hnefatafl* (D10-D37; Figures 4a and 4b). The completeness is suggested by the types of piece and the number (27), enough to lay-out a meaningful arrangement of 16 attacking pieces and 10 defenders led by a king piece. The king piece has a crowning bronze or iron stud inset with coloured glass. All the pieces have their bases perforated, most likely to take a peg so that they might be pinned in place on a wooden or bone board. The pawns are all of a similar type and presumably, if this was their arrangement, they were originally distinguished by colour, which has now worn off. The presence of a single die, of typical rectangular form, hints that the set may be incomplete; when such sets are found with dice there are usually two or three. Two of the sets from Birka (Sweden), include three dice: grave 644 (with glass pieces) and grave 581 (with bone pieces, the burial recently re-identified as a female warrior suggesting the importance of board game skill to that gender attribute).[13] The group from Ulltuna (Sweden), discovered in 1855,[14] comprises 37 (whale) bone pieces, one designated as a king by being larger and with a flat, copper alloy trefoil hat or crown across the top, and three elongated dice. There are two dice with 19 burned pieces from the Viking boat burial at Ile-de-Croix, Brittany (France).[15] The presence of dice can seem odd, but they may have been meant to add a divinatory aspect through the addition of fate determining the moves. More simply it may have been the appeal of adding unpredictable chance to the game's appeal. It is also true that the association of similar kinds of playing pieces with dice is chronologically deep.

The late sixth century princely burial from the Anglo-Saxon cemetery in Southend-on-Sea, Essex (England) has already been mentioned above. It

10 Peña 2007, 158-159, 160-164, 205-206.

11 Arbman 1943a, 57; Arbman 1943b, pl. 150.1; Koch 1982, 387-474; Stauch 1994; Blackmore *et al.* 2019, 247-253; Riddler 2013, 148-55.

12 Hall 2018, 195-218; Zintl 2016, 91-93.

13 Arbman 1943b, pl. 147.3, pl. 148.2; Price *et al.* 2019, 181-98.

14 Statens Historiska Museer, Stockholm inventory no. 2194.

15 Price 1989; Hall 2016, 439-455.

Figure 4a. Complete set of bone gaming pieces for Hnefatafl. Photo: M.A. Hall.

Figure 4b. Die. RMO Leiden, inv. no. WD 371.3.1b. Photo: RMO.

included 57 hemispherical or plano-convex counters and two dice, thought to have been kept in a leather bag, which, when committed to the grave, was hung on a wall peg along with a wooden board suspended by its iron handle. Only the handle and metal fittings of the board survive, which was resting on the floor of the chamber along with the pieces and the dice. At the other end of the chronological spectrum we can cite the fifth-fourth century BC Etruscan glass pieces (15) and a single bone die from burial 397 at the necropolis of the Certosa di Bologna (Italy), the glass pieces (24) and two bone dice from burial 128 at Arnoaldi (Italy), and the glass pieces (18) and three bone dice from burial 132 at Arnoaldi.[16] The assemblage from Certosa di Bologna 397 includes an untypical dark blue-green counter with an applied green spiral over yellow intersecting lines, giving it a strikingly similar appearance to the much later piece from Dorestad (see below). The Etruscan pieces probably relate to a version of the Greek game *Pente Grammai* (the five lines), which appears to be related to the backgammon group and which may have influenced the Roman development of the game.[17]

Generally speaking, complete or near-complete sets are largely known from funerary contexts – the Birka sets (and others) have already been cited and the amber 'set' from the burial mound at Skamby (Sweden) can be noted here.[18] There are occasional single or low numbers of gaming pieces from non-funerary, domestic/urban contexts (*e.g* the amber piece from Kaupang (Norway)[19] but complete sets are rare and so the Dorestad set is additionally exceptional

Figure 5. Bird's-eye view of Dorestad and its jetties. Artist: W. Euverman.

in being a complete set from a non-funerary context. The pieces were recovered from the harbour/lower town excavations along the Hoogstraat.[20] They do not appear to have been found in a house, but rather in one of the shelters built on one of the many jetties that projected out into the Rhine (Figure 5). These structures appear to have been occupied at least seasonally, presumably in relation to the arrival of ships. They are certainly in the main zone of contact between dwellers and visitors, Scandinavian or otherwise. From within the same excavation trench (371) came several pieces of ironwork including a knife, staples, a boat hook, points, two hammers and some plate fragments, a glass smoother, fragments of glass, leather scraps, a wooden scoop/shovel and an amber bead. Collectively, especially the glass, they suggest a date of AD 750-850 and certainly the gaming pieces do not contradict such a date.

16 All in the Museo Civico Archaeologica di Bologna, Italy, see Schädler 2019, 160-74; Macellari 2002.

17 Schädler 2009, 173-196; Kidd 2017, 83-99.

18 Rundkvist and Williams 2008, 69-102.

19 Resi 2011, 116-117.

20 Van Es and Verwers 1980.

Gaming boards

In terms of gaming boards (usually wood or bone), these are often the rarest of elements to survive archaeologically. Complete boards, as with the Irish example from the elite domestic context of Ballinderry Crannog (Ireland),[21] are incredibly rare and its completeness vitally reminds us that there is more than one way to handle a board. Partial boards are more common in the archaeological record, as with the examples from the Årby (Sweden) boat burial, the Gokstad (Norway) boat burial and the Frankish burial from Speyer, Pfalz (Germany).[22] More commonly, boards survive as fittings, that is, hinges, plates, handles and sometimes feet. Birka burials 886, 624 and 581 each included fittings for a board, comprising corner bindings and rivets.[23] The wooden board from Valsgärde 8 (Sweden) was reconstructed based on finding the pieces and the handles.[24] At Birka, similar handles were also used on casket lids (as well as buckets and hanging bowls), and some of these caskets would have been ideal for keeping gaming pieces in; bags were also used for this purpose, as interpreted for Valsgärde 7.[25] More recently, the already mentioned burial from Prittlewell (England) was found to have included a board, which survived through its handle and attachment plates. Further afield, the Roman board for *Duodecim Scripta* excavated at Qustul (Egypt) also had a handle for carrying and suspension on one of its long sides[26] – this board is important for the understanding of the Dorestad evidence.

This discussion of the archaeological evidence for gaming boards is by way of a contextual preliminary to the second, highly significant highlight of the Dorestad gaming assemblage, the hitherto unrecognised elements of one or more boards. They take the form of four, rectangular, bone plaques or tiles, with the upper face decorated with ring-and-dot motifs rather like the numbering on dice, in each case numbering five (D6-D9; Figure 6). They are closely paralleled by near identical Roman, Late Antique and early medieval examples – from Sedeinga (Sudan) and Qustul (Egypt), and from the Crypta Balbi in Rome (Italy) and the Santo Stefano necropolis in Cividale (Italy) – all identified as elements of boards for the game of *Duodecim Scripta*, or 'the game of twelve lines', later *Tabula* or *Alea*, early forms of backgammon.[27]

Figure 6. *Duodecim Scripta/tabula* gaming board tiles from Dorestad. Photo: M.A. Hall.

The game boards and pieces from two Meroitic burials at Seidinga (Sudan) were excavated in the early 1960s. Burial WT8 (a joint male and female inhumation), included 15 white and 13 black glass gaming pieces and two ivory dice. WT3 (a male inhumation) included 27 black and white, wood and ivory playing pieces, three ivory dice, fragments of a wooden board and possibly a storage box and 32 ivory tiles. The board games involved were poorly understood and misinterpreted as a chess or checkers game. Recently this aspect has been re-evaluated and a new interpretation offered.[28] The gaming assemblage is dated to the first/second century AD and it is the ivory tiles that are of most relevance to the present discussion. The majority of the 32 square tiles are blank and three are incised with ring-and-dot configurations, like the faces of dice, giving the numbers five, seven and eight. Comparing these with the complete, fourth century board, excavated in Qustul (Egypt) in the 1930s, allowed the identification that the Seidinga tiles were part of a board for the game *Duodecim Scripta*, the blank ones serving to demarcate the three race lines and the three decorated pieces probably forming the decorative elements in the centre of the board.[29] The board from Qustul and the elements from Seidinga thus permit the interpretation of the Dorestad tiles as elements of a board for *Duodecim Scripta*, though a date as early as the second-fourth century is not evidenced by the known burial record for this site, outside of De Horden. More likely in the overall context of Dorestad is that the tiles are sixth to eigth century AD in date.

This interpretation is suggested by further tiles from early medieval Italy, which in the context of the discussion here I suggest should be reinterpreted as elements of the race course layouts for *Duodecim Scripta/Tabula* boards.

21 O'Neill Hencken 1933, 85-104; Wallace and O' Floinn 2002.

22 Arbman 1940, 43-102; Nicolaysen 1882, 46-47; Polenz 1988, pl. 158.7; Hall 2016, 439-455, table 1.

23 Arbman 1943b, pl. 1a, 1b, 2 and 3.

24 Arwidsson 1954, pl.27.

25 Arwidsson 1977, pl. 1060 1/1, 1/2.

26 For Prittlewell see Blackmore *et al.* 2019, 250-252; for Qustul see Emery and Kirwan 1938, pl.87; De Voogt *et al.* 2017, 23-33, fig. 6.

27 Austin 1934, 24-34 and Austin 1935, 76-82; Murray 1951; Schädler 1995, 73-98; Parlett 1999.

28 De Voogt *et al.* 2017, *op.cit.* in n. 25; De Voogt 2019, 89-99.

29 Emery and Kirwan 1938, *op. cit.* in n. 25, 345; De Voogt *et al.* 2017, *op. cit.* in n. 25; Youngs 1983, 871 & n. 3.

These sixth-seventh century elements were excavated from the Longobardic necropolis of Santo Stefano, Cividale and from the San Lorenzo monastery workshop dumps at the Crypta Balbi, Rome.[30] At Santo Stefano, in tomb 24 the gaming assemblage included eight complete and partial tiles, with ogre edges and ring-and-dot motifs of four. From the Crypta Balbi the games assemblage includes 14 complete and partial tiles, again with the 'four' ring-and-dot motifs, also, like the Santo Stefano tiles, quartered. In addition there are several triangular tiles which may have decorated the frame of a gaming board. In the Crypta Balbi excavation report both reconstruction images, of the board and of the workshops with a board being made, depict a chequerboard interpretation – this misunderstands the evidence and here it is suggested that all these tiles represent elements of *Tabula* boards. The Crypta Balbi workshop is one of several Mediterranean workshops, including ones in Constantinople (Istanbul, Turkey) and Alexandria (Egypt),[31] whose outputs included gaming material, some of it being exported into Northern Europe. This suggests a plausible context for the arrival and use of the Dorestad tiles as part of a gaming board in the mid-first millennium AD.

There appears to be a more widespread under-recognition of such pieces as gaming board elements in the archaeological record. Generally such plaques are identified as fittings for boxes and caskets or as gaming pieces. A minimal search through the literature suggests that a re-assessment is needed; this would potentially identify a significantly increased number of such boards. The major excavations at Lullingstone Roman villa in Kent (England) recovered 30 plano-convex, glass gaming counters and two bone dice. The counters formed an element of a group of burial-goods within a temple-mausoleum. They were laid atop the remains (metal fittings) of a wooden board, in turn laid on top of 17 small, decorated bone plaques.[32] Whilst the report ventures a half-sentence that "some may have been used in the board-game," implying use as pieces, there is no notion that they were elements of the board. It ventures the interpretation that they were mounts from the box in which the gaming pieces may have been kept. An extensive listing of further, comparable mounts, from Britain, is discussed in the context of four mounts discovered in Orkney (Scotland).[33] Many of these (and notably those from Bu Sands, Orkney, would fit the model of interpretation as gaming board elements.

30 S. Stefano: Silva *et al.* 1990, 50-51, 123; Crypta Balbi: Arena *et al.* 2001, 416-418, with ill. p. 417 and pl. 129.

31 Hall 2018, 206-207.

32 Meates 1979, 129-130; Meates 1987, 143-144.

33 Hunter 1994, 319-336.

One glass piece

The third, and final, highly significant element of the gaming kit from Dorestad is the glass conical piece referred to at the start of this paper (Catalogue DX and Figure 7). Apart from anything else it has a huge artistic, aesthetic appeal. Similar to the bone set it has a basal perforation facilitating the attachment of a peg so that the piece could be used on a wooden or bone board. Determining which piece it is exactly is tricky without other pieces – it could be a king piece in a set of plain glass pieces or pieces of another material. It could also be a pawn in a set with a differently coloured king piece.

There are a range of parallels in terms of glass gaming pieces from the eighth and ninth centuries. The most well-known perhaps is the set from the Storhaug boat burial in Gunnershaug, Avaldsnes (Norway).[34] From further afield comes an equally striking example (Figure 8), excavated by Leslie Alcock at the Pictish hillfort of Dundurn, Perthshire (Scotland). Until recently this was seen as a unique piece but in late 2018, a second example (Figure 9), again with white feather trailing on dark blue glass and with the addition of five small white bosses across the top, contrasting with the swirling white and blue combination of the Dundurn piece (both possibly symbolising a crown and so designating the piece a *Hnefi* or king piece) was excavated during the Dig Ventures/ University of Durham project at Lindisfarne Abbey, Northumberland (England).[35] Both pieces are from non-funerary, domestic contexts.

Returning to the Scandinavian world, there are well-known glass pieces, both pawns and anthropomorphic kings, from the Birka graves 523, 644, 710 and 750, including three dice with one of the sets (grave 644), which oddly also seems to have two kings, and the group of pawns from the tenth century boat grave 3, Valsgärde (Sweden).[36] But the closest parallel is undoubtedly the recent find from Groß-Strömkendorf (Germany), the former Slavic, later Carolingian emporium of Reric on the German Baltic coast (Figure 10). As with the piece from Dorestad it is a conical piece with a dark green body overlain with red, yellow and white feather trailing. The find was a chance one made without any recorded context. An eighth or ninth century date fits in with the known archaeology (both trade and manufacture)

34 Roes 1965, 143, fig. 11, cat. 123; Bill 2019, 316 and fig. 5.6.

35 Dundurn: Alcock *et al.* 1989, 189-226, ill. 4.26, pl. 216, where it is identified as a boss; Hall 2007, 51, re-identifying it as a gaming piece. The Lindisfarne piece is currently being researched but see: https://digventures.com/2020/02/stunning-1200-year-old-glass-king-gaming-piece-found-on-Lindisfarne/.

36 Birka: Arbman 1943b, pl. 147.1 and 147.2, pl. 148.1 and 148.2; Lindquist 1984, 215. Valsgärde: Graham-Campbell and Kidd 1980, cat. 71 and pl. 37; Graham-Campbell 1980, cat. 95.

Figure 7. Conical glass gaming piece from Dorestad. RMO Leiden, inv. no. WD 343. Photo: RMO.

Figure 9. Glass gaming piece from Lindisfarne Abbey, Northumberland, find no. LDF 19 131. Photo: M.A. Hall.

Figure 8. Glass gaming piece from Dundurn, Perthshire. Hunterian Museum, University of Glasgow, GLAHM 138 398. Photo: M.A Hall.

Figure 10. Glass gaming piece from Groß-Strömkendorf. LMD Mecklenburg-Vorpommern, Landesarchäologie, inv. no. ALM2016 1109 131. Photo: S. Suhr.

of Reric.[37] As with Dorestad, there is evidence for glass manufacture at Reric and so these pieces could have been made in both places or one of them may have specialised in such gaming pieces. Reric's floruit was also the eighth century, and was brought to an end in the early ninth century by a Danish Viking raid and the forced removal of surviving merchants to the Danish emporium of Hedeby/Haithabu. In addition, there is a fragmentary piece from the southern shore of the Baltic, at Old Wolin (Poland), contextually dated to 1000-1050 AD. Published as a semi-circular gaming piece with a single trail or loop snaking around the body, the published description suggests the original colours are hard to identify because of corrosion.[38] As published, the underside appears not to be flat but rough, uneven and corroded and it would appear that it is the upper section of a conical gaming piece consistent with those discussed here.

A further gaming piece from collections of the Rijksmuseum van Oudheden at Leiden (Figure 11), 2.5 cm high, comes form a terp mount at Ferwerd, Friesland (the Netherlands) and is dated to the eighth century. Despite appearances it is not glass but the molar of an elk or moose, and there are comparable examples from Birka, using horse molars, from the Anglo-Saxon site at Faversham, Kent (England). Its fine blue-marbling effect invites the question as to whether some of the glass pieces may have been referencing animal skeletal examples, or indeed vice versa?

Whose game is it anyway? Play as cultural interaction and hybridity

This paper moves towards its concluding endgame, investigating the role of board game play in signalling cultural/social identities and cross-cultural networks, something we might sum up with the word 'mobility. This is not a straight forward issue because, generally

37 Wollschläger 2016, 252-255, ill. 200.2; for the background: Brather 2003, 514-515; Happ 2004; Harck and Lübke 2001; Jöns 2015, 245-252.

38 Kokora 2019, 215-216 and fig. 68.41.

Figure 11. Conical elk/moose molar gaming piece from Ferwerd, Friesland. RMO Leiden, inv. no. a 1921/10.180a. Photo: Mark A Hall.

speaking, whilst gaming kit survives from the past, the rules of play rarely do. We are often dealing with groups of games that have shared and imprecise identities that come about through human interactions and in response to the identities and aspirations of their players. Their rigid aspect of rules does not diminish their facility to create spaces for exchange and communication – they are cultural skills, a form of transferable communication. Their own language of play means they can cross boundaries, making them fundamental to cultural hybridity.[39]

The evidence discussed in this paper for play in Dorestad and the context of its understanding (including wider political and economic contexts) aggregates into an extensive network of places with shared play practices, including Frisia, Britain, Scandinavia, Germany and northern Italy. Dorestad was of course right at the frontier of Frankish and Frisian interaction. For the higher, elite level this has been skilfully summarised by Van Es and Verwers,[40] navigating a course of occasional conflict, political marriages and estate confiscations on either side of the Frisian-Frankish line. The settlement grew to its prosperous height under Charlemagne and Louis the Pious. A series of Viking raids and failed protection from Danish sub-rulers during the mid-to-late ninth century meant that by that century's end: "the network of persons and institutions that had led to Dorestad's prosperity had been torn apart".[41] But as Van Es and Verwers acknowledged, some contacts continued, notably the trade with the Austrasian territory around Cologne (Germany), signalled by the continuing arrival of Rhenish wares. Calamitous as events no doubt were for those facing their immediacy, it was still part of a pattern that over several centuries witnessed the cultural mixing of Romans, Batavians, Frisians, Franks, Scandinavians, Anglo-Saxons and no doubt others.

But unpicking the different cultural elements and assaying them an ethnicity is a dangerous and elusive game. The conical molar (see Figure 11) from the Ferwerd terp is from deep in Frisian territory, sandwiched between Franks and Danes, but is it uniquely Frisian? Certainly the evidence suggests it was part of a shared package of cultural traits used to create a sense of identity. It is part of a rich tradition of gaming pieces suggesting interaction with Scandinavian players and vice versa. There are several comparable molar pieces, for example, from Birka, including the six from grave 524[42] and indeed further afield, including examples from Anglo-Saxon Faversham, Kent (England), where 61 horse molar pieces and one die were excavated in the so-called King's Field between 1858-1868 and dated to the sixth/seventh century.[43] The style of bone gaming pieces in the harbour-found set from Dorestad certainly feels like it looks north to Scandinavia rather than south and east to Francia (though some of Dorestad's plano-convex pieces might). The archaeology does not appear to suggest an exclusive link for the gaming pieces with the elites of either side, Frisian or Frankish, in Dorestad. The link for most of it must lie in the to and fro of the movements of people and goods.

If the gaming pieces were not made locally, how did they arrive? And if they were made locally, by whom? The jetties of the harbour area (see Figure 5) supported a range of warehouses and other buildings that facilitated trade and production. The building in which the set was found was a shelter, a permanent structure but not necessarily permanently occupied. These seasonal structures are summed up by Van Es and Verwers as the fixed equivalent of the summer fair, mooring it conceptually to the river. Their understanding of the evidence encompasses ships' crews practising crafts whilst moored up, some in their boats no doubt if the stay was short and others using the 'shelters' or – as they call them – "pieds à terre, where they stayed in season and possibly also for the winter".[44] The gaming set could have been made here during one of those summer sojourns. It has been long held that the glass gaming pieces found in Scandinavia were likely made elsewhere in Europe – both Dorestad and Reric were places of glass manufacture and ideally placed to feed such material into the network. On present evidence,

39 Hall 2019, 199-212; Purcell 1995, 3-37.
40 Van Es and Verwers 2015, 378-389.
41 Van Es and Verwers 2015, 388.
42 Arbman 1943a, 160-161; Arbman 1943b, pl. 149.1.
43 British Museum registration 1284.70.
44 Van Es and Verwers 2015, 386.

Scandinavian traders rather than Vikings per se may be the most plausible leading agents helping to spread the tangible kit of board games along with the intangible concepts of use and adaptation in a friction-filled world of exchange, borrowings and hybridisations.

Future Moves

Future work can be considered for the Dorestad gaming assemblage that would help to answer these and other questions about materials, material supply, design and network contacts. Scientific analysis of the skeletal materials to determine species both terrestrial and marine and what kind would offer insights into the economic resourcing of play in the emporium. On-going analysis of material from Scandinavia, to determine the extent of marine mammal exploitation in the making of gaming pieces, is a good comparison model. It has revealed new data on the innovative use of whalebone for gaming pieces from the mid-sixth to the tenth century, with a switch to walrus ivory from the eleventh century.[45]

XRF analysis of the Dorestad king piece would confirm the materials used to create his 'crown' and could also reveal any microscopic traces of pigmentation on all the pieces. Similar analyses of the glass cone and the Roman glass paste pieces might help to determine recipes and potentially localise the production. Radiocarbon dating of all the skeletal pieces could furnish a much tighter chronological model and test whether styles of piece were successive or concurrent. In this game, science has all the winning moves.

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45 Hennius *et al.* 2018, 612-631.

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Outline catalogue of the gaming material culture from excavations in Dorestad

Cat. no.	Period	Find number and context	Material	Description	Game	Ref
D1	Roman (origin) Early medieval (reuse)	WD 849.2.28 From trench 849, De Geer area	Ceramic	Small, ceramic disc, re-shaped from a sherd of Samian pottery. Very worn, no trace of decoration and largely de-glazed. Diam.: 2.5cm.	Roman: ludus latruncu-lorum/merels/tabula (alea) Early medieval: merels/ tables	
D2	Roman (origin) Early medieval (reuse)	WD73 401.0.6 From trench 401, Harbour area	Glass paste	Opaque, turquoise, hemispherical counter. Diam.: 1.5cm.	Roman: ludus latrunculorum/merels Early medieval: merels/tafl?	
D3	Roman (origin) Early medieval (reuse)	WD 13137 From trench 259, Central Dorestad area	Glass paste	Opaque, pale, creamy-blue hemispher-ical counter with some pitting and base scarring. Diam.: 1.5cm	Roman: ludus latrunculorum/merels Early medieval: merels/tafl?	
D4	Roman (origin) Early medieval (reuse)	f 1950/3.1 From trench 34, Central Dorestad area	Glass paste	Opaque, white, hemispherical counter with much pitting in-filled with dirt. Two drilled holes horizontally aligned. Apparently found in two halves and restored. Diam.: 1.5cm	Roman: ludus latrunculorum/merels Early medieval: merels/tafl?	
D5	Roman (origin) Early medieval (reuse)	WD 784.7.13 From trench 784, De Geer area	Glass paste	Opaque, black, hemispherical/bun-shaped counter with some scarring and pitting. Diam.: 1.5cm	Roman: ludus latrunculorum/merels Early medieval: merels/tafl?	
D6	Late Roman/early medieval	WD 653a (II 446) From trench 35, Central Dorestad	Animal bone/ antler?	Rectangular plaque, creamy-brown colour, upper face incised with single ring-and-dots to make five motifs, like a die-face. Dimensions: 3.0x2.3x1.0cm	Duodecim Scripta/tables (a board element)	
D7	Late Roman/early medieval	Possibly WD74 425.4.4 If so, from trench 425, central south Dorestad	Animal bone/ antler?	Rectangular plaque, polished, dark-brown colour, upper face incised with single ring-and-dots to make five motifs, like a die-face. Dimensions: 3.3x2.5x1.0cm	Duodecim Scripta/tables (a board element)	
D8	Late Roman/early medieval	WD68 3094 Probably from trench 35, Central Dorestad area	Animal bone/ antler?	Rectangular plaque fragment, approximately one half only, retaining three ring-and-dot motifs (one partial) of it's inferable original five. Grey-blue colouration typical of burning (crema-tion?). Dimensions: 2.5x1.4x0.6cm	Duodecim Scripta/tables (a board element)	
D9	Late Roman/early medieval	WD68 3898 Probably from trench 35, Central Dorestad area	Animal bone/ antler?	Rectangular plaque, one corner, with its ring-and-dot motif, missing, other four largely intact, confirming a five motif. Grey-blue colouration typical of burning (cremation?). Dimensions: 2.8x1.6x0.5cm	Duodecim scripta/tables (a board element)	
D10-D37	Early medieval (750-900AD)	WD 371.3.1a and b From trench 371, Harbour area	Animal skeletal material (bone?)	Set of 27 domed/conical pieces, including one king piece distinguished by a composite insert (iron and glass?) in head. Diameter range: 1.9-2.9cm. Height range: 1.6-2.3cm. A rectangular die with opposing faces numbered 1:1, 3:5 and 4:6. Dimensions: 3.1x1.9x1.9cm	A tafl/hnefatafl variant. The die could also be used for tables and other games/ gambling	Van Es and Verwers 1980, 240; pl. 23, fig. 161-62 Willemsen 2009, 52-53, illus. 53;
D38	Early medieval (750-900AD)	WD 645 (II.300). '37' on underside label. From trench 25, Central Dorestad	Animal bone (?)	Single domed/conical piece, with a highly polished grey appearance. Flat underside, coarsely finished. Centrally placed, tapering cavity, partially obscured by handwritten label ("37"). Diam.: 2.6cm; height: 2.2cm.	A tafl/hnefatafl variant.	Roes 1965, cat. 178 and p.55
D39	Early medieval (750-900AD)	WD 646. From trench 25, Central Dorestad area	Animal bone (?)	Single domed/conical piece, with a highly polished grey appearance. Flat underside, coarsely finished and with centrally placed, tapering cavity. Some gouge/scar marks on one face. Diameter: 2.7cm; height: 2.3cm	A tafl/hnefatafl variant.	Roes 1965, cat. 178 and p. 55
D40	Early medieval (750-900AD)	WD 649 (II.297). '39' on underside. From trench 25, Central Dorestad area	Animal bone (?)	Polished hemispherical piece decorated on upper surface with three double-ring and dot motifs. Small label on underside is inked with "39". Not clear if this covers a cavity. Diam.: 3.5cm	Merels/a tafl/hnefatafl variant. Possible amulet?	
D41-D43	Early medieval (750-900AD)	WD72 15802 a, b and c	Animal bone (?)	(a) Plain, polished, blackened, hemispherical counter. Underside has a central, tapering cavity. Burnt (?). Diam.: c.3.5cm (b) Polished, grey, hemispherical coun-ter with slightly off-centre tapering cavity. Burnt (?). Diam.: c. 3.0cm (c) Polished, grey, hemispherical coun-ter with slightly off-centre tapering cavity. Burnt (?). Diam.: c. 3.0cm	Merels/a tafl/hnefatafl variant.	Van Es and Verwers 1980, fig. 160

Cat. no.	Period	Find number and context	Material	Description	Game	Ref
D44	Early medieval (750-900AD)	WD69 3461 (?) If correct from trench 46, Central Dorestad	Animal bone/ antler?	Plain, polished, hemispherical counter. Diam.: 1.7cm	A tafl/hnefatafl variant/ merels	
D45	Early medieval (750-900AD)	WD 72 16320	Animal bone (?)	A lightly polished, hemispherical counter with a rougher underside, no central piercing. Diam.: c. 3.5cm	Merels/a tafl/hnefatafl variant.	Van Es and Verwers 1980, fig. 160
D45	Early medieval (750-900 AD)	WD? 69 (number partially erased). From trench 3, Central Dorestad	Animal bone (?)/ antler (?)	Irregular, pointed conical piece. Highly polished Diam.: 1.5cm; height: 1.8 cm	A tafl/hnefatafl variant/ merels	
D46	Early medieval (750-900 AD)	WD70 10101 (not a known number in the Dorestad database). Possibly from trench 701, in the De Horden area	Animal bone/ antler (?)	Polished, pointed conical piece. Diam.: 1.8 cm; height: 1.2 cm	A tafl/hnefatafl variant/ merels	
D47	Early medieval (750-900 AD)	WD 650 (II. 419)	Animal bone/ antler?	Plain, polished, conical counter, with flattened-off tip. Diam.: 1.7 cm	A tafl/hnefatafl variant/ merels	
D48	Early medieval (750-900 AD)	Number and location currently unknown, but from the Harbour, Hoogstraat 1	Antler	Unfinished, plain disc.	Merels/tables Possibly an amulet?	Van Es and Verwers 1980, 240 and fig. 163
D49	Early medieval (750-900 AD)	Number and location currently unknown, but from the Harbour, Hoogstraat 1	Antler	Finished, plain disc, polished smooth from handling	Merels/tables Possibly an amulet?	Van Es and Verwers 1980, 240 and fig. 163
D50	Early medieval (750-900 AD)	WD 343 From trench 12, Central Dorestad area	Glass	Conical form, of opaque, dark green with a feather-like pattern of light blue and yellow/cream, culminating in a yellow apex. Flat base with a peg-hole. Diam.: 2.3 cm; height: 1.8 cm	A tafl/hnefatafl variant/ merels	Van Es and Verwers 2015, 250, fig. VI 19 1 Janssen 1843, pl. II Willemsen 2009, 52-53, illus. 55-6; Willemsen 2010, 2 and fig 2
D51	Early medieval (800-900)	WD 5169 From trench 204, in De Geer area	Ceramic	Badorf ware sherd with rouletting decoration cut down into a disc; buff-cream colour. Diam.: 4.8 cm	Merels/tables	Willemsen 2009, 52-53; illus. 57
D52	Early/later medieval	WD72 378.1.5 From trench 378, Harbour area	Sheep/goat astragalus	Plain knucklebone. Dimensions 2.8x2. ox1.8 cm	Divination/children's game	
D53	Early/later medieval	WD72 361.7.12 From trench 361, Harbour area	Sheep/goat astragalus	Plain knucklebone. Dimensions: 3.0x2.1x1.9 cm	Divination/children's game	
D54	Later medieval (earlier date not impossible but likely to be post 1100 AD)	f 1928/? From trench 34 in Central Dorestad area	Animal bone/ antler?	Round, flat, polished disc, upper surface decorated with a series of concentric rings one of them filled with a ring of single perforations/dots; a single dot/perforation at the centre. The underside is badly damaged leaving only a tiny surviving area of polished surface. Diam.: 3.0 cm; th: c.1.0 cm	Tables/merels	
D55	Post medieval	WD74 430.1.3. From trench 430, in southern part of Dorestad	Animal bone/ antler?	A pale, lightly polished domino, rectangular, divided into two compartments with a single, central line. One numbered 6 and the other 2, the numbers made by shallow cup marks. At each of the short ends is a single rivet hole with copper alloy staining. These suggest reuse as a box mount or perhaps edging for a board. Dimensions: 2.2x1.9 cm	Dominoes	
D56	Post medieval	WD 806.1.103 From trench 806, in the De Geer area	Copper alloy	A small, octagonal plaque, one face punched to give shallow pips (5) that show in relief on the opposite face.	The purpose of this item has not been determined. Probably not gaming related.	

A new gold ring from Dorestad?

Channa Cohen Stuart
and Annemarieke Willemsen

In July 2018, a small gold ring was found in a garden along the Hoogstraat in Wijk bij Duurstede (Figure 1).[1] It is decorated with partite triangles pressed into the gold, a type of decoration known from seventh-century pottery, which indicates it might be an early medieval ring. If it is, it is the first chance find from Dorestad in a century. The ring was acquired by the Municipality of Wijk bij Duurstede to be placed in a new Museum Dorestad that is scheduled to open in 2021.

A lucky find

In the summer of 2018, a horde of the moth *Cydalima Perspectalis* ate its way through the gardens of Wijk bij Duurstede. Several bushes of boxwood perished under the ravenous larvae, causing despair among gardeners. One of them, a resident of the Hoogstraat, had his grandson over for the weekend, and they decided to take the moth-stricken bushes down. After digging their way through the *buxus*, and carrying off loads of sand, a circular object caught their eye. The gardener, a retired plumber, assumed that it was a plumbing ring. But the size was odd and he thought it was a finger ring. A gold one. A few days later, when his son picked up the grandchild, the child told his father about grandpa's ring. The son was really interested in the object and decided to call an archaeologist friend. J. Langelaar took it upon himself to clean the object and consulted some other friends and specialists. In the meanwhile, the Hoogstraat resident searched through his garden, with a metal detector as well, but found nothing else. He realised that loads of sand had been removed before he found the ring. And he also reached out to the municipality of Wijk bij Duurstede, the National Museum of Antiquities (RMO) in Leiden and some other parties trying to understand the object and its value. All felt it might be an early medieval ring, although its exact shape raises questions, and the object was not scientifically tested. Nevertheless, the municipality bought the ring from its finder and owner and it will be on permanent loan to the future Museum Dorestad there. Until then, it is on loan to the RMO, where it is researched further.

Figure 1. Ring found in 2018 along the Hoogstraat in Wijk bij Duurstede. Photo: A. van de Bunt/Landschap Erfgoed Utrecht.

1 Portable Antiquities of the Netherlands (PAN) no. 59626 (https://portable-antiquities.nl/pan/#/object/public/59626).

Figure 2. Ring (Figure 1) documented for PAN. Photos: A. van de Bunt/Landschap Erfgoed Utrecht.

The ring

With a diameter of 18 mm, a height of 3 mm, a thickness of under 1 mm and a weight of 1,52 grams, the ring (Figure 2) is small and a bit flimsy. On the outside, 18 decorations have been stamped into the ring. At about the middle of the height, there are ten small triangles 2 mm high with parallel lines, all made with the same stamp. These are alternating with eight impressions of the same stamp placed higher and partly off the ring, of which the impressions show only the base of the striped triangle. In two places, two triangles are next to each other without a higher mark between. The stamp is pushed into the gold very lightly, leaving a very low relief, with the sharpest impression of the right-hand side, indicating the stamp was placed from the left side and 'rolled' towards the right. The higher placed marks often push up the upper rim of the ring, which as a result varies in height and is not straight. There are no markings on the inside, but there are traces of hammering and the joint is slightly visible.

The ring was found in a garden in the only part of the Hoogstraat with houses that predate the large excavations in this area of Wijk bij Duurstede in the 1960s and 1970s (Figure 3). It is on the side of the Hoogstraat where the settlement of Dorestad was located, while on the other side of the street was the former harbour. The house was built post-war in 1947. It can be assumed that the garden, that was constructed then, did not change substantially. Analysis of the floorplans of these houses, available at the city archives of Wijk bij Duurstede, reveal that they do not have cellars, or deep trenches. It is likely that the soil

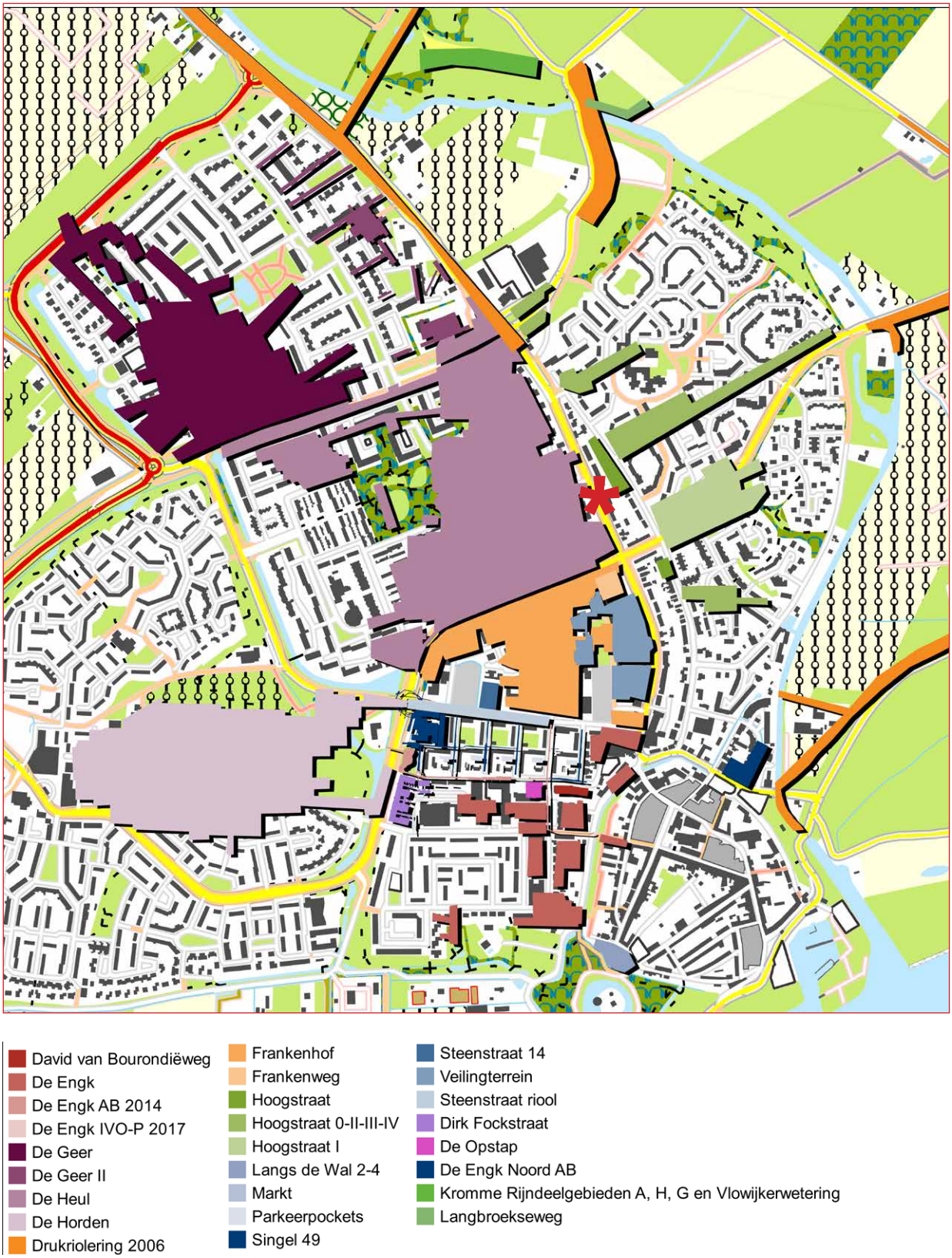

Figure 3. Map of Wijk bij Duurstede overlaid with the excavation tranches of Dorestad, and the find spot of the 2018 ring indicated with an asterisk. Map: ADC ArcheoProjecten.

Figure 4. Ring found in 1846 in Wijk bij Duurstede. RMO Leiden inv. no. WD 674. Photo: RMO.

of the garden came from the building work itself, as the ground removed for foundation digs was probably used to level the grounds in this area, as there was a difference in elevation between the former harbour front and the former harbour. XRF-analysis of the composition of the ring in 2020 by Dennis Braekmans, initiated by the RMO in Leiden, showed that it is 84% pure gold, about 20 carat.

Other rings from Dorestad

From early medieval Dorestad, another gold ring with a stamped decoration of triangles is known (Figure 4). It was found in 1846, when L.J.F. Janssen, then curator of the National Museum of Antiquities documented it (and made a wax impression of it) in the Utrecht collection of N. Balfoort. It was subsequently acquired for the museum and inscribed in 1868 with inventory number WD 674.[2] At the time, it was dated to the first half of the ninth century, but it is unclear on what grounds. This ring has some similarities with and some differences to the new find. The nineteenth-century find is slightly wider (20 mm), much higher (from 2 to 8 mm) and also thicker, making it sturdier. It weighs 2,57 grams and has a gold content of 81%, also 20 carats. It has a broad middle piece that tapers towards smaller ends, that are slightly overlapping. The ends were never soldered. The ring is made from a thin sheet of gold, that was folded inwards on both long sides; its seam can be seen inside and runs about the middle of the height. This ring is also decorated with triangles, also in two rows, but in this case they are 3 mm high and placed fully onto the surface of the ring with the tips pointing towards each other. All these were done with the same stamp, that leaves a small stub in the middle. On the wider, middle part there are nine stamped points above and below the double line of triangles, alongside the rims of the ring. All impressions are pushed well into the gold, made possible by the composition of two layers of gold sheet, leaving a much higher relief that on the new find. The nineteenth-century ring does have an uneven upper rim like the new find, partly caused by the hammered decoration, in this case the points, pushing up the rim. This ring was likely used as a finger ring. The other gold finger rings from Dorestad (like WD 15767[3] and WD 800.1.20) are from another type, having a D-shaped profile and a set stone or gemstone.

Parallels and dating

The decoration on both rings from Wijk bij Duurstede have another parallel in those on a ring from the Wieuwerd hoard, found in 1866 and dated based on the coin pendants in the first half of the seventh century, around 630 AD (Figure 5).[4] This is a taller, biconical ring, with rows of stamped points alongside the upper and lower rim, with in between two times a double row of small triangles pointing towards each other. The ring

2 Willemsen 2018, 153-154.

3 Wilemsen 2009, 71, 74.

4 Lafaurie, Jansen and Zadoks-Josephus Jitta 1961; Willemsen 2014, 125-127.

Figure 5. Ring from the Wieuwerd hoard. RMO Leiden inv. no. BnW 1. Photo: RMO.

is 21 mm in diameter and 14 mm high, weighing 3,6 grams. The impressions are deep and very much alike the ones on the 19th-century ring from Dorestad, but its thin rim is alike the new ring. The Wieuwerd hoard also contains another ring of the same biconical type, but undecorated, as well as two kidney-shaped pendants. Recently, a similarly shaped pendant (17 x 22 mm) was discovered in a small hoard with some gold *tremisses* coins, dating the hoard to the later part of the seventh century AD.[5]

These parallels indicate that the newly found ring is from the middle of the seventh century AD, as well as the older gold ring from Dorestad. This means both stem from an early, Merovingian phase of Dorestad, well known for the gold coins minted here, with the name of Madelinus and the statement *Dorestat fit* ("made in Dorestatus").[6] The model of the new find raises the question if it was used as a finger ring. Its small size is not decisive; it might be interpreted as a ring for the little finger, or for a child. Its thin sides are more problematic. It is possible that it was used as a hair ring, for a small braid, or hanging from a necklace, sewn onto clothing, or as decorative band on a small circular case, for instance a needle case.

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5 Portable Antiquities of the Netherlands (PAN) no. 59565 – with thanks to Stijn Heeren.

6 Willemsen 2014, 108, 113.

Beads from Dorestad

Mette B. Langbroek

Introduction[1]

During most archaeological campaigns at Dorestad, a significant number of beads were excavated. In contrast to beads from Scandinavian emporia such as Ribe, the beads from Dorestad have never been studied as a complete set. Several small bead assemblages from different excavation locations in Wijk bij Duurstede have been briefly published in excavation reports,[2] but a closer look at these beads was necessary, focusing on their use, deposition and provenance. As the publications of beads found in Scandinavian emporia show,[3] their study can contribute significantly to our understanding of the international networks Dorestad was part of.

Throughout the Early Middle Ages, beads occur very regularly in north-western Europe. In cemeteries dating to the Merovingian period (c.450-751 AD) colourful strings of beads were deposited in graves on a regular basis.[4] This deposition pattern changed in the second half of the seventh century: beads were excavated from only a handful of cemeteries dating to the late seventh and eighth centuries in the Netherlands. These rare bead sets have not been intensively studied at all, which has resulted in a lack of knowledge of Late Merovingian and Carolingian (751-c.900 AD) beads. This lack of bead studies in north-western Europe contrasts sharply to bead research in Scandinavia, where (pre) Viking-Age (c.800-1050 AD) beads have received a lot of attention during the past decades.[5] Some researchers of Scandinavian bead material have suggested that Scandinavians had few opportunities to obtain beads from the West, as they believe the use of beads had largely fallen out of fashion in north-western Europe.[6] The study of the beads from Dorestad thus presents an opportunity to create a basic corpus for beads from the late seventh, eighth and early ninth century in the Netherlands, and can indicate whether bead-networks between the west and Scandinavia had indeed come to a stand-still.

In this article, 395 beads found during the Dorestad excavations will be discussed. These are the Late Merovingian and Carolingian beads from twentieth- and twentyfirst-century excavations of the settlement sites at Hoogstraat (with the harbour), De Heul, Voorwijk, Veilingterrein, De Horden, Zandweg and Albert Heijn, and the cemeteries on De Heul and

1 This article is part of the 'Rural Riches' project funded by the ERC under the ERC-Advanced Grant (Grant agreement No. 741340).

2 Isings 1980; Isings 2015; Sablerolles and Henderson 2012.

3 Callmer 1977; Callmer 1991; Anderson and Sode 2010; Sode 2019.

4 Langbroek 2016.

5 Callmer 1977; Callmer 1991; Anderson and Sode 2010; Sode 2019; Delvaux 2017.

6 Delvaux 2017, 7.

Willigenburg, plus some beads from nineteenth century excavations in the area of the Hoogstraat, of which the find location remains unprecise. They are all kept in the Dorestad Collection at the National Museum of Antiquities (RMO) in Leiden. Several more beads from nineteenth-century excavations are present in the collection of the Provinciaal Utrechts Genootschap (PUG) kept at Landschap Erfgoed Utrecht, but the largest 'chunk' is definitely presented in this article. Hopefully the author will have the opportunity to study the remaining beads in the future. Due to a lack of sieving activities during the Dorestad excavations far into the 1990s, many more beads must have been missed. With this article comes a catalogue with a description per bead and a set of colour plates on which each bead from Dorestad is depicted (p. 69-99).

Research method

The beads found in Dorestad have been determined using two typologies: the typology for Merovingian beads that was developed by Constantin Pion in 2014, and the typology for Viking beads developed by Johan Callmer in 1977. Besides identifying and dating each bead according to these typologies, their material, condition, production technique, find location, colour(s), decoration, shape and provenance were documented. With the help of a stereomicroscope, several observations were documented per bead as well. Finally, all beads were photographed.

Pion's typology is based on the seriation of over 21,000 beads found in six Merovingian cemeteries in Belgium. It was adjusted and improved by Vrielynck, Mathis and Pion in 2018. In this typology, each bead type is dated to one or multiple periods (P1, P2, P3, P4 or P5) within the Merovingian era (Table 1). It was developed around the techniques used to manufacture Merovingian beads, a factor that had not been considered in previous typologies.[7] Early medieval beads were produced using a variety of techniques; most glass beads were either drawn or wound, but folded, perforated and mosaic beads occur regularly as well. Beads of other materials than glass, such as amber or amethyst, were shaped by cutting or knapping techniques before being polished. In Europe, evidence for winding beads has been found, but not for the other glass bead-making techniques: those are thought to have been restricted to the Eastern Mediterranean and/or the Near East.[8]

Callmer's typology is based on an extensive study of beads from Viking Age sites in Scandinavia. In his typology, each bead type is dated to one or multiple periods (BP I, BP II, BP III, BP IV, BP VII, BP VIII, BP VI, BP IX, or BP XII (Table 2). Callmer classified beads using straightforward descriptions of colour, shape, and size. Like Pion's typology,

Period	Legoux 2004	Date (approximation)
P1	MA1	480-530
P2	MA2	530-570
P3	MA3	560-610
P4	MR1	600-640
P5	MR1/MR2	620-670

Table 1. Pion's bead periods.

Period	Date (approximation)
BP I	before 820
BP II	820 – 845
BP III	845 – 875
BP IV	875 – 905
BP VII	905 – 935
BP VIII	935 – 955
BP VI	955 – 965
BP IX	965 – 990
BP XII	990 – 1000

Table 2. Callmer's bead periods.

Technique	Number of beads	Percentage
?	25	6.33%
cut	15	3.80%
drawn	71	17.97%
folded	3	0.76%
lathe-cut	1	0.25%
modelled	18	4.56%
mosaic	14	3.54%
perforated	4	1.01%
wound	244	61.77%
Total	**395**	**100.00%**

Table 3. Manufacturing techniques of beads found in Dorestad, in both amounts and percentages.

Provenance	Number of beads	Percentage
?	13	3.29%
Local (?)	2	0.51%
Europe	229	57.97%
Scandinavia	24	6.08%
Baltic	12	3.04%
Eastern Mediterranean	37	9.37%
Egypt	19	4.81%
Near East	59	14.94%
Total	395	100.00%

Table 4. Provenances of beads found in Dorestad, in both amounts and percentages.

7 For example Siegmund 1998.

8 Pion 2014, 178-229.

Figure 1. Amber beads found at Dorestad. Photo: R.J. Looman/ RMO.

it also takes into account the techniques that were used to produce beads.

Neither of these typologies turned out to be ideal for this case study: Pion's typology effectively ends around 650 AD, and Callmer's typology starts at the end of the eighth century. Many of the beads found at Dorestad date precisely from the period in between. Luckily, beads excavated in Ribe, which is mostly contemporaneous with Dorestad, have been elaborately published, and have been a great help in determining and dating beads from Dorestad.[9]

In total 395 beads from the Late Merovingian and Carolingian eras were studied. Of these 281 are monochrome and 114 are polychrome. They were made in at least nine different techniques (Table 3) and were produced both in Dorestad itself and much further away (Table 4). In the following, the beads will be discussed by material, provenance and technique.

Materials used

Almost all of the beads found in Dorestad are made of glass. Carolingian glass usually has an origin in the Near East, where both natron glass and Islamic plant-ash glass were produced.[10] This was confirmed for glass from Dorestad by analyses of glass finds from the Veilingterrein excavations.[11] Far fewer beads were made of faience, amber, ceramics, shell, amethyst, copper or bone (Table 5).

Table 5. Materials of beads found in Dorestad, in both amounts and percentages.

Material	Amount	Percentage
Glass	358	90,40%
Faience	17	4.29%
Amber	12	3.03%
Ceramics	3	0.76%
Shell	2	0.51%
Amethyst	1	0.25%
Copper	1	0.25%
Bone	1	0.25%
Total	**395**	99.75%

Amber

In comparison to the large amounts of raw amber that were found in Dorestad, there are relatively few amber beads: only twelve, of which three are trapezium shaped pendants and four are large 'spindlewhorl-beads' (Figure 1). In the Merovingion period amber beads occur much more often.[12] Raw amber was not only traded in Dorestad, it was also worked on site: during excavations of Hoogstraat I many small fragments of amber were documented.[13] Unfortunately only large pieces of raw amber were collected during the fieldwork,[14] so it is difficult to establish the type of amber objects that were made in Dorestad: perhaps future studies of the amber working remains found at the Veilingterrein site can give a more decisive answer. Most likely the large amounts of amber found in Dorestad where imported from the Baltic or Southern Scandinavia, even when small amounts of amber could be collected from the Dutch coastline.[15]

Faience

Seventeen Roman melon beads made of faience were excavated in Dorestad. Roman melon beads are known to have circulated for a long time after their manufacture in Egypt in the first and second century AD, as they are found regularly in Merovingian contexts throughout Europe.[16] Twelve of them were found during excavations at the site De Horden and may have been found in Roman context.

9 Anderson and Sode 2010; Sode 2004; Sode 2019; database of beads found in Ribe at http://sol.sydvestjyskemuseer.dk/.

10 Freestone 2006; Freestone 2015.
11 Sablerolles and Henderson 2012, 338-350.
12 Langbroek 2016.
13 Van Es and Verwers 1980, 169.
14 Willemsen 2009, 125.
15 See Langbroek 2016 and Kars and Wevers 1983 for a discussion on the provenance of early medieval amber.
16 Pion 2014, 174-176.

As other potentially early medieval beads have been excavated on De Horden, these twelve specimens were incorporated into the study.

Ceramics

Three beads made out of ceramic material were found in Dorestad. Unfortunately, their find location in Dorestad remains unknown. Two of the beads are large and were probably used as spindle whorls. The other bead is of a smaller annular type, that was perforated after the body was baked.

Amethyst

On the Veilingterrein site, one almond shaped amethyst bead was found. Amethyst beads typically occur in this region in the seventh century AD.[17]

Shell

Two shell-disc beads were excavated from grave 88 in the cemetery on De Heul. This bead type is well-known from many late seventh-century graves throughout Europe,[18] but also occurs on ninth- and tenth-century sites on Gotland.[19] Several shell-disc beads were also excavated in Ribe.[20]

Copper

Amongst the beads of unknown location within Dorestad is one bead made of a twisted copper wire. It is heavily corroded.

Bone

The only bead made of bone was found in the settlement area of site De Heul. It has a bright white colour: it was probably exposed to a source of heat.

Glass beads from Europe

Almost 68% of the studied beads were made somewhere in Europe. Most of these 268 'European' beads were made by winding molten glass around a metal rod or mandrel. In the perforations of many of these beads some black tarnish can be observed: iron that came loose from the hot mandrel. Depending on the type, these beads were made locally or regionally. Noteworthy, these locally or regionally produced beads are very comparable to beads that were found elsewhere in Europe. A possible explanation is that similar beads

Figure 4. Ribe-beads found at Dorestad. Photo: M.B. Langbroek.

were made by travelling craftsmen.[21] However, it is not unthinkable that some of the common types were produced in a single place and spread throughout Europe via exchange networks. Two bead types found in Dorestad, waspbeads and so-called 'Ribe-beads', are an example of centrally produced wound beads, as they are thought to have been manufactured in Ribe.[22]

Monochrome wound beads

In total 242 beads made of wound glass were excavated in Dorestad. Most of these, 161 pieces, are monochrome. Monochrome wound beads (Figure 2) are notoriously difficult to date, as they were very common from the Iron Age onwards. The most common colour amongst monochrome wound beads in Dorestad is translucent blue, followed by opaque red, opaque green, opaque yellow, opaque white and opaque black. Orange does not occur often (but see 'Mystery beads' below). In Scandinavia, blue monochrome wound beads are very common.[23] Classifyied by shape, the annular bead is most common with 56 examples. Other shapes that occur regularly, though less often, are cylindrical shapes, barrel shapes and biconical shapes. These are also the most common shapes in monochrome wound beads from Viking Age Scandinavia.[24]

Polychrome wound beads

In total, 82 wound and polychrome beads were studied (Figure 3). The most common decoration patterns are coloured borders, waves, spirals, interlacing waves and eyes. Most of the polychrome wound beads were made with two or three different colours. Most polychrome beads have a base of black, red or blue with a yellow or white decoration. These colours and decorations are all also the most common among polychrome wound beads from Viking Age Scandinavia.[25]

17 Drauschke 2011, 51; Huggett 1988, 66; Ljungkvist 2009, 6.
18 Siegmund 1998, 77; Ament 1976, 309; Drauschke 2011, 64.
19 Textandtrowel.wordpress.com
20 Personal communication by Pieterjan Deckers.
21 Sablerolles and Henderson 2012; Dijkstra, Sablerolles and Henderson 2010.
22 Sode 2004.
23 Callmer 1977, 80.
24 Callmer 1977, 42-45.
25 Callmer 1977, 45-51.

Figure 2. Monochrome wound beads found at Dorestad. Photo: M.B. Langbroek.

Figure 3. Polychrome wound beads found at Dorestad. Photo: M.B. Langbroek.

Figure 5. Wasp beads found at Dorestad. Photo: M.B. Langbroek.

Ribe beads

Only three so called 'Ribe-beads' with their characteristic blue body and red and white decoration patterns were found in Dorestad (Figure 4). Most likely, these were manufactured in the early or middle eighth century AD in Ribe, where production waste of this bead type has been excavated.[26]

Wasp beads

21 so-called 'wasp beads' dating to the second half of the eighth century were excavated in Dorestad. Wasp beads are easily recognizable by the bright yellow bands that are wound around a dark (black, green or red) core (Figure 5). In the Netherlands, this type of bead was also found in the cemeteries of Wijchen-Centrum and Zweeloo,[27] and further to the north they are known from Reric.[28] Most wasp beads have been excavated in Ribe, which is why it has been suggested they were produced there.[29]

Goldfoil beads

Very surprising bead-finds from Dorestad are two wound beads with a gold foil decoration (Figure 6). Both were found at the site Albert Heijn. The pattern of the gold foil is similar to the gold foil decoration that was found on glass vessels excavated elsewhere in Dorestad, and consists of bands and

26 Sode 2004, 90-91.

27 Hazenberg and Heeren 2010, grave 44; Van Es and Schoen 2008, 911-912.

28 Pöche 2005.

29 Sode 2004, 95; personal communication by Pieterjan Deckers.

Figure 6. Wound beads with goldfoil decoration found at Dorestad. Photo: M.B. Langbroek.

diamond shapes.[30] One of these beads appears to have been wound from a shard of such a decorated vessel. The other one is a so-called 'eye-bead', of which the surface was at some point 'upgraded' with a gold foil decoration. The gold itself is not preserved completely, yet the imprint of the gold foil is still visible. No parallels to these beads are known to the author: probably these were made as local improvisations.

Mystery beads

The manufacturing technique of a group of 15 mostly red and orange[31] barrel shaped and elongated oval beads was difficult to establish (Figure 7). In the glass, irregular patterns were observed that did not tally with any of the techniques of bead manufacture known to the author. Sode, Gratuze and Lankton have described similar barrel shaped red and orange beads from Scandinavia, that date to the seventh and eighth century AD. According to them, these beads were somehow shaped around a mandrel, which results in poorly fused seams and irregular lines in the beads. It is possible that the long oval and barrel shaped red and orange beads from Dorestad were also made using this method. The Scandinavian examples were made out of different kinds of glass, amongst which high-alumina glass from Northern India, a region where similar beads have been found. The consensus so far is that these red and orange 'mystery beads' were made in Europe with any sort of raw glass that was available to the bead maker.[32]

Glass beads from the Near East

About 115 of the 395 studied beads were manufactured in the Near East: a portion of 29% that reflects the international character of Dorestad. The question remains via which routes these beads travelled. Due to the fact that Near Eastern beads are found regularly in Scandinavian emporia[33] and the lack of evidence for similar beads in north-western Europe, researchers of Scandinavian bead trade have suggested that beads from the Near East were transported to Scandinavia via the Russian river system.[34] Now that it has been established that these beads are found in significant amounts in Dorestad, it cannot be ruled out that Near Eastern beads were also transported northwards via European rivers, as their Merovingian predecessors were.[35]

Segmented metalfoil beads

The segmented metalfoil beads that were found in Dorestad consist of two layers of drawn glass that sandwich a thin layer of silver foil. The outer layer is usually made of a translucent colourless or brown-yellow glass that, in combination with the silver foil, creates either a silver or gold illusion. Blue outer layers that create a silver-metallic effect also occur. In Dorestad, a total of 45 segmented metalfoil beads were excavated, that date towards the end of the eighth century AD (Figure 8). Similar beads are known from several sites in Scandinavia, but are also found in Slovenia and Hungary. These beads are thought to have been produced in the Eastern Mediterranean, where their predecessors were produced in the sixth century AD.[36] This was confirmed by chemical analyses of segmented metalfoil beads from Scandinavia, that demonstrated them to have been made out of Islamic plant-ash glass.[37]

Tiny beads made of drawn glass

Amongst the beads, there was a set of eighteen drawn beads (Figure 9). Most are monochrome and very small: they were manufactured by cutting up thin, hollow rods of glass and were subsequently heated to round off the cut edges. Like segmented beads, these small beads were made in the Near East. They are often found in sixth-century graves in Europe, but are no longer found in burials from the start of the seventh century AD onwards.[38] From the end of the eighth century AD, they reappear again: they were excavated in large numbers in Haithabu, Birka and Ribe,[39] and were also found in a grave in Paderborn.[40]

30 Willemsen 2009, 139, 150-151; Sablerolles and Henderson 2012, 314-317.
31 Not all are orange or red: one is green, another is blue.
32 Sode, Gratuze and Lankton 2017, 331.
33 Sode 2019, 186-187.
34 Sode 2019, 193; Delvaux 2017, 16; Callmer 1991.
35 Pion 2014.
36 Greiff and Nallbani 2008, 361.
37 Sode 2019, 187-189.
38 Pion 2014, 199.
39 Sode 2019, 189-190.
40 Stiegemann and Wemmhoff 1999, 173-174.

Figure 7. Mystery beads found at Dorestad. Photo: M.B. Langbroek.

Figure 8. Segmented metalfoil beads found at Dorestad. Photo: M.B. Langbroek.

Mosaic beads

14 mosaic beads were found in Dorestad and they are the most spectacular beads excavated. They were built up from several pieces of mosaic glass. These were made by cutting them from mosaic rods of polychrome glass, that were composed in such a manner that in the interface patterns of eyes or flowers were created. Most mosaic beads from Dorestad are so-called 'eye-beads' from the late eighth and early ninth century AD (Figure 10). In the early medieval period, mosaic beads were mainly produced in the Near East, most likely in Egypt, but remains of a mosaic bead workshop were also excavated in Ribe.[41] The mosaic beads found in Dorestad all have an origin in the Near East: they share no similarities with the mosaic beads produced in Ribe. Similar beads have also been excavated in Scandinavia, Russia, South-East Asia, the Middle East and Northern Africa.[42]

Lead glass beads

Lead glass beads are hexagonal beads that are cut from a hollow glass rod with very high lead content. These beads are generally a bright emerald green colour, but they are prone to weathering and then develop an opaque white colour.[43] Lead glass beads have been excavated in Scandinavia, Northern Germany, and Central Europe.[44] They date to the eighth and ninth century AD. Probably, they were made in the Syrian-Egyptian region and were imported together with segmented metalfoil beads.[45] Six hexagonal lead glass beads were found during the nineteenth-century excavations of Dorestad, and at the sites Veiligterrein, De Geer, and the cemetery on De Heul (Figure 11). Four are of an emerald green colour and two are weathered into white opaque beads.

41 Andersen and Sode 2010.
42 Sode 2019, 186-187.
43 Andrae 1975, 131.
44 Callmer 1977, 90; Steppuhn 1997.
45 Steppuhn 1997, 209.

Figure 9. Drawn beads found at Dorestad. Photo: M.B. Langbroek.

Figure 10. Mosaic beads found at Dorestad. Photo: M.B. Langbroek and R.J. Looman/ RMO.

Figure 11. Lead-glass beads found at Dorestad. Photo: M.B. Langbroek.

Distribution throughout Dorestad

For most beads, the general find location could be reconstructed. However, the exact find location could not be established for beads found in the nineteenth century and 32 beads of which the find numbers are currently missing. The beads from Dorestad were found in the cemeteries on De Heul and Willigenburg, in the harbour (part of the sites Hoogstraat, Zandweg, Voorwijk) and in the settlement areas (sites Hoogstraat, De Heul, Veilingterrein, Albert Heijn, De Geer, De Horden). At each location a similar variation of beads was found: both wound and drawn beads, both monochrome and polychrome beads, both beads produced regionally and from much further away. Each section of Dorestad thus demonstrates a similar bead-loss pattern (Table 6). Even the beads that were deliberately deposited in the cemeteries on De Heul and Willigenburg show the same variation in types, techniques and provenance. Clearly, the same bead types that were worn in everyday life were also used in the burial ritual.

The deposition of beads in (pre-) Viking Age graves in Scandinavia, especially beads that were imported, is often ascribed to the higher social classes.[46] The random bead-loss pattern throughout the settlement of Dorestad does not support this interpretation. In the Netherlands, both in Merovingian and Carolingian times, beads from all corners of the world seem to have been broadly available.[47]

Production waste

During the excavations of site Veilingterrein some remains of bead production were discovered: besides thirteen glass *tesserae* and some evidence for the production of glass vessels, nine pieces of coloured glass rods, drops of molten glass and coloured raw glass were

46 See for example Delvaux 2017, 10.

47 Langbroek 2018.

Site	Local (?)	Europe (wound beads)	Scandinavia (Ribe-beads and waspbeads)	Baltic (amber)	Eastern Mediterranean (segmented beads)	Egypt (faience and amethyst)	Near East (drawn and mosaic beads)	Unknown provenance	Total
Albert Heijn	2	1	1	0	0	0	7	0	11
Cemetery on De Heul	0	56	0	0	20	1	6	0	83
De Heul	0	10	1	1	2	1	6	0	21
Hoogstraat	0	12	2	5	0	2	2	2	24
Veilingterrein	0	12	6	0	5	1	7	0	31
Voorwijk	0	7	1	0	1	1	2	0	12
Cemetery Willigenburg	0	28	0	0	0	0	2	0	30
Zandweg	0	9	1	0	0	0	4	0	14
De Horden	0	4	0	0	0	12	1	1	18
De Geer	0	2	1	0	0	0	3	0	6
19th Century	0	70	11	5	9	1	14	3	113
Unknown Location	0	21	0	1	0	0	5	5	32
total	2	230	24	12	37	19	59	13	395

Table 6. Provenances and manufacturing techniques per find location in Dorestad.

Figure 12. Bead production remains found at the Veilingterrein and Zandweg. Photo: M.B. Langbroek and R.J. Looman/RMO.

Site	findnr	subnr	Material	Glass subcategory	translucent/ opaque	colour(s)	Observations Microscope	Remarks
Veilingterrein	Veilingterrein 4834	1	glass	monochrome	translucent	colourless translucent	Round drop of glass production waste. One side is smooth, other side is rough with many bubbles	Could have been used for either bead or vessel production.
Veilingterrein	Veilingterrein 4150	2	glass	monochrome	opaque	yellow opaque	A piece of a drawn rod of yellow opaque glass with square section. Bubbles on 1 side, which must have been close to a source of heat. Other side is relatively smooth.	Could have been used for either bead or vessel production.
Veilingterrein	Veilingterrein 3289	3	glass	monochrome	opaque	white opaque	A piece of a drawn rod of white opaque glass with round section. It is broken lengthwise into two pieces. Iridisation on the surface, following the drawing lines.	Could have been used for either bead or vessel production.
Veilingterrein	Veilingterrein 3647	4	glass	polychrome	both	colourless translu-cent, white opaque	A piece of a twisted reticella rod. Colourless translucent core with a white opaque spiral. Similar to rods found in the early medieval monastery Vincenso al Volturno in Italy.	Could have been used for either bead or vessel production.
Veilingterrein	Veilingterrein 5791	5	glass	monochrome	opaque	green opaque	A wound bead which was flattened at one side, closing the perforation. At one side the perforation can be seen clearly, with black tarnish (iron from the mandrel) attached to it. It looks like it was pinched closed with a hot iron utensil, as black and red tarnish can be seen on the surface of the flattened side.	Definite bead production remains.
Veilingterrein	Veilingterrein 5041	6	glass	monochrome	translucent	blue translucent	Flake of a rounded cake of blue translucent glass, with some of the original smooth rounded surface. Oval bubbles visible in the glass, very regularly spaced.	Could have been used for either bead or vessel production.
Veilingterrein	Veilingterrein 6500	7	glass	monochrome	opaque	yellow opaque	3 pieces of the same opaque yellow glass melted together: a 4-lobed rod, a large rounded piece, and a thin piece with black tarnish: clearly sat on a mandrel/pontil of about 10 mm diameter.	Could have been used for either bead or vessel production.
Veilingterrein	Veilingterrein 6071	8	glass	monochrome	translucent	colourless translucent	Flake of colourless translucent glass, with some grey tarnish at one side: sat on a pontil/man-drel with about 5 mm diameter. Iridisation on the surface.	Could have been used for either bead or vessel production.
Veilingterrein	Veilingterrein 1195	9	glass	monochrome	opaque	yellow opaque	Thick flat piece of yellow opaque glass. Yellow lead stannite inclusions visible in the paste. The broken off sides have some black iron stains. Also, some ceramic pieces seem to have nested in the paste of the sides. Perhaps it is just clay that got fired and coloured red when this piece of glass was near a heat source?	Could have been used for either bead or vessel production.
Zandweg	WD 754.2.63b	10	glass	monochrome	opaque	white opaque	Tiny globular bit of glass with some large air bubble-gaps in it, that look like a perforation to the naked eye. One of those air bubble-gaps is filled with a red and black substance that looks like the red and black tarnish you often see in perforations: iron from the mandrel?	bead production remains?
Zandweg	WD 754.2.63b	11	glass	monochrome	opaque	white opaque	Tiny globular bit of glass with some large air bubble-gaps in it, that look like a perforation to the naked eye. The glass is totally crystallised which gives this drop of glass its white opaque appearance. One small part is translucent: probably translucent glass originally.	bead production remains?

Table 7. Bead production remains found at the Veilingterrein and Zandweg.

unearthed.[48] Two further drops of glass were found at site Zandweg (Figure 12 and Table 7). The most spectacular piece is a twisted rod of white opaque and colourless *reticella* glass, parallels of which have also been found during excavations of the ninth-century monastery of San Vincenzo al Volturno in Italy.[49] The bead production remains were found spread across many different features and farmyards: no concentrations indicative for a specific bead workshop were found.[50] The few remains do show that beads were made occasionally in Dorestad, for example by travelling craftsmen.[51] In comparison to the quantity of evidence for bead production in Scandinavian sites such as Ribe,[52] the Dorestad material looks rather meagre. A similar conclusion was drawn by Preiβ, who studied glass working remains of Dorestad. Early medieval glass-working in Dorestad was present, but was not dependent on stationary and permanent workshops.[53]

Dorestad and beads from contemporaneous sites

Beads from sites contemporaneous to Dorestad have only been excavated at a few places in the Netherlands. From the second half of the seventh century AD, beads were hardly deposited as grave gifts anymore, because of changing burial practives influenced by the adoption of Christianity. Many small beads and fragments must have been overlooked in settlement excavations due to lack of sieving activities. Examples of contemporary sites with beads are the cemeteries of Zweeloo and Godlinze in the northern Netherlands and Dommelen in the southern Netherlands. The beads from Dommelen are not comparable to the beads found in Dorestad.[54] However, in both Zweelo and Godlinze direct parallels of beads from Dorestad were excavated.[55]

There are many parallels for the Dorestad beads found in northern emporia dating to the seventh, eighth and ninth century AD, such as Ribe, Kaupang, Haithabu, Ahus and Paviken on Gotland,[56] especially beads that originate in the Near East. Beads that were certainly produced in Scandinavia itself occur only sporadically in Dorestad: only three examples of the so-called 'Ribe-beads' were found. In the future, chemical analyses of beads from Dorestad and Scandinavian sites could provide further insights into the exchange of beads between both areas.

Wear, circulation and social significance

The beads from settlement contexts in this study show a lot of wear and tear; they are much more worn than beads from burial contexts in Dorestad or from Merovingian graves elsewhere. A nice example is a very worn glass spindle whorl bead that was made in the sixth century AD, which was 'upgraded' with lines of red glass covered with yellow dots[57] and was eventually discarded or lost in Dorestad somewhere in the eighth century AD. A similar 'upgraded' bead was found in a seventh century grave on the Münzenberg near Frankfurt in Germany[58] (Figure 13).

It is probably logical that worn down or broken beads were lost or discarded in settlement contexts as (accidental) 'waste', and that only beads of good quality were deposited in graves. Furthermore it seems that in the eighth century AD, beads were circulating much longer than during the centuries before, partly because that they were deposited in graves at a much lower rate. From the seventh century AD onwards, 'old' beads seem to become more fashionable than they were in previous centuries: it is not uncommon to find beads that manufactured a century or longer before their deposition in seventh century graves.[59] Often these anachronistic beads show signs of heavy wear, much like the beads found in the settlement areas of Dorestad do.[60] It would not be surprising then, if several of the Dorestad beads were originally produced a century or longer before their deposition. A clear example are the heavily worn Roman faience melon beads found

48 Sablerolles and Henderson 2013, 332; see also Preiβ 2010 for a more elaborate study on glass production remains from Dorestad, including 36 glass *tesserae*.

49 Stiegemann and Wemhoff 1999, 176.

50 Sablerolles and Henderson 2013, 333-334.

51 Dijkstra, Sablerolles and Henderson 2010.

52 Sode 2004.

53 Preiβ 2010, 126.

54 Study of the beads from Dommelen by the author in progress.

55 Van Giffen 1920, plaat X; Nicolay *et al.* 2018; Van Es and Schoen 2008, 911-912.

56 Callmer 1977; Anderson and Sode 2010; photographs of beads from all these sites can be found at www.textandtrowel.org.

57 Bead maker Floor Kaspers has ensured that this is very unlikely, as it is very difficult to add new glass to a cold bead: you risk shattering the entire piece! Still, the added red and yellow decoration sits so obviously on top of the surface and is in such a different style than the 'original' bead, that I cannot believe it was added during the original manufacture of the bead. Possibly the original bead was heated before the new red and yellow glass was applied.

58 My thanks to Herr Kögler from the Wetterau Museum in Friedburg and Herr Lindenthal from Archäologische Denkmalpflege Wetteraukreis that took pictures of the specific bead.

59 Ongoing research on beads from the Merovingian cemetery of Lent-Lentseveld at the Faculty of Archaeology, Leiden University, shows that beads deposited in graves dating to the sixth century AD had been worn for years before being interred. In seventh-century graves truly anachronistic beads occur. Possibly, these were collected from older graves during grave-reopening activities, although the heavy wear on some of them suggests their continued circulation in society.

60 A good example are some heavily worn millefiori beads, produced in the middle of the sixth century, that were deposited in late seventh century graves in Dommelen.

Figure 13. Upgraded spindle whorl-beads found at Dorestad and the Münzenberg. Photo: R.J. Looman/RMO and Wetterau-Museum, Friedberg (Hessen).

at sites Hoogstraat and De Heul. For other beads this is difficult to confirm for now, because context information on Dorestad finds remains scarce. In the future, use-wear analyses can possibly provide more clarity.

What does the longer circulation of beads indicate? Ethnographic research has shown that beads can be used as much more than personal adornments. The latter is a typical 'disenchanted' modern Western notion. Instead, the choice to make, acquire and wear beads is driven by the value and meaning society associates with them and the belief that beads are able to convey complex social and cultural messages.[61] There are many ethnographic examples of cultures in which beads accumulate more value the longer they circulate. For the Kelabit people of Sarawak on Borneo, the most important and valuable aspect of a bead is its age and its former owners, preferably ancestors. Their appearance is less important. Some of the most valuable beads are over a thousand years old.[62] As Mirjam Kars has shown for the Merovingian Period, between acquisition and deposition an object such as a bead can become a gift, part of an inheritance, return into networks of exchange or be taken out of circulation through deposition in a burial, among other possibilities.[63] At its initial production, a bead may have simply been a 'commercial' product, a commodity. Then, through being exchanged, beads may have gained significance and meaning for their wearers. Building on this idea, a set of beads can be interpreted as a representation of the social relations of the wearer, including ties with former wearers of the beads.[64] Thinking along these lines, separate beads can be interpreted as a *pars pro toto* of social groups the wearer was part of, such as his/her family, whilst the entire assemblage may be indicative of what constituted the wearer as a person and/or signify the rites of passage they had experienced. Simultaneously, when one of these beads was passed on to another person, the previous wearer may be represented in that very bead. In these practices, signs of a dividual or fractal personhood can be understood,[65] as a set of beads could be divided and added to other sets of beads without diminishing the integrity of the whole.[66]

Keeping all of these ideas in mind, the beads from Dorestad may have been worn by different persons, and have travelled significant distances whilst circulating in Late Merovingian and Carolingian societies, accumulating both more wear and more meaning. If anything, the material culture found in Dorestad indicates how mobile and connected its inhabitants were: a bead that was brought into or produced at Dorestad may have left again via both commercial or social networks.

Conclusions

In this article, the circa 400 beads from Dorestad that are kept in the National Museum of Antiquities in Leiden have been discussed. This is the lion's share of beads excavated from Dorestad. Beads from the late seventh, eighth and ninth century AD have barely been studied before in the Netherlands, and this study has presented a first view on beads from this period in the Netherlands.

The majority of the beads from Dorestad are made of glass. Beads of other materials, such as amber, faience, amethyst and shell only occur occasionally. The glass beads were made using a variety of techniques, of which wound

61 Mannion 2015, 90.
62 Janowski 1998, 237-241.
63 Kars 2011, 81.
64 Kars 2014, 126.
65 Cf. Fowler 2004; see also Theuws 2013.
66 Cf. Mannion 2015, 91.

beads from Europe and drawn beads from the Near East are the most common. Beads produced using other techniques, such as mosaic beads and lead glass beads from the Near East, occur less often. At each excavated site of Dorestad a similar variation of beads was found: both wound and drawn beads, both monochrome and polychrome beads, both beads produced regionally and imported from further afield. This is also true for the beads that were deliberately deposited in graves in the cemeteries of Dorestad. This suggests that beads deposited in graves also played a role during everyday life in Dorestad, and that beads were very commonly owned objects which were not reserved for the higher social classes.

There is some tentative evidence for the production of beads at Dorestad: several coloured glass rods, drops of molten glass and pieces coloured raw glass were unearthed at the site Veilingterrein. These remains do show that beads were made occasionally in Dorestad, for example by travelling craftsmen, but probably not on a permanent basis. In comparison to the quantity of evidence for bead production in Scandinavian sites such as Ribe, the Dorestad material looks rather meagre.

In general, the bead assemblage is highly comparable to those of contemporary sites in the Northern Netherlands and Scandinavia, especially concerning beads from the Near East. A portion of twenty-nine percent of the Dorestad beads were manufactured in the Near East, which reflects the international character of Dorestad. Previously, researchers of Viking Age bead trade to Scandinavia have suggested that beads from the Near East were transported to Scandinavia via the Russian river system. The occurrence of Near Eastern beads in Dorestad suggests the European river system was used as well.

Overall, the beads excavated in Dorestad suggest that, much like during the Merovingian period, beads continued to play an important role in everyday life. The heavy wear on many of the beads suggests that they were worn for long periods of time before being discarded. Whilst circulating in society, beads may have been worn by different persons, and may have travelled significant distances, accumulating more wear and meaning over time.

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About the author

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sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	WD 810.3.107b	?	glass	polychrome	both	complete	x	x	J001(6)	1-2-3-4-7-6	mosaic	green translucent, yellow opaque, red opaque, white opaque, black opaque	mosaic eyes	globular	Near East
2	WD 813.3.89c	?	glass	polychrome	both	complete	x	x	x	x	wound	colourless translucent, dark blue opaque, silver, gold foil	spiral	barrel shaped	Local?
3	WD 810.3.101b	?	glass	monochrome	opaque	complete	x	x	A134	1-7-8-6	wound	red opaque	none	cylindrical	Europe
4	WD 810.3.103c	?	glass	monochrome	translucent	weathered	A4?	?	E140?	1-2-3?	drawn	yellow translucent	none	segmented	Near East
5	WD 813.3.127a	?	glass	monochrome	translucent	complete	A4?	?	E140?	1-2-3?	drawn	yellow translucent	none	segmented	Near East
6	WD 810.3.101a	?	glass	monochrome	?	complete	A4?	?	E?	x	drawn	?	none	segmented	Near East
7	WD 810.3.96f	?	glass	monochrome	translucent	complete	A4.3-01b	P3	E140?	1-2-3?	drawn	yellow translucent	none	segmented	Near East
8	WD 810.3.108a	?	glass	monochrome	translucent	complete	A4.3-01b	P3	E140?	1-2-3?	drawn	yellow translucent	none	segmented	Near East
9	WD 810.3.135b	?	glass	polychrome	both	complete	B8.2-?	x	x	x	wound	green translucent, white opaque, red opaque, gold foil	eyes	globular	Local?
10	WD 810.3.19	?	glass	monochrome	translucent	broken	D1.7-01?	P0?	Q60?	2-3-4-7-8?	perforated	green translucent	none	hexagonal lead glass bead	Near East
11	WD 810.3.19	?	glass	polychrome	opaque	complete	x	x	B060	2-7	wound	black opaque, yellow opaque	borders	wasp bead	Scandinavia

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	WD 757.3.93	?	glass	polychrome	opaque	complete	x	x	B060	2-7	wound	black opaque, yellow opaque	borders	wasp bead	Scandinavia
2	WD 788.5.36	?	glass	monochrome	translucent	complete	D1.?	?	A170	1-2-3-7-9-12	perforated	blue translucent	none	asymmetric biconical	Near East?
3	WD 788.5.36	?	glass	monochrome	translucent	complete	D1.?	?	A170	1-2-3-7-9-12	perforated	blue translucent	none	asymmetric biconical	Near East?
4	WD 788.5.36	?	glass	monochrome	translucent	complete	D1.?	?	x	x	perforated	colourless translucent	none	asymmetric biconical	Near East?
5	WD 767.3.2	?	glass	monochrome	opaque	broken	B1.2-01c	P4	x	x	wound	yellow	none	segmented	Europe
6	WD 795.2.30	?	glass	monochrome	translucent	broken	x	x	A174	1-2-3-7-9-12	wound	dark blue translucent	none	cylindrical	Europe

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	WD 596	?	bone	x	x	weathered	F?	?	x	x	cut	white opaque	none	disc shaped	Europe
2	WD 473	?	glass	polychrome	translucent	broken	A4.?	?	E120	1-2-3	drawn	blue-green translucent, colourless translucent, silver	none	segmented	Eastern Mediterranean
3	WD 5148	topsoil	glass	monochrome	translucent	complete	B1.1-06b	P1-P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
4	WD 7446	?	glass	polychrome	both	complete	x	x	J001(4)	1-2-3-4-7-6	mosaic	green translucent, yellow opaque, red opaque, white opaque, dark blue translucent	mosaic eyes	oval	Near East
5	WD 3497a	burnt zone	glass	polychrome	both	complete	x	x	J001(2)	1-2-3-4-7-6	mosaic	green translucent, yellow opaque, red opaque, white opaque, blue translucent, light blue translucent	mosaic eyes, regular lines	globular	Near East
6	WD 1747	long rectangu-lar pit	glass	polychrome	opaque	complete	x	x	x	x	wound	red opaque, yellow opaque	borders, regular dots	biconical wasp bead	Scandinavia
7	WD 6933	stray find	glass	monochrome	opaque	complete	B1.4-04a	P3	A272	?	wound	blue green opaque	none	short cylindrical	Europe
8	WD 9218	grave	glass	monochrome	translucent	complete	B1.6-01?	?	x	x	wound	green translucent	none	pentagonal	Europe
9	WD 2056	ditch	glass	monochrome	translucent	complete	B1.6-02?	?	A310	6-7	wound	green translucent	none	cubic (wonky)	Europe
10	WD 2732	stray find	glass	monochrome	opaque	broken	x	x	A272	?	wound	light blue opaque	none	cylindrical, slightly biconical	Europe
11	WD 303b	?	glass	monochrome	opaque	weathered	B1.6-01c	P2b	Q?	2-3-4-7-8-6-9-12	drawn	white opaque	none	hexagonal lead glass bead (flattened)	Near East
12	WD 6086	?	glass	monochrome	opaque	complete	B1.3-02	P3	x	x	?	red opaque	none	barrel shaped mystery bead	Europe
13	WD 4266	pit	glass	polychrome	opaque	complete	B11.11-02?	?	x	x	wound	Dark red opaque, light blue opaque, white opaque	borders, wave	cylindrical	Europe
14	WD 7203	long ditch	glass	monochrome	translucent	complete	A1.2-06?	P1?	F061?	1-2-3	drawn	light blue translucent	none	small short cylindrical	Near East

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
15	WD 7203	long ditch		monochrome	translucent	broken	A4.?	?	E120	1-2-3	drawn	blue-green translucent, colourless translucent, silver foil	none	segmented	Eastern Mediterranean
16	WD 7200	wastepit	glass	monochrome	translucent	complete	A1.2-01	P1	F51	1-2-3-4-7-8-6-9	drawn	blue translucent	none	small annular	Near East
17	WD 9325	dark zone	faience	monochrome	opaque	broken	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
18	WD 7337	pit	glass	polychrome	both	broken	A3.1-07	P2	x	x	drawn	red opaque, colourless translucent	none	small annular	Near East
19	WD 1269	pit	glass	polychrome	both	broken	B12.1-07?	P1?	x	x	wound	green-blue translucent, white opaque	combed spiral	annular	Europe
20	WD 1967 36	elongated pit	amber	x	x	complete	F1.1-03	P1a	x	x	cut	amber	none	annular	Baltic
21	WD 2842	pit	glass	polychrome	both	complete	B12.?	?	x	x	wound	colourless translucent, white opaque, red opaque	combed spiral	asymmetric biconical	Europe

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	WD 556.1.0	?	glass	polychrome	opaque	weathered	B1.5-?	?	x	x	wound	white opaque, yellow translucent	none	melon bead	Europe
2	WD 592.1.128	?	glass	polychrome	both	complete	A3.?	?	x	x	drawn	blue green translucent, yellow opaque	none	pentagonal	Near East
3	WD 565.2.33	?	glass	monochrome	translucent	weathered	B1.1-12c	?	A172	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
4	WD 592.5.12	?	glass	polychrome	both	broken	?	?	B310	2-3-4-7-8-6-9-12	wound	dark green translu-cent, red opaque, white opaque, blue translucent	mosaic eyes	globular	?
5	WD 589.2.280	?	glass	monochrome	translucent	broken	B1.1-12a	?	A002	1-2-3-4-7-8-6-9-12	wound	colourless translucent	none	annular	Europe
6	WD 589.2.280	?	faience	monochrome	opaque	weathered	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
7	WD 557.3.19	?	faience	monochrome	opaque	broken	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
8	WD 592.4.48	?	faience	monochrome	opaque	weathered	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
9	WD 563.3.0	?	faience	monochrome	opaque	weathered	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
10	WD 502.2.12	?	faience	monochrome	opaque	broken	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt

Site De Horden continued

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
11	WD 589.3.1	?	faience	monochrome	opaque	weathered	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
12	WD 592.4.16	?	faience	monochrome	opaque	broken	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
13	WD 602.1.129	?	faience	monochrome	opaque	broken	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
15	WD 589.2.262	?	faience	monochrome	opaque	broken	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
15	WD 599.1.63	?	faience	monochrome	opaque	weathered	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
16	WD 598.2.291	?	faience	monochrome	opaque	weathered	G1.2-05	Roman	x	x	modelled	blue opaque	none	melon bead	Egypt
17	WD 563.4.8	?	glass	monochrome	translucent	weathered	B1.5-02c	P1	A178	3-7-9	wound	blue translucent	none	melon bead	Europe
18	WD 542.1.18	?	faience	monochrome	opaque	weathered	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt

Site Hoogstraat

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	WD 373.2.5	topsoil	glass	monochrome	translucent	complete	B1.1-08a	?	x	x	wound	green translucent	none	annular	Europe
2	WD 15950	?	glass	monochrome	opaque	complete	C1.2-?	?	x	x	folded	green opaque	none	cylindrical	Europe
3	WD 15803	'stain'	glass	monochrome	opaque	complete	B1.3-06	P5	x	x	wound	blue green opaque	none	biconical	Europe
4	WD 358.2.10	?	glass	monochrome	translucent	broken	B1.1-06b	P0-P3	A171?	1-2-3-7-9	wound	blue translucent	none	globular	Europe
5	WD 358.2.10	?	glass	polychrome	both	broken	x	x	J001 (6)	1-2-3-4-7-6	mosaic	green translucent, yellow opaque, red opaque, white opaque, blue translucent, light blue translucent	mosaic eyes, regular lines	oval	Near East
6	WD 361.4.12b	pit	glass	monochrome	opaque	complete	x	x	x	x	?	red opaque	none	long oval mystery bead	?
7	WD 361.4.12b	pit	glass	monochrome	opaque	complete	x	x	x	x	?	red opaque	none	long oval mystery bead	?
8	WD 361.4.12b	pit	glass	monochrome	translucent	complete	B1.4-07?	P5?	x	x	wound	green translucent	none	cylindrical	Europe
9	WD 361.4.12b	pit	glass	polychrome	opaque	broken	x	x	x	x	?	red opaque, light blue opaque	central line	long oval?	?
10	WD 361.4.12b	pit	glass	polychrome	both	complete	x	x	B436?	?	wound	blue translucent, white opaque, red opaque.	eyes	annular Ribe-bead	Scandinavia
11	WD 16154	ditch	glass	monochrome	translucent	weathered	B1.1-06b	P0-P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
12	WD 353.0.1	?	faience	monochrome	opaque	weathered	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
13	WD 16154	ditch	amber	x	x	broken	x	x	x	x	cut	amber	none	trapezium pendant	Baltic
14	WD 366.2.1	level surface	amber	x	x	weathered	F1.1-02	P3	x	x	cut	amber	none	annular	Baltic

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
15	WD 374.1.0d	?		x	x	weathered	x	x	x	x	cut	amber	none	trapezium pendant	Baltic
16	WD 371.0.1	?	amber	x	x	weathered	F1.1-02	P3	x	x	cut	amber	none	annular	Baltic
17	WD 35764	?	amber	x	x	broken	F1.1-03	P1a	x	x	cut	amber	none	annular	Baltic
18	WD 5485d	ditch	glass	polychrome	both	broken	B12.1-03	P1-P2	x	x	wound	blue-green translucent, white opaque	combed spiral	biconical	Europe
19	WD 5485d	ditch	glass	polychrome	both	broken	B12.?	?	x	x	wound	green-blue translucent, white opaque, yellow opaque, red opaque	combed spiral, borders	melted	Europe
20	WD 405.5.14b	?	glass	polychrome	both	complete	x	x	J001(2)	1-2-3-4-7-6	mosaic	green translucent, yellow opaque, red opaque, white opaque, blue translucent, light blue translucent	mosaic eyes, regular lines	oval	Near East
21	WD 404.3.0	?	glass	polychrome	both	weathered	B2.2-02?	?	x	x	wound	dark green translucent, yellow opaque	borders, wave	annular wasp bead	Scandinavia
22	WD 405.2.22	?	glass	polychrome	both	broken	?	?	x	x	wound	light blue translucent, white opaque, green-blue translucent	central line, eyes	globular	?
23	WD 449.2.17	?	glass	monochrome	translucent	complete	B1.3-?	?	x	x	wound	green translucent	none	barrel shaped	Europe
24	WD 463.0.0b	?	faience	monochrome	opaque	weathered	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt

subnr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	WD 880.3.10a	?	glass	polychrome	both	broken	B6.2-01a?	?	x	x	wound	blue translucent, white opaque	wave	annular	Europe
2	WD 880.3.1a	?	glass	polychrome	opaque	complete	x	x	B060	2-7	wound	dark red opaque, yellow opaque	borders	wasp bead	Scandinavia
3	WD 880.3.1a	?	glass	monochrome	translucent	complete	B1.1-06b	P0-P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
4	WD 12919	pit	glass	polychrome	both	complete	x	x	G002	1-2-7	mosaic	red opaque, blue translucent, green trans-lucent, white opaque, yellow opaque.	mosaic eyes, mosaic flowers, regular lines	cylindrical	Egypt
5	WD 11522	stain'	glass	polychrome	opaque	complete	x	x	x	x	wound	red opaque, yellow opaque	borders	cylindrical	Europe
6	WD 10.384b	stray find	glass	monochrome	opaque	complete	B1.3-03	P3	x	x	wound	white opaque	none	biconical	Europe
7	WD 10.384b	stray find	glass	monochrome	translucent	complete	B1.1-05a	P3	A210	1	wound	light blue translucent	none	annular	Europe

subnr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
8	WD 10.384b	stray find	glass	polychrome	translucent	broken	x	x	E140	1-2-3	drawn	yellow translu-cent, colourless translucent, silver	none	segmented	Eastern Mediterranean
9	WD 10.384b	stray find	glass	polychrome	both	complete	x	x	x	x	drawn	green translucent, red opaque	none	small cylindrical	Near East
10	WD 10.384b	stray find	glass	monochrome	translucent	weathered	C1.4-?	?	x	x	folded	light blue translucent	none	long-biconical	Near East
11	WD 10.384b	stray find	glass	monochrome	opaque	complete	x	x	x	x	wound	black opaque	none	annular	Europe
12	WD 11388	stray find	glass	polychrome	both	complete	x	x	group B o?	1-4-7?	wound	blue translucent, white opaque, red opaque	regular lines, borders, eyes	polyhedral	Europe

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	WD 753.2.151a	?	glass	polychrome	both	complete	x	x	B060?	2-7?	wound	colourless translucent, yellow opaque	borders	wasp bead	Scandinavia
2	WD 754.2.90	?	glass	monochrome	translucent	complete	A1.2-01	P1	F051	1-2-3	drawn	blue translucent	none	small annular	Near East
3	WD 753.2.128	?	glass	monochrome	translucent	complete	A1.2-01	P1	F051	1-2-3	drawn	blue translucent	none	small annular	Near East
4	WD 753.2.22	?	glass	monochrome	opaque	complete	B1.6-02?	?	A182	1-2-3-7-9-12	wound	dark blue green translucent	none	rectangular	Europe
5	WD 754.2.63b	?	glass	monochrome	translucent	weathered	x	x	Q60	2-3-4-7-8-6-9-12	drawn	green translucent	none	hexagonal lead glass bead	Near East
6	WD 753.2.71	?	glass	monochrome	translucent	broken	B1.8-?	P5?	x	x	wound	colourless translucent	none	twisted	Europe
7	WD 753.2.81	?	glass	monochrome	opaque	broken	B1.7-04	P5	A180	1-2	wound	blue opaque	none	almond shaped	Europe
8	WD 753.2.64	?	glass	polychrome	both	broken	B2.?	?	B640	?	wound	green-blue translucent, yellow opaque	wave	annular	Europe
9	WD 753.2.71b	?	glass	monochrome	opaque	complete	B1.1-08d	?	A360	1-2-3-4	wound	green opaque	none	annular	Europe
10	WD 753.2.71b	?	glass	monochrome	opaque	complete	B1.3-?	?	x	x	wound	green opaque	none	oval	Europe
11	WD 753.2.71b	?	glass	polychrome	opaque	weathered	B2.7-?	?	x	x	wound	light blue opaque, yellow opaque	wave	cylindrical	Europe
12	WD 753.2.101	?	glass	monochrome	opaque	complete	B1.1-04a	?	A22?	1-2?	wound	white opaque (silver iridescence)	none	globular	Europe
13	WD 753.2.101	?	glass	monochrome	opaque	broken	B1.1-01a?	P0-P3?	A30?	9-12?	wound	dark brown opaque	none	small annular	Europe
14	WD 754.2.83	?	glass	monochrome	translucent	complete	A1.2-01	P1	F51	1-2-3-4-7-8-6-9	drawn	blue translucent	none	small annular	Near East

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	Veilingterrein 5288	?	glass	monochrome	translucent	complete	B1.8-07	P5	x	x	wound	blue-green translucent	none	twisted	Europe
2	Veilingterrein 5288	?	glass	polychrome	both	complete	x	x	x	x	drawn	green trans-lucent, red opaque, white opaque	regular lines	small cylindrical	Near East/ India?
3	Veilingterrein 5288	?	glass	monochrome	translucent	complete	x	x	x	x	wound	green translucent	none	long biconical	Europe
4	Veilingterrein 5288	?	glass	monochrome	translucent	broken	x	x	Q?	x	?	green translucent	none	hexagonal lead glass bead	Near East
5	Veilingterrein 5288	?	glass	monochrome	translucent	broken	D1.?	x	Q?	x	drawn	green translucent	none	hexagonal lead glass bead	Near East
6	Veilingterrein 2150	?	glass	monochrome	translucent	broken	x	x	E062	1-2-3-7-6	drawn	blue translucent	none	segmented	Eastern Mediterranean
7	Veilingterrein 4764	?	glass	polychrome	opaque	complete	B3.4-?	?	B061?	3-4-7-8-6?	wound	black opaque, yellow opaque	interlacing	cylindrical	Europe/ Scandinavia
8	Veilingterrein 4764	?	glass	monochrome	translucent	complete	x	x	E130	1-2-3	drawn	yellow translucent, silver	none	segmented	Eastern Mediterranean
9	Veilingterrein 3737	?	glass	monochrome	translucent	broken	B1.8-06a?	P1	A170?	1-2-3-7-9-12	wound	blue translucent	none	almond shaped	Europe
10	Veilingterrein 3322	?	glass	polychrome	translucent	complete	x	x	E130	1-2-3	drawn	yellow translucent, colourless translucent, silver	none	segmented	Eastern Mediterranean
11	Veilingterrein 3322	?	glass	monochrome	translucent	complete	A4.2-01	P1-P3	E110	1-2-3	drawn	colourless translucent, silver	none	segmented	Eastern Mediterranean
12	Veilingterrein 3322	?	glass	monochrome	opaque	broken	x	x	A178	3-7-9	wound	blue translucent	none	melon bead	Europe?
13	Veilingterrein 6521	?	glass	monochrome	translucent	complete	x	x	Q60	2-3-4-7-8-6-9-12	drawn	green translucent	none	hexagonal lead glass bead	Near East
14	Veilingterrein 2351	?	glass	monochrome	opaque	complete	B1.6-02a?	P4?	A139	7-8	wound	red opaque	none	rectangular	Europe
15	Veilingterrein 3560	?		monochrome	translucent	broken	B1.14-?	?	x	x	wound	blue-green translucent	none	flattened oval	Europe
16	Veilingterrein 5276	?	glass	monochrome	translucent	broken	A4.4-01	P3	E110	1-2-3	drawn	colourless translucent, silver	none	segmented	Eastern Mediterranean
17	Veilingterrein 5074	?	glass	monochrome	translucent	complete	B1.4-07?	P5?	x	x	wound	green translucent	none	cylindrical	Europe
18	Veilingterrein 5382	?	glass	monochrome	opaque	complete	B1.3-02	P3	A131	1-2-3-4-7-8-6-9-12	wound	red opaque	none	barrel shaped	Europe

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
19	Veilingterrein 5800	?	glass	monochrome	translucent	complete	x	x	x	x	wound	colourless translucent	none	long conical (slightly lobed)	Europe
20	Veilingterrein 3134	?	glass	monochrome	translucent	complete	A1.2-01	P1	F051	1-2-3	drawn	blue translucent	none	small annular	Near East
21	Veilingterrein 3407	?	glass	monochrome	translucent	complete	A1.2-01	P1	F051	1-2-3	drawn	blue translucent	none	small annular	Near East
22	Veilingterrein 5130	?	glass	polychrome	both	complete	x	x	B060?	2-7?	wound	colourless translucent, yellow opaque	borders	wasp bead	Scandinavia
23	Veilingterrein 193	?	glass	polychrome	opaque	complete	x	x	B060	2-7	wound	black opaque, yellow opaque	borders	wasp bead	Scandinavia
24	Veilingterrein 5079	?	glass	polychrome	opaque	complete	x	x	B308	3-4-7-8	wound	red opaque, yellow opaque	borders, wave	wasp bead	Scandinavia
25	Veilingterrein 4721	?	glass	polychrome	both	complete	x	x	B551?	5-7?	wound	colourless translucent, yellow opaque	borders, wave	rectangular wasp bead	Scandinavia
26	Veilingterrein 5561	?	glass	polychrome	opaque	complete	x	x	B072?	1-2-3	wound	black opaque, yellow opaque	borders, wave	polyhedral wasp bead	Scandinavia
27	Veilingterrein 4183	?	glass	polychrome	opaque	complete	x	x	B306?	3-4-7-8?	wound	red opaque, yellow opaque	borders, wave	annular wasp bead	Scandinavia
28	Veilingterrein 1741	?	glass	polychrome	both	broken	x	x	B480	2-3-4-7-8-6-9-12	wound	blue translucent, white opaque	mosaic eyes	globular	Mesopotamia
29	Veilingterrein 4644	?	amethyst	x	x	complete	F2.2	P4	x	x	cut	amethyst	none	almond shaped	Egypt
30	Veilingterrein 1920	?	glass	polychrome	both	broken	x	x	B545?	3-4-7-8?	wound	green translucent, red opaque, white opaque	regular lines, waves	cylindrical	Europe
31	Veilingterrein 2069	?	glass	polychrome	opaque	weathered	B6.4-?	?	x	x	wound	green opaque, yellow opaque	borders, regular dots	cylindrical (wasp bead?)	Europe

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	WD 7861	?	glass	monochrome	opaque	complete	B1.3-02	P3	x	x	wound	red opaque	none	biconical	Europe
2	WD 7861	?	glass	monochrome	opaque	complete	x	x	x	x	?	red opaque	none	long oval	Europe
3	WD 9188	grave 54	glass	monochrome	opaque	weathered	A2.1-03	P2	x	x	drawn	red opaque	none	long oval	Near East?
4	WD 9188	grave 54	glass	monochrome	translucent	complete	C1.?	?	x	x	folded	blue translucent	none	cubic	Near East?
5	WD 9188	grave 54	glass	monochrome	translucent	weathered	B1.2-04b	P4	x	x	wound	light blue translucent	none	segmented	Europe

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
6	WD 9155	grave 129	glass	monochrome	opaque	complete	B1.3-02	P3	x	x	wound	red opaque	none	long biconical	Europe
7	WD 9155	grave 129	glass	monochrome	opaque	complete	B1.3-02	P3	x	x	wound	red opaque	none	biconical	Europe
8	WD 9155	grave 129	glass	monochrome	opaque	complete	B1.1-08c	?	x	x	wound	green opaque	none	annular	Europe
9	WD 9155	grave 129	glass	monochrome	translucent	complete	B1.1-06b	P0-P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
10	WD 10.070 (10.075?)	grave 57	glass	monochrome	translucent	broken	A2.?	?	E?	?	drawn	colourless translucent, gold foil	none	barrel shaped	Eastern Mediterranean
11	WD 10.070 (10.075?)	grave 57	glass	monochrome	opaque	weathered	D1.2-03	P2	x	x	drawn?	red opaque	none	cubic	Near East?
12	WD 10.070 (10.075?)	grave 57	glass	monochrome	translucent	weathered	B1.13?	?	A175?	1-2-3-7-9-12?	?	blue translucent	none	long oval mystery bead	?
13	WD 10.070 (10.075?)	grave 57	glass	monochrome	translucent	complete	B1.1-06b	P0-P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
14	WD 10.070 (10.075?)	grave 57	glass	monochrome	translucent	complete	B1.1-06b	P0-P3	A171	1-2-3-7-9-12	wound	blue translucent	none	globular	Europe
15	WD 6466	child's grave?		monochrome	translucent	complete	x	x	E60	1-2-3	drawn	blue translucent	none	segmented	Eastern Mediterranean
16	WD 6466	child's grave?	glass	monochrome	translucent	complete	x	x	E140	1-2-3	drawn	yellow translucent, silver	none	segmented	Eastern Mediterranean
17	WD 6466	child's grave?	glass	monochrome	translucent	complete	x	x	E110	1-2-3	drawn	colourless translucent, silver	none	segmented	Eastern Mediterranean
18	WD 6466	child's grave?	glass	monochrome	translucent	complete	x	x	E60	1-2-3	drawn	blue translucent	none	segmented	Eastern Mediterranean
19	WD 6466	child's grave?	glass	monochrome	translucent	complete	x	x	E140	1-2-3	drawn	yellow translucent, silver	none	segmented	Eastern Mediterranean
20	WD 6466	child's grave?	glass	monochrome	translucent	complete	x	x	E140	1-2-3	drawn	yellow translucent, silver	none	segmented	Eastern Mediterranean
21	WD 6466	child's grave?	glass	monochrome	translucent	complete	x	x	E60	1-2-3	drawn	blue translucent	none	segmented	Eastern Mediterranean
22	WD 6466	child's grave?	glass	monochrome	both	complete	x	x	E140	1-2-3	drawn	colourless opaque, yellow translucent, silver	none	segmented	Eastern Mediterranean
23	WD 6466	child's grave?	glass	monochrome	translucent	complete	B1.1-11a	?	A291	3-4	wound	green-blue translucent	none	annular	Europe
24	WD 6466	child's grave?	glass	monochrome	translucent	weathered	x	x	E110	1-2-3	drawn	colourless translucent, silver	none	segmented	Eastern Mediterranean
25	WD 6466	child's grave?	glass	monochrome	translucent	complete	x	x	E60	1-2-3	drawn	blue translucent	none	segmented	Eastern Mediterranean
26	WD 6466	child's grave?	glass	polychrome	both	weathered	x	x	E140	1-2-3	drawn	white opaque, yellow translucent, silver	none	segmented	Eastern Mediterranean

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
27	WD 6466	child's grave?	glass	monochrome	both	weathered	x	x	E140	1-2-3	drawn	white opaque, yellow translucent, silver	none	segmented	Eastern Mediterranean
28	WD 6466	child's grave?	glass	monochrome	translucent	complete	A1.3-04	?	F?	1-2-3?	drawn	blue-green translucent	none	cylindrical	Eastern Mediterranean
29	WD 6466	child's grave?	glass	monochrome	both	weathered	x	x	E140	1-2-3	drawn	white opaque, yellow translucent, silver	none	segmented	Eastern Mediterranean
30	WD 6466	child's grave?	glass	monochrome	translucent	complete	x	x	E110	1-2-3	drawn	colourless translucent, silver	none	segmented	Eastern Mediterranean
31	WD 6466	child's grave?	glass	monochrome	translucent	weathered	x	x	E60	1-2-3	drawn	blue translucent	none	segmented	Eastern Mediterranean
32	WD 6466	child's grave?	glass	monochrome	opaque	weathered	x	x	Q?	2-3-4-7-8-6-9-12?	drawn	white opaque	none	hexagonal lead glass bead	Near East?
33	WD 6466	child's grave?	glass	monochrome	opaque	complete	B1.1-04b	P0-P3	A22	1-2-3	wound	white opaque	none	annular	Europe
34	WD 6466	child's grave?	glass	monochrome	both	complete	x	x	E140	1-2-3	drawn	white opaque, yellow translucent, silver	none	segmented	Eastern Mediterranean
35	WD 6466	child's grave?	glass	monochrome	translucent	complete	x	x	E140	1-2-3	drawn	yellow translucent, silver	none	segmented	Eastern Mediterranean
36	WD 6466	child's grave?	glass	monochrome	translucent	weathered	x	x	E60	1-2-3	drawn	blue translucent	none	segmented	Eastern Mediterranean
37	WD 10.078	grave 88	glass	polychrome	opaque	complete	B6.1-02d	P2b	B025?	1-2-8	wound	white opaque, red opaque	irregular dots	globular	Europe
38	WD 136.2.?a	grave 88	glass	monochrome	opaque	weathered	B1.6-02b? / F6.5-02	P4? / P1	A027	3-4-7-8-6	wound	white opaque	none	cubic	Europe
39	WD 136.2.?a	grave 88	glass	monochrome	opaque	weathered	B1.3-07?	P2b?	x	x	wound	dark green opaque	none	barrel shaped	Europe
40	WD 136.2.?a	grave 88	glass	monochrome	opaque	complete	B1.5-?	?	x	x	wound	light green opaque	none	lobed	Europe
41	WD 136.2.?a	grave 88	glass	monochrome	opaque	complete	B1.1-08a	?	x	x	wound	green opaque	none	annular	Europe
42	WD 136.2.?a	grave 88	glass	monochrome	opaque	complete	B1.3-08	P4	A090	1-2-3-4-7-8-6-9-12	?	orange opaque	none	barrel shaped mystery bead	?
43	WD 136.2.?a	grave 88	glass	monochrome	opaque	complete	B1.3-08	P4	A090	1-2-3-4-7-8-6-9-12	?	orange opaque	none	barrel shaped mystery bead	?
44	WD 136.2.?a	grave 88	glass	monochrome	opaque	complete	B1.3-08	P4	A090	1-2-3-4-7-8-6-9-12	wound	orange opaque	none	barrel shaped	Europe

sub-nr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
45	WD 136.2.?a	grave 88	glass	monochrome	opaque	weathered	B1.2-01c?	P4?	x	x	wound	yellow opaque	none	segmented	Europe
46	WD 136.2.?a	grave 88	glass	monochrome	opaque	complete	x	x	A136	1-2-3-4-7-8-6-9-12	?	red opaque	none	conical mystery bead	?
47	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.1-06b / F6.5-01	P0-P3 / P1	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
48	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.1-06b	P0-P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
49	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
50	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
51	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
52	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.1-06a / F6.5-02	P3 / P1	A270	1	wound	dark blue-green translucent	none	annular	Europe
53	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.1-06a / F6.5-02	P3 / P1	A270	1	wound	dark blue-green translucent	none	annular	Europe
54	WD 136.2.?a	grave 88	glass	monochrome	translucent	broken	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
55	WD 136.2.?a	grave 88	glass	monochrome	translucent	broken	B1.1-06b	P0-P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
56	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
57	WD 136.2.?a	grave 88	glass	monochrome	translucent	broken	x	x	A182?	1-2-3-7-9-12?	wound	blue translucent	none	conical, square section	Europe
58	WD 136.2.?a	grave 88	glass	monochrome	translucent	broken	x	x	A182?	1-2-3-7-9-12?	wound	blue translucent	none	conical, square section	Europe
59	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	x	x	A182	1-2-3-7-9-12	wound	blue translucent	none	rectangular	Europe
60	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.8-06b	P1	x	x	wound	blue translucent	none	twisted	Europe
61	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.8-06b	P1	x	x	wound	blue translucent	none	twisted	Europe
62	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.8-06b	P1	x	x	wound	blue translucent	none	twisted	Europe
63	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.14-02	?	A180?	1-2?	wound	blue translucent	none	almond shaped	Europe
64	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.14-?	?	x	x	wound	colourless translucent	none	almond shaped	Europe

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65	WD 136.2.?a	grave 88	faience	monochrome	opaque	weathered	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
66	WD 136.2.?a	grave 88	glass	polychrome	opaque	complete	B2.3-?	?	B300?	4-7-8?	wound	red opaque, green opaque	wave	small annular	Europe
67	WD 136.2.?a	grave 88	glass	polychrome	opaque	broken	B2.3-?	?	x	x	wound	red opaque, green opaque	wave	small annular	Europe
68	WD 136.2.?a	grave 88	glass	polychrome	both	complete	B2.6-01a	?	B381?	1-2-3-4-7-8-6-9-12	wound	blue-green translucent, white opaque	wave	annular	Europe
69	WD 136.2.?a	grave 88	glass	polychrome	both	weathered	B2.5-02	P4	x	x	wound	white opaque, blue-green translucent	wave	small annular	Europe
70	WD 136.2.?a	grave 88	glass	polychrome	both	broken	x	x	A260?	1-2-3-4-7-8-9-12	wound	green-blue translucent, red opaque	line	small annular	Europe
71	WD 136.2.?a	grave 88	shell	monochrome	opaque	weathered	x	x	x	x	cut	white opaque	none	disc shaped	Eastern Mediterranean
72	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.1-06a?	P3?	A260?	1-2-3-4-7-8-9-12	wound	blue-green translucent	none	small annular	Europe
73	WD 136.2.?a	grave 88	shell	monochrome	opaque	weathered	x	x	x	x	cut	white opaque	none	disc shaped	Eastern Mediterranean
74	WD 136.2.?a	grave 88	glass	monochrome	opaque	weathered	B1.2-01c?	P4?	x	x	wound	yellow opaque	none	segmented	Europe
75	WD 136.2.?a	grave 88	glass	monochrome	opaque	complete	B1.5-?	?	x	x	wound	light green opaque	none	lobed	Europe
76	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	B1.8-06b	P1	x	x	wound	blue translucent	none	twisted	Europe
77	WD 136.2.?a	grave 88	glass	monochrome	translucent	broken	x	x	A182?	1-2-3-7-9-12?	wound	blue translucent	none	long conical	Europe
78	WD 136.2.?a	grave 88	glass	monochrome	opaque	weathered	B1.1-01a	P0-P3	x	x	wound	black opaque	none	small annular	Europe
79	WD 136.2.?a	grave 88	glass	monochrome	translucent	complete	x	x	x	x	wound	colourless translucent	none	long oval	Europe
80	WD 136.2.?a	grave 88	glass	monochrome	opaque	weathered	B1.3-08	P4	A090	1-2-3-4-7-8-6-9-12	wound	orange opaque	none	biconical	Europe
81	WD 136.2.?a	grave 88	glass	monochrome	opaque	weathered	B1.4-02a	P3	x	x	wound	red opaque	none	cylindrical	Europe
82	WD 136.2.?a	grave 88	glass	monochrome	translucent	weathered	B1.1-08d	?	A260	1-2-3-4-7-8-9-12	wound	green-blue translucent	none	annular	Europe
83	WD 136.2.?a	grave 88	glass	monochrome	opaque	weathered	B1.1-02a	P2-P5	x	x	wound	yellow opaque	none	small annular	Europe

subnr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	WD 5821	?	glass	monochrome	translucent	complete	B1.12-?	?	A361?	1?	wound	green translucent	none	cylindrical	Europe
2	WD 8236	pit	glass	polychrome	both	complete	x	x	J001 (2)	1-2-3-4-7-6	mosaic	green translucent, yellow opaque, red opaque, white opaque, blue translucent, light blue translucent	mosaic eyes, regular lines	oval	Mesopotamia
3	WD 8233	straight ditch	glass	monochrome	translucent	broken	A2.?	?	x	x	drawn	blue translucent	none	rectangular	Near East
4	WD 5974	between skeletons 5895 and 5896	glass	monochrome	translucent	complete	B1.4-07?	P5?	x	x	wound	green translucent	none	small cylindrical	Europe
5	WD 8213	pit	glass	polychrome	opaque	broken	B1.7-03	P5	x	x	wound	green opaque, blue-green opaque	spiral	almond shaped	Europe
6	WD 5728	?	glass	monochrome	translucent	complete	B1.14-02	?	A180	1-2	wound	blue opaque	none	almond shaped	Europe
7	WD 9126	'with skeleton'	glass	monochrome	opaque	complete	B1.4-02a	P3	x	x	wound	red opaque	none	cylindrical	Europe
8	WD 8228	pit	glass	monochrome	opaque	complete	x	x	x	x	?	red opaque	none	long oval mystery bead	Europe
9	WD 6273	between parts of incomplete skeleton	glass	monochrome	opaque	complete	B1.3-02	P3	x	x	wound	red opaque	none	Long biconical	Europe
10	WD 6659	stray find	glass	monochrome	opaque	weathered	x	x	A134	1-7-8-6	?	red opaque	none	cylindrical mystery bead	Europe
11	WD 9112	grave, incomplete skeleton	glass	monochrome	opaque	complete	B1.6-02a?	P4?	A139	7-8	wound	red opaque	none	rectangular	Europe
12	WD 9112	grave, incomplete skeleton	glass	polychrome	opaque	complete	D1.2-04?	P2?	x	x	?	red opaque, orange opaque	none	long oval mystery bead	Europe
13	WD 9112e	grave, incomplete skeleton	glass	monochrome	opaque	complete	B1.6-02a?	P4?	A139	7-8	wound	red opaque	none	rectangular	Europe
14	WD 9112e	grave, incomplete skeleton	glass	monochrome	opaque	complete	x	x	x	x	wound	light blue opaque	none	rectangular	Europe
15	WD 9112a	grave, incomplete skeleton		monochrome	opaque	complete	1.4-04a?	P3?	x	x	wound	light blue opaque	none	cylindrical	Europe
16	WD 9112a	grave, incomplete skeleton	glass	monochrome	opaque	complete	B1.4-02a	P3	A134	1-7-8-6	?	red opaque	none	cylindrical mystery bead	Europe

subnr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
17	WD 9112d	grave, incomplete skeleton	glass	monochrome	translucent	complete	x	x	x	x	wound	colourless translucent	none	long oval, square section	Europe
18	WD 9112d	grave, incomplete skeleton	glass	monochrome	opaque	complete	x	x	x	x	wound	light blue opaque	none	rectangular	Europe
19	WD 9112b	grave, incomplete skeleton	glass	monochrome	opaque	complete	x	x	x	x	wound	light blue opaque	none	rectangular	Europe
20	WD 9112b	grave, incomplete skeleton	glass	monochrome	opaque	complete	B1.1-03b	P1-P5	A130	1-2-3-4-7-8-6-9-12	wound	red opaque	none	annular	Europe
21	WD 9131	'with skeleton'	glass	monochrome	opaque	complete	B1.4-02a	P3	x	x	wound	red opaque	none	small cylindrical	Europe
22	WD 9131	'with skeleton'	glass	polychrome	both	complete	B?	?	x	x	wound	blue translucent, yellow opaque, white opaque	borders, interlacing	cylindrical	Europe
23	WD 9112f	grave, incomplete skeleton	glass	monochrome	opaque	complete	x	x	x	x	wound	light blue opaque	none	rectangular	Europe
24	WD 9112f	grave, incomplete skeleton	glass	monochrome	opaque	complete	x	x	x	x	wound	light blue opaque	none	rectangular	Europe
25	WD 9112f	grave, incomplete skeleton	glass	monochrome	opaque	complete	1.4-04a?	P3?	x	x	wound	light blue opaque	none	cylindrical	Europe
26	WD 9112f	grave, incomplete skeleton	glass	monochrome	translucent	complete	x	x	x	x	wound	colourless translucent	none	long oval, square section	Europe
27	WD 9112f	grave, incomplete skeleton	glass	monochrome	opaque	complete	B1.6-02a?	P4?	A139	7-8	wound	red opaque	none	rectangular	Europe
28	WD 9112f	grave, incomplete skeleton	glass	monochrome	opaque	complete	B1.6-02a?	P4?	A139	7-8	wound	red opaque	none	rectangular	Europe
29	WD 7080	grave pit 7066/7071	glass	monochrome	translucent	complete	B1.1-01b	P1	A032	7-9-12	wound	dark brown translucent	none	annular	Europe
30	WD 7099	grave	glass	polychrome	opaque	broken	B11.3-01c	P2	x	x	wound	red opaque, yellow opaque, white opaque	interlacing, irregular dots.	biconical	Europe

subnr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	WD G.V.4 / WD 284?	?	glass	monochrome	opaque	complete	B1.5-06	P5	A137?	7 (?)	wound	dark red opaque	none	melon bead	Europe
2	WD 278	?	ceramic	x	x	complete	x	x	x	x	modelled	brown opaque	none	melon bead	?
3	WD 341	?	glass	polychrome	both	complete	x	x	x	x	wound	colourless translucent, red opaque, black opaque	spiral	disc shaped	Europe
4	WD GII.117	?	glass	polychrome	translucent	complete	B1.1-12d?	P?	x	x	wound	green translucent, yellow translucent	none	asymmetric biconical	Europe
5	WD II.122	?	amber	x	x	complete	F1.1-03	P1a	x	x	cut	amber	none	annular	Baltic
6	WD 54.II.121	?	amber	x	x	complete	F?	?	x	x	lathe-cut	amber	none	biconical	Baltic
7	WD 68 II.22?	?	amber	x	x	broken	x	x	x	x	cut	amber	none	trapezium pendant	Baltic
8	WD 56	?	amber	x	x	weathered	F1.1-02	P3	x	x	cut	amber	none	annular	Baltic
9	WD 62	?	amber	x	x	broken	F1.4-02	P4	x	x	cut	amber	none	globular	Baltic
10	WD 283?	?	faience	monochrome	opaque	weathered	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
11	WD GII.118	?	glass	polychrome	both	complete	B12.1-03	P1-P2	x	x	wound	green-blue translucent, white opaque	combed spiral	annular	Cologne?
12	WD GII.119	?	glass	polychrome	both	weathered	B12.?	?	x	x	wound	green-blue translucent, white opaque, red opaque, yellow opaque	combed spiral, regular lines, regular dots.	annular	Cologne?
13	WD GII.116	?	glass	polychrome	both	weathered	B12.?	?	x	x	wound	light blue-green translucent, white opaque, blue translucent	borders, wave, regular dots	annular	Europe
14	WD 334 GV 115	?	glass	monochrome	translucent	weathered	x	x	x	x	wound	green translucent	none	biconical	Europe
15	WD 334 GV 117	?		polychrome	opaque	complete	x	x	x	x	wound	black opaque, white opaque	regular lines	annular	Europe
16	WD 335	?	glass	monochrome	opaque	weathered	B1.1-05b	?	x	x	wound	light blue opaque	none	annular	Europe
17	WD 335	?	glass	monochrome	translucent	weathered	B1.1-12?	?	A002	1-2-3-4-7-8-6-9-12	wound	colourless translucent	none	annular	Europe
18	WD 335	?	glass	polychrome	opaque	weathered	B3.2-01d	P3	x	x	wound	red opaque, white opaque	interlacing	annular	Europe
19	WD 336	?	glass	monochrome	translucent	weathered	B1.1-11a	?	A002	1-2-3-4-7-8-6-9-12	wound	colourless translucent	none	annular	Europe
20	WD 334 GV 114	?	glass	polychrome	both	complete	B9.1-02?	P3?	x	x	wound	dark brown translucent, white opaque, red opaque, yellow opaque	polychrome ribbon, regular lines	biconical	Europe

subnr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	WD G.V.4 / WD 284?	?	glass	monochrome	opaque	complete	B1.5-06	P5	A137?	7 (?)	wound	dark red opaque	none	melon bead	Europe
2	WD 278	?	ceramic	x	x	complete	x	x	x	x	modelled	brown opaque	none	melon bead	?
3	WD 341	?	glass	polychrome	both	complete	x	x	x	x	wound	colourless translucent, red opaque, black opaque	spiral	disc shaped	Europe
4	WD GII.117	?	glass	polychrome	translucent	complete	B1.1-12d?	P?	x	x	wound	green translucent, yellow translucent	none	asymmetric biconical	Europe
5	WD II.122	?	amber	x	x	complete	F1.1-03	P1a	x	x	cut	amber	none	annular	Baltic
6	WD 54.II.121	?	amber	x	x	complete	F?	?	x	x	lathe-cut	amber	none	biconical	Baltic
7	WD 68 II.22?	?	amber	x	x	broken	x	x	x	x	cut	amber	none	trapezium pendant	Baltic
8	WD 56	?	amber	x	x	weathered	F1.1-02	P3	x	x	cut	amber	none	annular	Baltic
9	WD 62	?	amber	x	x	broken	F1.4-02	P4	x	x	cut	amber	none	globular	Baltic
10	WD 283?	?	faience	monochrome	opaque	weathered	G1.2-05	Roman	x	x	modelled	light blue opaque	none	melon bead	Egypt
11	WD GII.118	?	glass	polychrome	both	complete	B12.1-03	P1-P2	x	x	wound	green-blue translucent, white opaque	combed spiral	annular	Cologne?
12	WD GII.119	?	glass	polychrome	both	weathered	B12.?	?	x	x	wound	green-blue translucent, white opaque, red opaque, yellow opaque	combed spiral, regular lines, regular dots.	annular	Cologne?
13	WD GII.116	?	glass	polychrome	both	weathered	B12.?	?	x	x	wound	light blue-green translucent, white opaque, blue translucent	borders, wave, regular dots	annular	Europe
14	WD 334 GV 115	?	glass	monochrome	translucent	weathered	x	x	x	x	wound	green translucent	none	biconical	Europe
15	WD 334 GV 117	?		polychrome	opaque	complete	x	x	x	x	wound	black opaque, white opaque	regular lines	annular	Europe
16	WD 335	?	glass	monochrome	opaque	weathered	B1.1-05b	?	x	x	wound	light blue opaque	none	annular	Europe
17	WD 335	?	glass	monochrome	translucent	weathered	B1.1-12?	?	A002	1-2-3-4-7-8-6-9-12	wound	colourless translucent	none	annular	Europe
18	WD 335	?	glass	polychrome	opaque	weathered	B3.2-01d	P3	x	x	wound	red opaque, white opaque	interlacing	annular	Europe
19	WD 336	?	glass	monochrome	translucent	weathered	B1.1-11a	?	A002	1-2-3-4-7-8-6-9-12	wound	colourless translucent	none	annular	Europe
20	WD 334 GV 114	?	glass	polychrome	both	complete	B9.1-02?	P3?	x	x	wound	dark brown translucent, white opaque, red opaque, yellow opaque	polychrome ribbon, regular lines	biconical	Europe
21	WD 339	?	glass	polychrome	opaque	complete	x	x	G050(11)	2-3-4-7	mosaic	blue translucent, yellow opaque, white opaque, red opaque, green opaque	checkerboard, borders	cylindrical	Near East

subnr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
22	WD G.V. 101-105	?	glass	polychrome	both	weathered	x	x	E140	1-2-3	drawn	colourless opaque, yellow translucent, silver	none	segmented	Eastern Mediterranean
23	WD G.V. 101-105	?	glass	polychrome	both	weathered	x	x	E140	1-2-3	drawn	colourless opaque, dark yellow translucent, silver	none	segmented	Eastern Mediterranean
24	WD G.V. 101-105		glass	polychrome	both	weathered	x	x	E110	1-2-3	drawn	colourless opaque, colour-less translucent, silver	none	segmented	Eastern Mediterranean
25	WD G.V. 101-105	?	glass	monochrome	translucent	complete	x	x	E130	1-2-3	drawn	yellow translucent	none	segmented	Eastern Mediterranean
26	WD G.V. 101-105	?	glass	monochrome	translucent	weathered	x	x	E110	1-2-3	drawn	colourless translucent, silver	none	segmented	Eastern Mediterranean
27	WD G.V. 106-111	?	glass	polychrome	translucent	weathered	x	x	E60	1-2-3	drawn	colourless opaque, blue translucent	none	segmented	Eastern Mediterranean
28	WD G.V. 106-111	?	glass	polychrome	both	broken	x	x	E140	1-2-3	drawn	colourless opaque, dark yellow translucent, silver	none	segmented	Eastern Mediterranean
29	WD G.V. 106-111	?	glass	monochrome	translucent	broken	x	x	E110	1-2-3	drawn	colourless translucent, silver	none	segmented	Eastern Mediterranean
30	WD G.V. 106-111	?	glass	monochrome	translucent	weathered	x	x	E130	1-2-3	drawn	yellow translucent	none	segmented	Eastern Mediterranean
31	WD G.V. 106-111	?	glass	monochrome	translucent	broken	A4.4-02?	?	E?	1-2-3	drawn	colourless translucent	none	segmented	Near East
32	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
33	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
34	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
35	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
36	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
37	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
38	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
39	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
40	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
41	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
42	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
43	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
44	WD 333	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
45	WD 334 GV 113	?	glass	monochrome	translucent	complete	B1.1-06b	P0-P3	A170?	1-2-3-7-9-12	wound	blue translucent	none	globular	Europe
46	WD 334 GV 116	?	glass	polychrome	opaque	complete	B6.1-01?	?	B2004	?	wound	black opaque, white opaque, yellow opaque, red opaque, green opaque, blue translucent	spiral, irregular dots	globular	?

subnr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
47	WD 339	?	glass	polychrome	opaque	weathered	x	x	B060	2-7	wound	black opaque, yellow opaque	borders	wasp bead	Scandinavia
48	WD 339	?	glass	polychrome	opaque	broken	x	x	B060	2-7	wound	black opaque, yellow opaque	borders	wasp bead	Scandinavia
49	WD 339	?	glass	polychrome	opaque	weathered	x	x	J001(4)	1-2-3-4-7	mosaic	green translucent, yellow opaque, red opaque, white opaque, blue translucent	mosaic eyes	oval	Near East
50	WD 339	?	glass	polychrome	opaque	broken	x	x	G050(8)	2-3-4-7	mosaic	green translucent, yellow opaque, red opaque, white opaque, blue translucent, light blue translucent	mosaic eyes, borders	cylindrical	Near East
51	WD 339	?	glass	polychrome	opaque	complete	x	x	H001(5)	2-3-4-7	mosaic	green translucent, yellow opaque, red opaque, white opaque, blue translucent	mosaic eyes	oval	Near East
52	WD 339	?	glass	polychrome	opaque	complete	B1.8-03	P5	x	x	wound	red opaque	none	twisted	Europe
53	WD 339	?	glass	polychrome	opaque	complete	x	x	B362	3-4-7-8	wound	dark red opaque, yellow opaque	borders, wave	wasp bead	Scandinavia
54	WD 339	?	glass	polychrome	both	complete	x	x	B060?	2-7?	wound	colourless translucent, yellow opaque	borders	wasp bead	Scandinavia
55	WD 339	?	glass	polychrome	opaque	weathered	x	x	B060	2-7	wound	black opaque, yellow opaque	borders	wasp bead	Scandinavia
56	WD 339	?	glass	polychrome	opaque	complete	x	x	x	x	wound	black opaque, yellow opaque	borders, waving spiral	long cylindri-cal wasp bead	Scandinavia
57	WD 339	?	glass	polychrome	opaque	complete	x	x	B308?	3-4-7-8?	wound	red opaque, yellow opaque	borders	wasp bead	Scandinavia
58	WD 339	?	glass	polychrome	opaque	complete	x	x	B060	2-7	wound	black opaque, yellow opaque	borders	wasp bead	Scandinavia
59	WD 339	?	glass	polychrome	opaque	complete	x	x	B308?	3-4-7-8?	wound	red opaque, yellow opaque	borders	wasp bead	Scandinavia
60	WD G.V. 340	?	glass	polychrome	translucent	complete	x	x	Q36	2-3-4-7-8-6-9-12	drawn	blue translucent, light blue translucent	none	polyhedral	Near East
61	WD G.V. 340	?	glass	monochrome	opaque	broken	B1.4-01a	P3	A64	1-2-3-4-7-8-6-9-12	wound	yellow opaque	none	cylindrical	Europe
62	WD G.V. 340	?	glass	monochrome	opaque	weathered	B1.4-02a	P3	A134	1-7-8-6	wound	red opaque	none	cylindrical	Europe
63	WD G.V. 340	?	glass	monochrome	opaque	complete	B1.6-01b?	P2?	x	x	wound	red opaque	none	pentagonal	Europe
64	WD G.V. 340	?	glass	polychrome	both	complete	x	x	x	x	wound	green-blue translucent, blue translucent,	spiral	cylindrical	Europe
65	WD G.V. 340	?	glass	monochrome	opaque	complete	B1.6-02?	?	A311?	7-6?	wound	green-blue translucent	none	rectangular	Europe
66	WD G.V. 340	?	glass	monochrome	opaque	complete	B1.4-02a	P3	A135	1-7-8-6	wound	red opaque	none	cylindrical	Europe

subnr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
67	WD G.V. 340	?	glass	polychrome	opaque	complete	B5.2-02d	P2	x	x	wound	red opaque, yellow opaque	spiral	cylindrical	Europe
68	WD G.V. 340	?	glass	polychrome	opaque	complete	x	x	x	x	wound	black opaque, white opaque	waves	cylindrical	Europe
69	WD G.V. 340	?	glass	monochrome	translucent	complete	x	x	x	x	wound	green translucent	none	large biconical	Europe
70	WD G.V. 340	?	glass	monochrome	opaque	complete	B1.12-?	?	A361?	1?	wound	green opaque	none	cylindrical	Europe
71	WD G.V. 340	?	glass	polychrome	opaque	complete	B1.4-04a	P3	A272	?	wound	green-blue translucent	none	cylindrical	Europe
72	WD G.V. 340	?	glass	monochrome	opaque	complete	B1.4-07?	P5?	A343	1-2-3-4-7-8-6-9-12	wound	green translucent	none	cylindrical	Europe
73	WD G.V. 340	?	glass	monochrome	opaque	weathered	x	x	x	x	wound	green opaque	none	large biconical	Europe
74	WD G.V. 340	?	glass	monochrome	opaque	complete	x	x	x	x	?	green opaque	none	long oval mystery bead	Europe
75	WD G.V. 340	?	glass	monochrome	opaque	complete	x	x	Q60	2-3-4-7-8-6-9-12	drawn	green translucent	none	hexagonal lead glass bead	Near East
76	WD G.V. 340	?	glass	monochrome	translucent	complete	A1.3-04	?	x	x	drawn	dark blue-green translucent	none	cylindrical	Near East
77	WD 336	?	glass	monochrome	opaque	complete	B1.3-08	P4	A90	1-2-3-4-7-8-6-9-12	?	orange opaque	none	barrel shaped mystery bead	Europe
78	WD 336	?	glass	monochrome	opaque	complete	B1.3-08	P4	A90	1-2-3-4-7-8-6-9-12	?	orange opaque	none	barrel shaped mystery bead	Europe
79	WD 336	?	glass	monochrome	opaque	complete	B1.3-08	P4	A90	1-2-3-4-7-8-6-9-12	?	orange opaque	none	barrel shaped mystery bead	Europe
80	WD 336	?	glass	polychrome	opaque	complete	B1.3-02	P3	A131	1-2-3-4-7-8-6-9-12	?	red opaque, orange opaque	none	barrel shaped mystery bead	Europe
81	WD 336	?	glass	monochrome	opaque	complete	B1.4-07?	P5	x	x	wound	green opaque	none	barrel shaped	Europe
82	WD 336	?	glass	monochrome	translucent	complete	x	x	x	x	wound	dark brown translucent	none	pentagonal	Europe
83	WD 336	?	glass	monochrome	translucent	complete	x	x	x	x	wound	dark brown translucent	none	pentagonal	Europe
84	WD 336	?	glass	polychrome	both	weathered	B6.1-01d?	?	B2004	?	wound	blue translucent, green translucent, yellow opaque, white opaque, red opaque	irregular dots	barrel shaped	?
85	WD 336	?	glass	polychrome	opaque	complete	B3.3-05	P3	B160	?	wound	white opaque, red opaque	interlacing	biconical	Europe
86	WD 336	?	glass	polychrome	opaque	complete	x	x	B024	9-12	wound	white opaque, red opaque, green translucent	mosaic eyes	cylindrical	Near East
87	WD 336	?	glass	polychrome	both	complete	x	x	B386	1-2-3-4-7-8-6-9-12	wound	blue translucent, white opaque, red opaque	polychrome ribbon	cylindrical Ribe-bead	Scandinavia
88	WD 336	?	glass	monochrome	opaque	complete	B1.1-07	P1	A31	7-9-12	wound	Black opaque	none	annular	Europe

subnr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
89	WD 336	?	glass	polychrome	opaque	weathered	B6.1-02?	?	x	x	wound	red opaque, white opaque, yellow opaque	irregular dots	9	Europe
90	WD 336	?	glass	polychrome	opaque	weathered	B9.3	P3	x	x	wound	red opaque, yellow opaque, green translucent	polychrome ribbon	barrel shaped	Europe
91	WD 335	?	glass	monochrome	translucent	complete	A1.2-01	P1	F51	1-2-3-4-7-8-6-9	drawn	blue translucent	none	small annular	Near East
92	WD 335	?	glass	monochrome	translucent	complete	A1.2-01	P1	F51	1-2-3-4-7-8-6-9	drawn	blue translucent	none	small annular	Near East
93	WD 335	?	glass	monochrome	translucent	complete	A1.2-01	P1	F51	1-2-3-4-7-8-6-9	drawn	blue translucent	none	small annular	Near East
94	WD 335	?	glass	monochrome	translucent	broken	B1.4-04a	P3	A272	?	wound	blue-green translucent	none	cylindrical	Europe
95	WD 335	?	glass	monochrome	opaque	complete	B1.4-03a	P3	A021	1-2	wound	white opaque	none	disc shaped	Europe
96	WD 335	?	glass	monochrome	translucent	complete	x	x	x	x	wound	dark brown translucent	none	pentagonal	Europe
97	WD 335	?	glass	monochrome	translucent	broken	B1.5-07	P5	A273	?	wound	blue-green translucent	none	lobed	Europe
98	WD 335	?	glass	polychrome	both	complete	x	x	B547	?	wound	colourless translucent, white opaque, red opaque	borders, wave	biconical	Europe
99	WD 335	?	glass	monochrome	opaque	complete	B1.1-04b	P1-P3	A022	1-2-3-4-7-8-6-9-12	wound	white opaque	none	annular	Europe
100	WD 335	?	glass	monochrome	translucent	complete	B1.1-11a?	?	A260	1-2-3-4-7-9-12	wound	green-blue translucent	none	annular	Europe
101	WD 335	?	glass	polychrome	opaque	weathered	B3.3-05	P3	B160	?	wound	white opaque, red opaque	interlacing	annular	Europe
102	WD 335	?	glass	polychrome	both	complete	x	x	B451	3-4-7-9	wound	blue translucent, red opaque, white opaque	interlacing, eyes	annular Ribe-bead	Scandinavia
103	WD 335	?	glass	monochrome	opaque	weathered	B1.1-03c	P1-P3	A131	1-2-3-4-7-8-6-9-12	wound	red opaque	none	annular	Europe
104	WD 335	?	glass	monochrome	translucent	complete	B1.1-06b	P0-P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
105	WD 335	?	glass	monochrome	opaque	complete	B1.3-01	P3	A061	1-2-3-4-7-8-6-9-12	wound	yellow opaque	none	barrel shaped	Europe
106	WD 335	?	glass	monochrome	translucent	weathered	B1.1-11a	?	A260?	1-2-3-4-7-9-12?	wound	green translucent	none	annular	Europe
107	WD 335	?	glass	monochrome	translucent	complete	B1.1-06b	P0-P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
108	WD 335	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
109	WD 335	?	glass	monochrome	translucent	complete	B1.1-06a	P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
110	WD 335	?	glass	monochrome	opaque	weathered	x	x	F031	3-6	drawn	white opaque, yellow translucent	none	small annular	Near East
111	WD 335	?	glass	monochrome	opaque	complete	B1.1-03b	P1-P5	A130	1-2-3-4-7-8-6-9-12	wound	red opaque	none	small annular	Europe
112	WD 335	?	glass	monochrome	opaque	broken	B1.2-01a	P4	x	x	wound	yellow opaque	none	segmented	Europe
113	WD 339	?	glass	polychrome	opaque	broken	x	x	G050(9)	2-3-4-7	mosaic	blue translucent, white opaque, red opaque, yellow opaque, green translucent	checker-board eyes, borders	cylindrical	Near East

subnr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
1	WD 685a	?	glass	monochrome	translucent	complete	B1.?	?	A182	1-2-3-7-9-12	wound	blue translucent	none	rectangular	Europe
2	WD onbek-end 360	?	glass	polychrome	both	broken	x	x	J001(4)	1-2-3-4-7	mosaic	green translucent, yellow opaque, red opaque, white opaque, blue translucent	mosaic eyes	oval	Near East
3	WD 757	?	glass	monochrome	translucent	broken	B1.4-04a	P3	A361?	1?	wound	blue-green translucent	none	cylindrical	Europe
4	WD 7905	?	glass	monochrome	opaque	complete	B1.6-01e	P2	x	x	wound	blue-green opaque	none	pentagonal	Europe
5	WD onbek-end 26	?	glass	polychrome	opaque	broken	x	x	x	x	wound	red opaque, white opaque	combed spiral	biconical	Europe
6	WD onbek-end 24	?	glass	polychrome	both	broken	x	x	G50	2-3-4-7	mosaic	red opaque, yellow opaque, white opaque, blue translucent, green translucent	checker-board eyes, striped borders	cylindrical	Near East
7	WD onbek-end 24	?	glass	monochrome	translucent	weathered	A4.3-01b	P3	E140	1-2-3	drawn	yellow translucent, silver foil	none	segmented	Near East
8	WD onbek-end 24	?	ceramic	monochrome	opaque	complete	F8.?	?	x	x	?	brown opaque	none	annular	?
9	WD onbek-end 25	?	glass	monochrome	translucent	broken	A3.1-?	?	E60	1-2-3	drawn	blue translucent	none	segmented	Near East
10	WD onbek-end 25	?	glass	polychrome	opaque	weathered	B6.1-?	?	B2004	?	wound	blue opaque, yellow opaque, red opaque, white opaque	irregular dots	barrel shaped	Europe
11	WD onbek-end 25	?	glass	monochrome	opaque	weathered	B1.1-06b	P0-P3	A190	1-2	wound	blue opaque	none	annular	Europe
12	WD onbek-end 25	?	glass	monochrome	translucent	broken	A3.1-?	?	E60	1-2-3	drawn	blue translucent	none	segmented	Near East
13	WD onbek-end 23	?	copper	monochrome	opaque	weathered	F6.3-?	?	x	x	wound	copper	none	twisted	Europe
14	WD onbek-end 23	?	ceramic	monochrome	opaque	weathered	F8.?	?	x	x	wound	grey opaque	carved lines	annular	Europe
15	WD onbek-end 23	?		polychrome	opaque	weathered	B5.?	?	x	x	wound	green opaque, yellow opaque	spiral	asymmetric biconical	Europe
16	WD?	?	glass	polychrome	both	complete	B11.4-01?	P4?	x	x	wound	red opaque, white opaque, blue-green opaque	wave, regular lines	barrel shaped	Europe
17	WD onbek-end 22	?	glass	polychrome	both	broken	x	x	B480	2-3-4-7-8-6-9-12	wound	blue translucent, white opaque	mosaic eyes	globular	Near East
18	WD onbek-end 22	?	glass	monochrome	opaque	melted	x	x	x	x	?	dark red opaque	none	melted	Europe?
19	WD onbek-end 22	?	glass	monochrome	opaque	melted	x	x	x	x	wound	yellow opaque	none	melted	Europe
20	WD onbek-end 22	?	glass	monochrome	opaque	melted	x	x	x	x	?	blue translucent	none	melted	Europe?

subnr	findnr	Feature	Material	Glass Subcategory	Translucent / Opaque	Condition	Vrielynck / Mathis/ Pion Type	Pion Phase	Callmer 1977 Type	Callmer 1977 Phase	Technique	Colour(s)	Decoration	Shape	Origin
21	WD onbek-end 22	?	glass	polychrome	both	melted	x	x	x	x	?	yellow translucent, red opaque, black opaque	?	melted	Europe?
22	WD onbek-end 22	?	glass	polychrome	both	melted	x	x	x	x	?	red opaque, blue translucent, green-blue opaque	?	melted	Europe?
23	WD onbek-end 22	?	glass	polychrome	opaque	melted	B3.2-02a	P2	x	x	wound	red opaque, yellow opaque	interlacing	melted	Europe?
24	WD onbek-end 22	?	glass	monochrome	opaque	melted	B1.1-06b	P0-P3	A171	1-2-3-7-9-12	wound	blue opaque	none	annular	Europe
25	WD onbek-end 22	?	glass	monochrome	translucent	melted	B1.2-04c	P4	x	x	wound	blue translucent	none	segmented	Europe
26	WD onbek-end 22	?	glass	polychrome	opaque	weathered	x	x	B069	1-2-3	wound	black opaque, yellow opaque, red opaque	borders, regular lines, waves	cylindrical	Europe
27	WD onbek-end 22	?	glass	polychrome	both	melted	B5.4-?	?	x	x	wound	yellow translucent, yellow opaque	spiral	annular	Europe
28	WD onbek-end 22	?	amber	monochrome	opaque	weathered	F1.8-03	P1-P5	x	x	cut	amber	none	oval/ annular	Baltic
29	WD onbek-end 22	?	glass	monochrome	opaque	complete	B1.1-06b	P0-P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
30	WD onbek-end 22	?	glass	monochrome	opaque	melted	B1.1-06b	P0-P3	A171	1-2-3-7-9-12	wound	blue translucent	none	annular	Europe
31	WD onbek-end 22	?	glass	monochrome	opaque	melted	B1.6-01c	P2	x	x	wound	white opaque	none	melted pentagonal	Europe
32	WD onbek-end 22	?	glass	monochrome	opaque	melted	B1.4-03b	P4	x	x	wound	white opaque	none	double cylindrical	Europe

Site Albert Heijn

1 2 3 4 5 6 7 8 9 10 11

Site De Geer

1 2 3 4 5 6

Site De Heul

1 2 3

4 5 6 7 8 10 11 12 13 14

15 16 17 18 19 20 21

5 mm

Site De Horden

5 mm
2 + 9 :
rest :

1 2 3 4 5 6 7 8 9 10

11 12 13 14 15 16 17 18

Site Hoogstraat

1 2 3 4 5 6 7 8 9 10 11

5 mm
1-12:
12-19:

12 13 14 15 16 17 18 19

Site Hoogstraat

5 mm

20 21 22 23 24

Site Voorwijk

5 mm
4 - 6 :
rest :

1 2 3 4 5 6 7 8 9 10

11 12

Site Zandweg

1 2 3 4 5 6 7 8

9 10 11 12 13 14

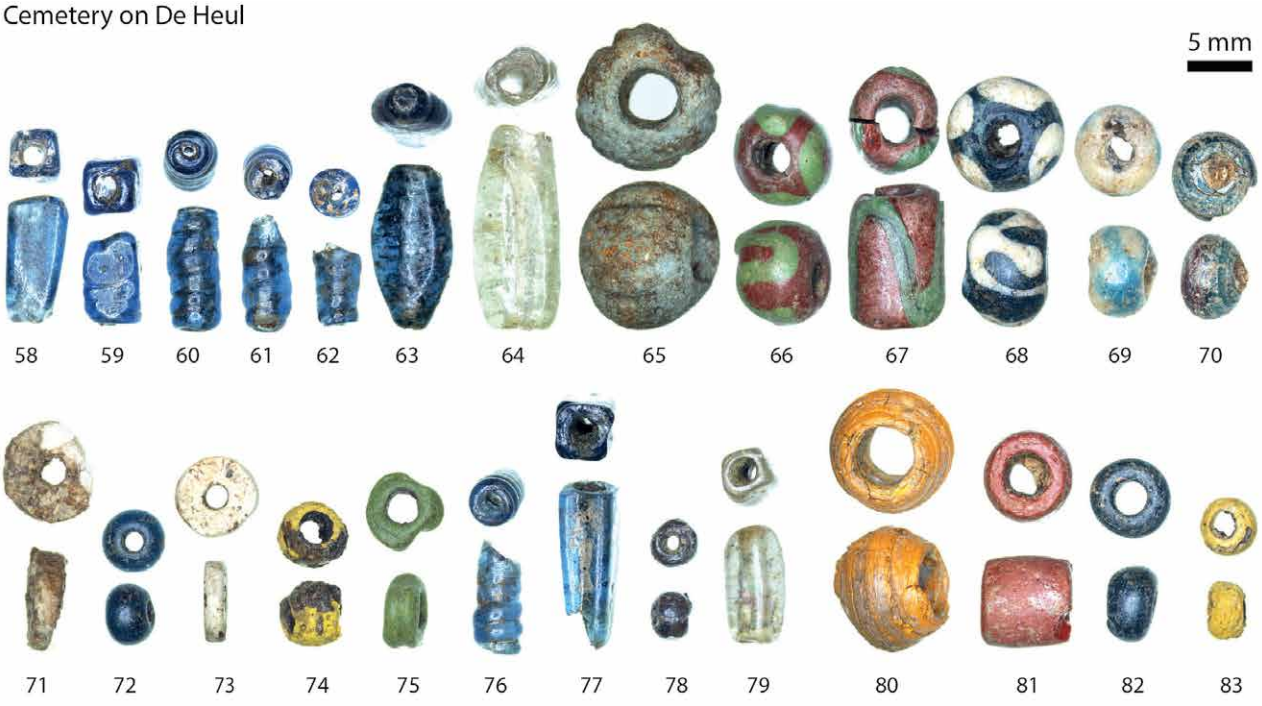
5 mm

Site Veilingterrein

Cemetery on De Heul

Cemetery on De Heul

Cemetery on De Heul



Cemetery Willigenburg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19th century finds

5 mm

98 99 100 101 102 103 104 105 106

107 108 109 110 111 112 113

1 2 3 4

Unknown location

5 6 7 8 9 10 11 12 13

5 mm

5, 14, 15, 26, 27 :

rest :

14 15 16 17 18 19 20 21 22 23

24 25 26 27 28 92 30 31 32

Mixed Emotions

The swords of Dorestad

Annemarieke Willemsen

The sword is a weapon and a symbol. Of all weapons, the sword sparks the imagination most. Its lethal thrust is feared, but the skilfully forged blade and decorated hilt are admired. The sword symbolises the power and wealth of its bearer, but it can also have its own name and personality. A sword could not be thrown away just like that. In fights all over the world, spears, axes, clubs and daggers were used as well. But everywhere the sword became the weapon of choice and symbol of the elite, of warriors and knights, of the king: only he can draw the sword from the stone.[1]

Introduction

Dorestad was the largest town of the Low Countries in the Carolingian era. Located about 20 miles southeast of Utrecht on the Rhine, it was a riverine emporium on the northern edge of the Carolingian Empire and a European junction. It had a mint, a toll, an outstretched harbour and a few thousand inhabitants. From written sources it is known as a place of political, economic and religious importance. Among the goods sold at its market, known from toll registers, Frankish sword blades were famous. That these were bought by future enemies as well is underlined by the embargo placed by the emperor Charles the Bald in 867 AD on the export of blades to Scandinavian and Slavic territories.[2] Moreover, in written sources, Dorestad is often mentioned as a site of armed conflict. Its first mentioning in the Frankish royal annals is as the location of the 'battle at the *castrum* Dorestad' in 695 AD and it is reported to be attacked by Vikings on various occasions from 834 onwards, and defended by the Carolingian emperors. The final blow to the town was a Viking attack in 863 AD, when half of its residents are reported to have been killed.

Over the almost two centuries of excavations at the site of Dorestad, many swords were found, in various contexts, but among the 2500 skeletons dug up here, just a few have sword wounds. Among the larger assemblage of weaponry and horse gear excavated here, which also includes typical Carolingian winged lances, 'sugarloaf' shield bosses, heavy arrows, decorated spurs and stirrups, the broadswords stand out, in numbers and in quality. The variety in excavated swords from Dorestad, the ways they were (re-)used and discarded here, and their status and reputation is supported by depictions of swords in Carolingian art.

1 Introductory text of the exhibition on swords 'Cutting-edge history' in the National Museum of Antiquities at Leiden in the summer of 2016.

2 Willemsen 2009, 126.

Figure 1. Iron broadsword with faintly three-lobed pommel, copper-inlaid hilt, and X on pattern-welded blade. Length 93.1 cm, width 9.2 cm. 800-825 AD. RMO Leiden inv. no. f 1936/11.1. Photo: RMO.

Figure 2. Iron broadsword with triangular pommel and pattern-welded blade. Length 89.5 cm, width 9.5 cm. 775-825 AD. 800-850 AD. RMO Leiden inv. no. f 1936/11.2. Photo: RMO.

Figure 3. Iron broadsword with low triangular pommel and pattern-welded blade. Length 93.8 cm, width 9.9 cm. 750-800 AD. RMO Leiden inv. no. f 1952/2.1. Photo: RMO.

Figure 4. Iron 'Dorestad Sword' with faintly three-lobed pommel and decorated gilded silver hilt. Preserved length 79 cm, width 9.8 cm. 800-850 AD. RMO Leiden inv. no. WD 7085 A. Photo: Restaura.

Figure 5. Iron broadsword with three-lobed pommel and pattern-welded blade (lower part missing). Length 65 cm, width 9.1 cm. 800-850 AD. RMO Leiden, inv. no. WD 372.4.11. Photo: RMO.

Figure 6. Iron broadsword with triangular pommel and pattern-welded blade. Length 89.5 cm, width 9.0 cm. 700-750 AD. RMO Leiden inv. no. WD 570.1.1. Photo: RMO.

Figure 7. Iron broadsword with domed pommel and +ATALBALD+II on pattern-welded blade. Length 96.8 cm, preserved width 8.7 cm, 1000-1040 AD. RMO Leiden inv. no. f 1940/8.1. Photo: RMO.

Present arms!

The site of Dorestad yielded many *spathas*: two-sided iron broadswords that are in this time typically up to 100 cm long, with an often pattern-welded blade about 5 cm wide and a straight guard up to 9 cm wide; the hilt can be decorated and the whole sword weighs about one kilogram (Figures 1-7). From Dorestad, there is one *spatha* with a gilded silver hilt, one *spatha* with an inlaid hilt, four other *spathas* with their hilts, blades of at least another four *spathas*, four pommels (of which one with inlays), three guards and some tips. This means there were at least over 20 broadswords, all now in the Dorestad Collection at the National Museum of Antiquities (RMO), a number unparalleled in the early medieval Netherlands. In this count and this article, shorter one-sided sword-knives (*seaxes*) and fragments thereof have not been included, although the size of some of the *seaxes* from Dorestad makes them serious swords in combat. There are also mentions in nineteenth-century reports of swords found here, that have not been preserved. In addition, there is a later, Ottonian broadsword found nearby, at the same site as one of the Carolingian swords, which bears the name ATALBALD on its blade (Figure 7). By that time, Dorestad was no more, and the site was known as 'VVic', which according to a 948 written source was the place 'which once was Dorestad'.[3]

When mapped out, the find spots of the broadswords are spread out across most of the territory of Dorestad (Figure 8). Three clusters of finds are the most interesting, as they show mixed emotions towards swords, especially in the way they were handled when discarded. One cluster consists of three complete *spathas* in the harbour region east of the Hoogstraat. The second one comprises three parts of swords excavated at site 'De Geer'. The third and most intriguing is a high-status sword burial in the settlement area west of the Hoogstraat.

A quartet of swords

Two well-preserved broadswords were donated to the National Museum of Antiquities (RMO) by the Dutch national waterworks Rijkswaterstaat in 1936.[4] One (f 1936/11.1, see Figure 1 and front cover) has a three-lobed pommel that, like its guard, has been inlaid with small brass strips. It has a pattern-welded blade that also shows an incrusted mark: an X flanked by horizontal lines. On one side of the grip, an impression of textile has been preserved. The other sword (f 1936/11.2, see Figure 2) has a triangular-shaped pommel and a pattern-welded blade. These two swords were found together with two extremely large *saxes* or *scramasaxes* (Figure 9).[5] This group has been interpreted as a possible common offering by four men at the same time. The four weapons were found during dredging for sluice works near Wijk bij Duurstede "in the river Lek near K.M. [kilometer mark] 71".[6] Archival research into the exact location of the sluice that was worked on in 1936, and subsequent plotting of the location onto a map with the excavation trenches of Dorestad, reveals that these four weapons were in the old river bed of the Rhine flowing by the south-eastern corner of Dorestad, just outside the traces of the jetties that protruded into the river bed here. The swords were placed in the water, but within throwing distance of the jetty. The letters by Rijkswaterstaat mention more fragments of swords found here, that were then donated by the Leiden museum to the Municipality of Wijk bij Duurstede.

Somewhat further north, another broadsword was excavated from this same harbour zone in 1972. This sword (WD 372.4.11, see Figure 5) has a faintly three-lobed pommel, a guard (with traces of decoration) and a pattern-welded blade of which the tip end is missing. Its present length is 63 cm and it weighs about 870 grams; it is thought to have

3 Willemsen 2009, 171.
4 Ypey 1963, 153-158.
5 Ypey 1963, 156, 158; Amkreutz and Willemsen 2016, 47.
6 Letters between Rijkswaterstaat and the National Museum of Antiquities preserved in the archives of the latter, dated between 14 August and 6 November 1936.

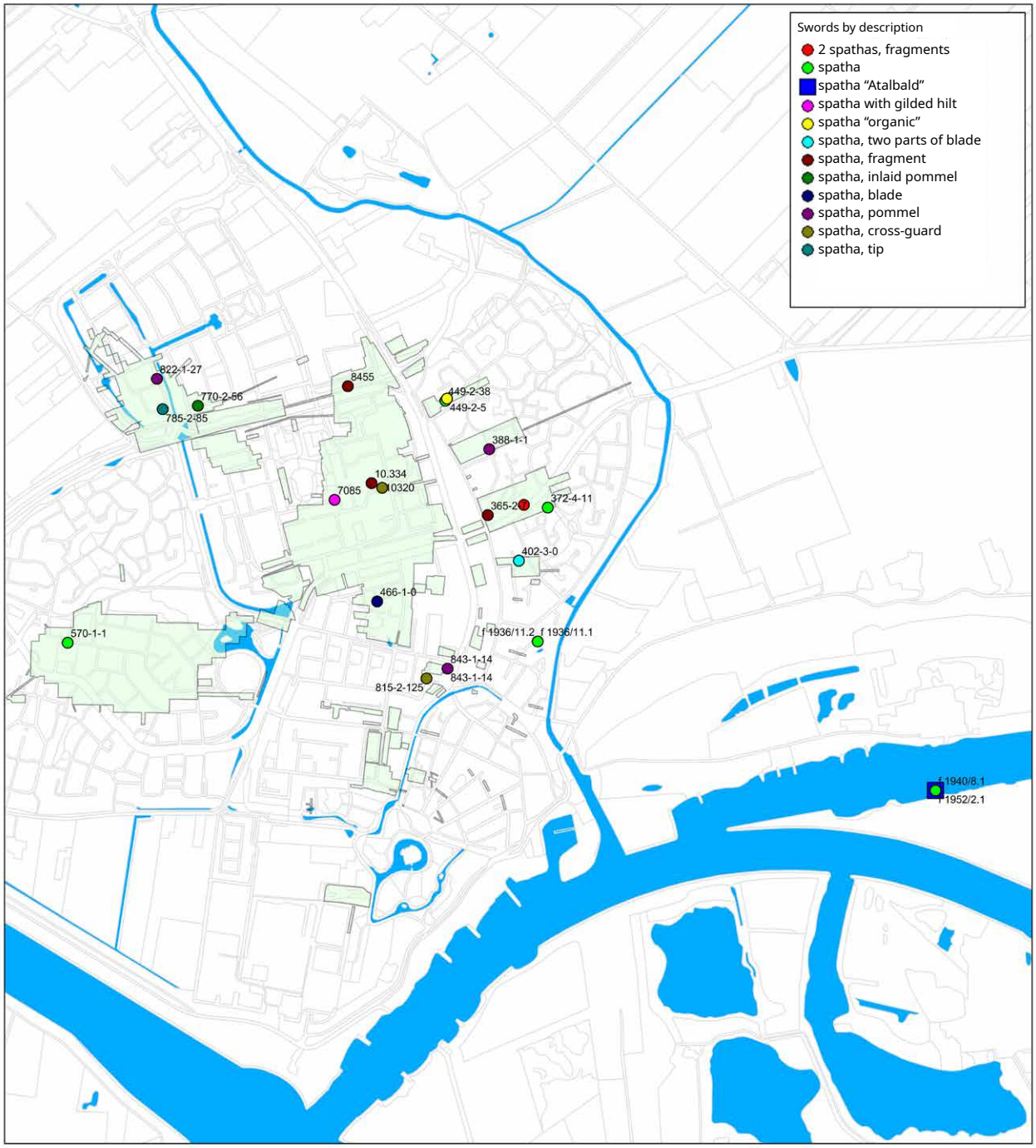

Figure 8. Map of sword finds in Dorestad. Map: M. Kosian/RCE.

originally been 90 to 95 cm long. It was published by Jaap Ypey, who dates it to the last quarter of the eighth to the middle of the ninth century.[7] This sword was also in the river bed, in waterlogged conditions, a short distance from the jetties. Some other parts of swords were found in this harbour zone, including the other fragments at the site of the four complete swords, and they form a line alongside the jetties, where they were thrown or left in the water, probably as offerings.

There is one further, completely preserved broadsword with a pattern-welded blade showing a herringbone

7 Ypey 1980.

Figure 9. Iron large seax with lines along the edge of the blade. Length 64.5 cm, width 5.2 cm. RMO Leiden inv. no. f 1936/11.3.

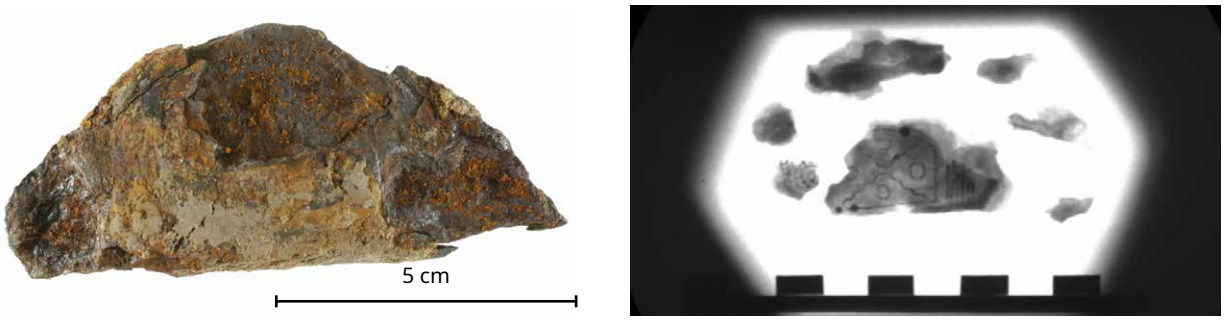

Figure 10. Iron pommel cap with inlaid decoration. Width 4.7 cm, height 2.0 cm. RMO Leiden inv. no. WD 770.O.2.56. Left: present condition. Right: X-ray showing decoration. Photos: Restaura.

pattern (see Figure 3) that was dredged from the Rhine bed in 1952 at the site of a brick factory. This is the longest of the Dorestad swords and it dates from the eighth century AD. Its find location and its good preservation typify this sword as a river deposition as well. At this same spot, another broadsword had been found in the river in 1940, which is an Ottonian sword from the early eleventh century AD with a domed pommel and the inscription +ATALBALD+II (see Figure 7).[8] These two complete swords indicate that this edge of the river Rhine was a place used for weapon depositions for over two centuries.

Swords at a stronghold

Three parts of broadswords, two pommels (c.5 cm wide) and one blade tip, were found in the north-western area of Dorestad on the site known as 'De Geer'. All are very corroded, but an X-ray of the most complete pommel shows that it was decorated (Figure 10). Their find spots are close together and all fit inside a large stronghold surrounded with a double ditch recognised here (Figure 11), that is known to date from the Carolingian period from the contents of a well inside. This stronghold was identified by Jan van Doesburg as the 'villa non modica' mentioned in a written source of 863.[9] The presence of swords here would in any way be congruent with the presence of a Carolingian elite here.

The finds are only parts of hilts. It is unclear if the remainders of the swords were once there as well, and have now been lost, or if there were only ever fragments here. The latter would point towards the making, fitting and/or recycling of sword parts here. We know blades were sold at the market of Dorestad, and that there was an important iron industry on the Veluwe, to the immediate north of this river area. Dorestad would be the preferred candidate for the production of Frankish swords. Jaap Ypey suggested in 1980 that sword makers must have worked in Dorestad and Wim van Es added the possible presence of goldsmiths to those of blacksmiths.[10] If we look for smiths making or dismantling swords, then one or more may have been situated within or directly next to this stronghold on De Geer.

Apart from the river finds of swords mentioned above and the possible weapon grave described below, the other parts of swords have been found scattered across most of the site (see Figure 8). From the harbour area, on the eastern side of the Hoogstraat but away from the water's edge, there are five smaller fragments of broadswords, plus two parts of the same blade, and a pommel. These include the four fragments of blades, of which one over 46 cm long with clear pattern-welding, that are mentioned among the published finds from this area.[11] All these fragments are in the zone where land was claimed by depositing large quantities of sand and household waste into the river bed, that was falling dry as the river was slowly moving eastwards, and by building a vast complex of jetties on top. The locations of these finds within this waste deposit, their fragmentary nature and the absence of complete swords or significant parts, points to these sword parts as thrown away after use.

8 Ypey 1963, 160-162; Amkreutz and Willemsen 2016, 54.
9 Van Doesburg 2010.
10 Ypey 1980, 203; Van Es 2006, 94.
11 Van Es, Verwers and Isings 2009, 220-221, 227.

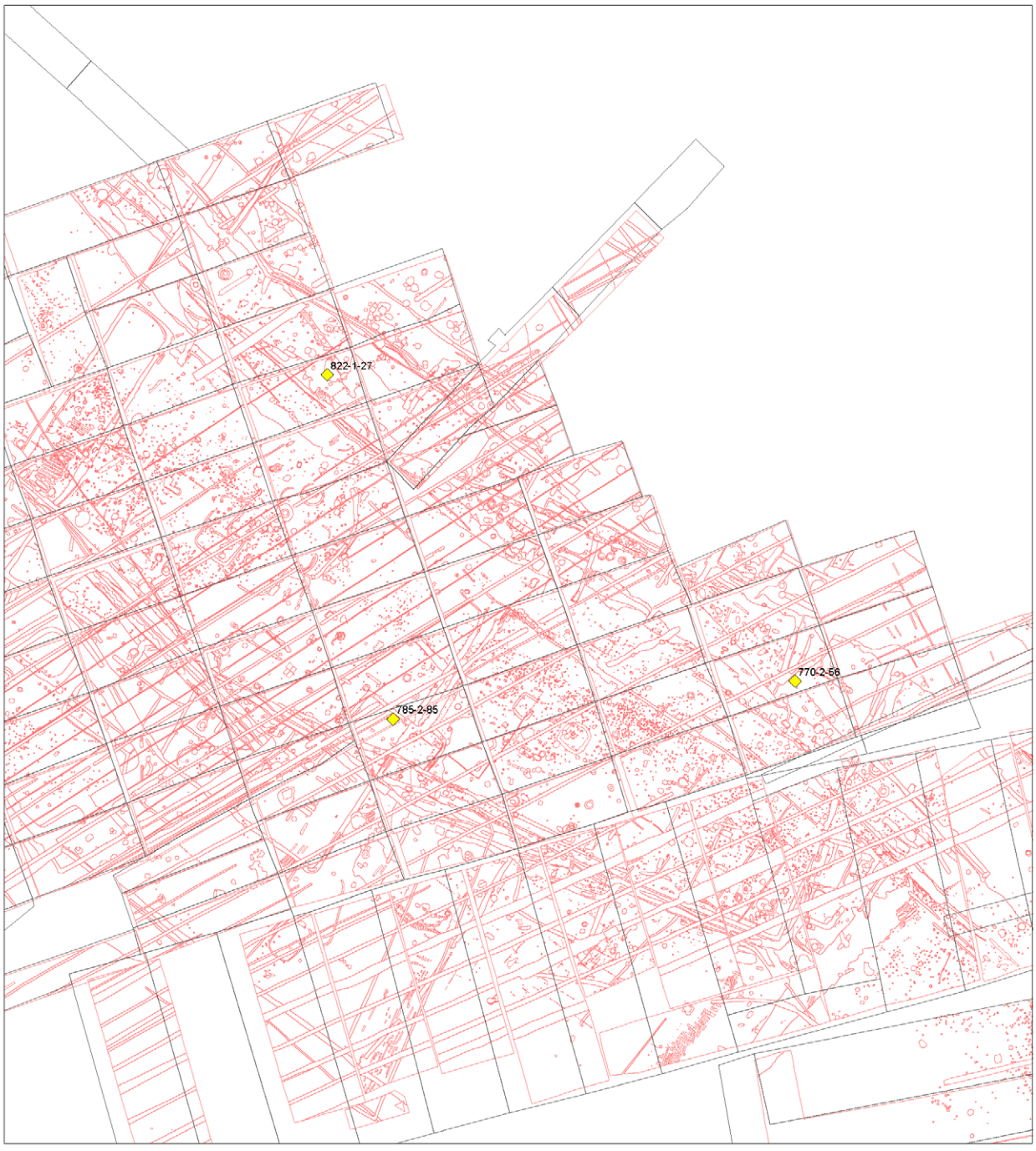

Figure 11. Map showing three sword fragments inside a stronghold on de Geer. Map: M. Kosian/RCE.

Figure 12. Bone cross-guard of a broadsword. Width 9.3 cm, height 1.8 cm. RMO Leiden inv. no. WD 639.

Figure 13. 'Dorestad Sword' (see Figure 4), reconstruction drawing. Artist: R. Bakker.

Figure 14. 'Dorestad Sword' (see Figure 4), detail of the gilded hilt.

Four fragments of broadswords are known from the slightly raised area on the western side of the Hoogstraat called De Heul, and two pommels and a cross guard came from the area of De Engk in the southern part of Dorestad (directly to the north of the present-day town of Wijk bij Duurstede). As we know of both housing and cemeteries on both these sites, the precise nature of these finds remains unclear. That is also true for the swords mentioned in reports of the nineteenth-century bone diggings on both sides of the Hoogstraat, of which only a bone cross guard (Figure 12) remains recognizable in the collections. With its width of over 9 cm, it must have belonged to a broadsword as well, and it is a reminder that a sword is made up of more than metal; the wood, bone and textiles of its grip and the sheathing are usually missing in the archaeological record.

The oldest of the complete Frankish *spathas* (see Figure 6) was found at the site of De Horden. It has a triangular pommel and is dated to the first half of the eighth century AD. The blade of this sword was very corroded. As the area is mainly known for its extensive Roman occupation and burial grounds, but also yielded seventh- and early-eight-century burials, and iron nails were found close by, this sword may have well been in a grave once.

The 'Dorestad sword'

The most important sword find from Dorestad is without doubt the so-called 'Dorestad sword', a luxury broadsword with a gilded hilt (Figures 4, 13 and 14).[12] This decorated

12 Willemsen 2012, 71-77.

Figure 15. Head of iron lance, present length 46.2 cm, maximum width 6.0 cm. RMO Leiden inv. no. WD 7085 B.

two-part hilt is made of silver, with much of the gilding worn down. It is constructed of a three-lobed pommel cap on a pommel guard and a cross guard. Both horizontal guards are decorated in the same way with a intertwining pattern, but the pommel cap is deviant, with a flowery pattern between two stylised animals looking outwards. The cap does not fit perfectly on the pommel guard and is also notably more worn than the guards. It is probably much older than those; the 'sharp edges' of the pattern on the guards can be dated on parallels to 750-850 AD, but the ornamentation of the hybrid pommel cap is dated to c.700 AD.[13] It must have been part of and older sword, at least two generations older and easily over a century older, maybe a heirloom, carefully reused in a new hilt. That a sword can incorporate older parts that add to its biography and value, and may be attached or changed at significant moments, was recently shown eloquently by Sue Brunning in her study of early medieval swords from the United Kingdom and Scandinavia. She also stresses that hilts wear quicker than blades and a new hilt should not be interpreted as a new sword, but rather a refurbished old sword.[14] The blade of the 'Dorestad sword' is much corroded and shows no clear pattern on X-rays. It is possible that the blade formed one sword with the pommel cap, made c.700 AD, and that only the guards were made anew for it, although the heavy grip tongue made Jaap Ypey think the blade might be later as well.[15]

The higly corroded blade looked very different from the other swords from Dorestad and indeed from its well-preserved hilt. This difference in preservation caused hilt and blade to become disconnected for forty years. Although the objects bear the same find number (WD 7085) and fit together perfectly, the gilded hilt was taken into care as a masterpiece, while its blade went into general storage, with thousands of other rusted metal finds. They were only refitted together in the preparations for the large Dorestad Exhibition in the National Museum of Antiquities in 2009, when it took the restorers at Restaura 56 hours to piece it together. The grip between the hilt parts and the missing tip of the blade was reconstructed then as well.[16]

The condition of this sword is due to its preservation: it is one of the (near-) complete broadswords at Dorestad that was not found in the former river bed, but was likely placed in a burial. It was excavated on July 18, 1969 by youngsters of a Dutch youth archaeological organization, the Nederlandse Jeugdbond ter Bestudering van de Geschiedenis (NJBG) who were on an excavation camp assisting the team of the National Archaeological Service (ROB). According to them, the sword showed up as 'a black line' in the ground, and they have photos of how it was shoved unto the side of a cardboard box to recover it.[17] The field drawings show an oblong black pit here, from which a long lance head was recovered too (WD 7085 B, Figure 15). The part preserved is 47 cm long, but it was broken off at the edge of the shaft. Most likely the shaft was broken just above two protruding parts, typical for the winged lances that are typical of the eighth and early ninth centuries AD. Winged lances were used for hunting large animals and thus became a status symbol for the elite, but images in Carolingian art how that these weapons were used to kill people as well, which supplies this symbol with a dual nature.[18] A third recovery from this spot is a broken, light green glass funnel beaker with a long thin foot (WD 7085 C).

Grave of an unknown soldier

An assemblage like this, with two high-class weapons within a black patch in the ground, usually points to an inhumation grave of a man, characterised by these elite weapons as a high-ranking warrior – easily called a king. Needless to say, these objects were recovered rather than excavated, and because of the lack of context information it cannot be fully excluded that the sword, the lance and the beaker were deposited in this area separately and were not connected. But overall it is most likely to have been a burial, in which this wonderful sword was left with its owner, signalling his status and identity. For that, it is in a most interesting spot, with an evenly interesting dating. The sword was excavated on the same day as and only 80 metres away from the most famous find from this site, the Dorestad Brooch. The latter was found by the same youngsters in a water well, and although the brooch must have been produced around 800 AD, it only ended

13 Van Es 2006, 90-94; Van Es, Verwers and Isings 2015, 239, 241, 405.
14 Brunning 2019, 78-84.
15 Van Es 2006, 94.
16 Willemsen 2012, 72-73.
17 As communicated by Judith Schuyf, who was there, see Willemsen 2012, 72.
18 Willemsen 2020, 48.

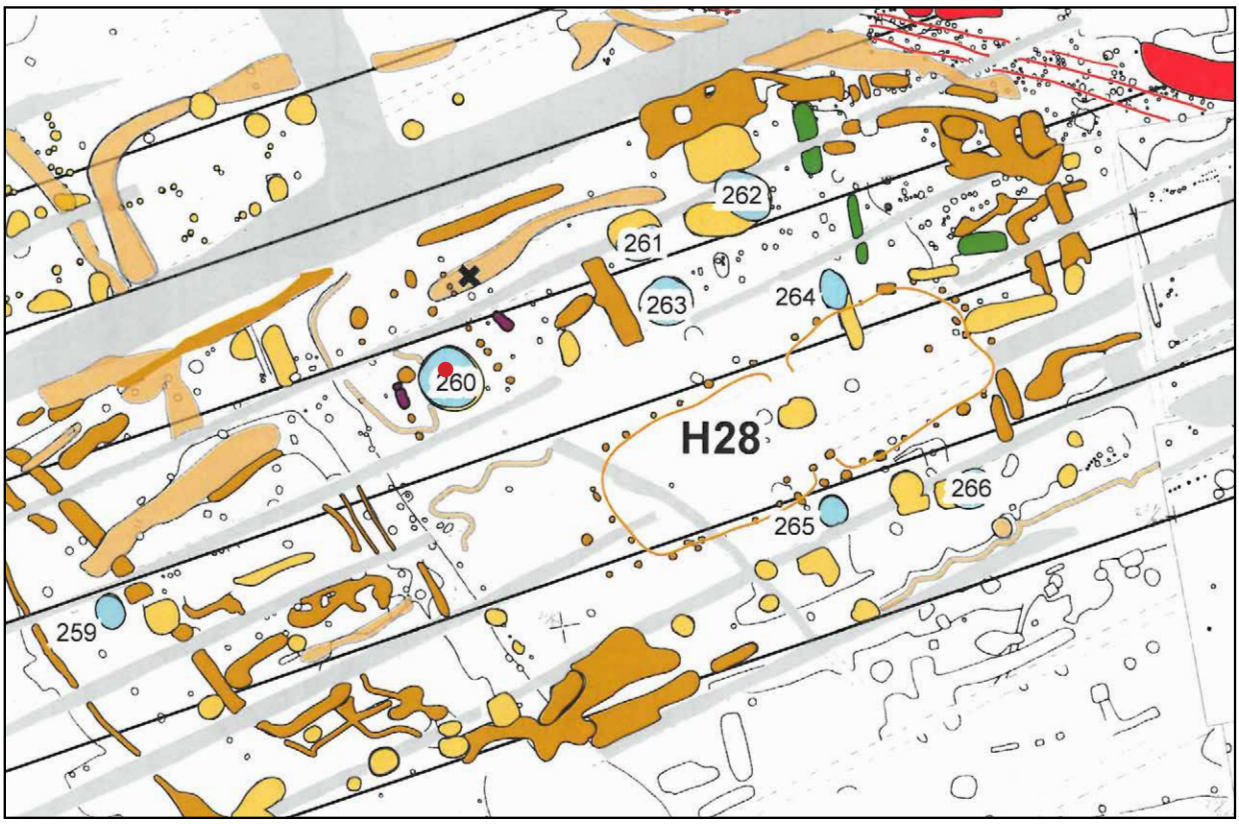

Figure 16. Map of the house plot H28 with find spots of Dorestad Sword (x) and Dorestad Brooch (O, in well no. 260) indicated. Map: M. Kosian/RCE.

up in the well around 850 AD, two generations later. In the course of its long life, it was also transformed, from a large brooch, most likely worn by a woman on the front of a cloak, to a decoration on a wooden casket or book cover.[19] The respective find spots of the Dorestad Brooch and the Dorestad Sword are in the settlement at De Heul, west of the Hoogstraat, on one and the same plot of a very large wooden house, labeled H28 by the excavators (Figure 16). This of course sparks the questions who lived here, and who was buried here.

The suggestion of the brooch and the swords stemming from two ninth-century graves was already done by Wim van Es in his 2006 article "Gladius cuius capulus aureus erat", proposing that the sword and lance come from a male burial left relatively intact, but that a nearby female grave originally containing the brooch was disturbed and shovelled into a well. He noticed two graves in the vicinity of the well, that were placed north-south, which is uncommon in Dorestad, and may point to a small private burial plot here.[20] The specific adjustments of the brooch, showing that it was on a casket or book cover in its later life, makes it unlikely – though not impossible – that it was a grave good. So does the dating of the trenches here, which point to both the well filled in and the grave constructed around 850 AD, a time when burial goods are almost absent in Dorestad. But if we are indeed looking at two high status burials of a 'pagan' nature on the plot of a house in the middle of the ninth century, in a town that had been militantly Christian for over half a century by then, and where hundreds and hundreds of people were buried without possessions in east-west oriented graves in designated cemeteries, the question remains: who lived here?

It is of course tempting to connect this burial, and indeed this house plot, in some way to the presence of the 'Danish princes' Harald and Rorik (and their entourage) at Dorestad from 850 AD, as is known from written records. If a Viking nobleman was buried here, a weapon grave on a house plot would make sense, and might even be interpreted as a statement of not being a Christian. As there are no human bones from this black pit, there is currently no way to find out anything about the background of the person buried here. Therefore, we cannot pinpoint what emotion was expressed by placing this sword with him. But the presence of a broadsword, winged lance and nice beaker in this grave point to a

19 Willemsen 2009, 80-90; Willemsen 2012, 71-77.

20 Van Es 2006, 91.

Figure 17. Man holding sheathed sword with gilded hilt next to emperor Charles the Bald, Gold Codex of St Emmeran, Court School, c. 870. Munich, Bayerische Staatsbibliothek, CLM 14000, f. 5v (detail). Photo: BSB Munich.

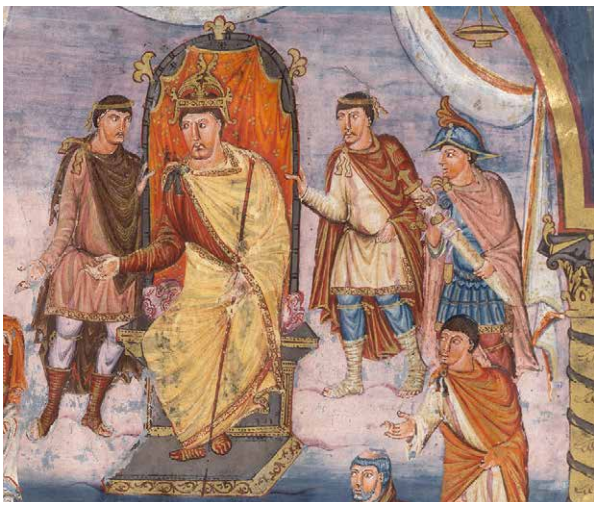

Figure 18. Helmed man holding sheathed sword with gilded hilt and trefoil decorations on sword belt, in the company of emperor Charles the Bald. 'First Bible of Charles the Bald', Tours 845. Paris, Bibliothèque Nationale de France, ms lat 1, f. 423r (detail). Photo: BNF Paris.

nobleman in any case, and as it is the only preserved sword with a gilded hilt known from the early medieval Netherlands, he must have been of the highest class, 'close to the king', whether he was from Frankish or Danish origin. Although many finds from Dorestad point to its elite, especially luxurious weaponry, horse gear and jewellery, and written sources particularly connect this town to people from the highest social classes, this sword burial – and therefore the house here – is to date the only fixed context at the site for one of them.

Golden swords

This sword with its gilded hilt is not only extraordinary in the context of Dorestad. Swords with precious metal hilts are rare anywhere, and mostly known from burials interpreted as those of kings, or at least leaders, standing out not only by the luxurious weaponry, but also other rich grave goods and expensive types of burials, like those include chambers, boats or horses. In the art of this period, they are seen specifically in the context of the emperor, often held by a man standing next to him, like in two precious manuscripts showing an enthroned Charles the Bald (Figures 17 and 18). In both cases, the sword has a gold-coloured hilt and gold elements on the sheath as well, and is in its sheath with the sword belt wrapped partly around it. It has been suggested that this is the emperor's sword, held for him by a loyal paladin, but in both manuscripts, the man holding the sword is mirrored by a man with lance and shield on the other side of the emperor; they can be personal bodyguards, or indeed immediate subordinates showing off insignia gifted by the emperor. A sword with a gilded hilt is of course also known from the description of the dress of Charlemagne himself; his biographer Einhard tells how Charlemagne had a sword inlaid with precious stones ("gemmata") for special occasions, but otherwise wore as his 'everyday sword' a "gladius cuius capulus ac balteus aureus aut argenteus erat": a sword of which the hilt and the belt were made of gold or silver".[21]

With this text in mind, it must be stressed that the Dorestad Sword not only has a gilded hilt, but that underneath the gold it is made of massive silver. While the inlays of copper found on the iron hilts of other broadswords also give a golden colour to the hilt, and we cannot be sure that swords depicted with a gold-coloured hilt were actually in precious materials, the Dorestad Sword not only looked very expensive, but was actually extremely valuable. It is definitely a very high-status weapon, fit for a king, or someone very close. The social rank immediately below royalty, is described in German as 'königsnähe', so being close to the king. The owner of the Dorestad sword must have been precisely that, and he may have been the one in charge of Dorestad when he carried the sword. The way this weapon was disposed of does not point to the local, Christian nobility, but rather to a 'stranger' from the

21 Einhard 1968, 46.

Figure 19. Skull with trauma caused by a sword blade, cemetery De Engk. RMO Leiden inv. no. WD 6780.

Figure 21. Skull with trauma caused by a sword blade, cemetery De Heul. RMO Leiden inv. no. WD 10405.

Figure 20. Skull with trauma caused by a sword blade, cemetery De Heul. RMO Leiden inv. no. WD 10098.

Figure 22. Edge of wound in skull, caused by a pattern-welded blade, cemetery De Heul. RMO Leiden inv. no. WD 9889.

Northern Netherlands or even further north, where people still buried dead in north-south burials with grave goods in the ninth century AD: "It is possible to think of one of the Norsemen who ruled Dorestad in the name of the Frankish ruler. He may then have received the gilded *spatha* from the Frankish king as a sign of the important governing function entrusted to him".[22]

22 Van Es 2006, 100.

Sharp-bladed trauma

Remarkably few of the over 2500 skeletons excavated from Dorestad show clear traces of a violent death caused by a sword. Where present, these sword blows can be discerned on the skeletons of mainly young men, mostly in skulls and upper arms. In those spots, the sword pierced the flesh and hit the bone; this is called 'sharp-bladed trauma'. Sometimes these sword wounds healed, which shows up as rounded edges of the wound, where the bone regrew. Sometimes a bone reaction like that is missing, proving that the blow was lethal.

Figure 23. Battle using swords with three-lobed and triangular hilts and patterns on blades, lances and bow-and-arrows. Stuttgarter Psalter, St-Germain-des-Prés, 820-830 AD. Stuttgart, Württembergische Landesbibliothek, Cod. bibl. fol. 23, f. 71v. Photo: WLB Stuttgart.

Figure 24. Broadswords with patterns or lettering on the blades, shields with pointy bosses, and on the right a group of women. Stuttgarter psalter (see Figure 23), f. 94v. Photo: WLB Stuttgart.

Figure 25. David and Goliath. In the lower part, David is killing the giant with the latter's own sword, that has a three-lobed gold-coloured hilt. Goliath also has a winged lance, mail shirt, helmet and shield with pointy boss. Stuttgarter psalter (see Figure 23), f. 158v. Photo: WLB Stuttgart.

Fatal swords gashes can be seen in two skeletons from the cemetery at De Engk, as recently studied by Marein Heikoop. This cemetery contained at least 719 individuals, and was used from c.650 AD onwards. One skull (WD 6531-1) is of a man aged 23-40 who was hit three times in the back of the head, while the other (WD 6780-1) was of a man under 25 years of age who received one blow on the forehead, one on the back of the head, and one crossing the left side of the skull from top to bottom, from the coronal suture to the lambdoid suture (Figure 19).[23]

From the cemetery at de Heul, as studied by Raphaël Panhuijsen, three male skeletons show lethal sword gashes as well (Figure 20), out of a total number of at least 536 people buried here between c.600 and 800 AD. One of these (WD 9889) was a man of 20-25 years of age, who was hit in the jaw and the upper arm. The edges of the wounds on two skulls (WD 9889 and WD 10.405) show a typical 'shading' of small, uneven parallel lines, that was interpreted as the imprint of a pattern-welded blade, meaning that these cuts are the specific results of blows issued by pattern-welded swords (Figure 21 and 22). All this trauma was suffered peri-mortem, which means that sword blows were the reasons for these individuals to die.[24]

23 Heikoop 2020, 35.

24 Panhuijsen 2010.

There may have been some more cases of sharp bladed trauma at Dorestad, as many skeletons were lost unstudied in the nineteenth century bone digs, and not all preserved skeletons have yet been studied for trauma, for instance the further 546 individuals buried at the cemetery De Geer II, used between c.660 and c.890 AD. But based on what was already studied, five cases in over 1200 burials is not many. Even in a town that was so repeatedly attacked violently, as we know from written sources, and where reputedly half of the population was murdered in one fierce Viking attack, to be killed by a sword was clearly not a common fate. All sword victims were young men, between 20 and 40 years old. This is the typical age and sex group for fighters anywhere, more involved in battles than other groups in society and therefore more likely to die in one. These violent deaths therefore are most likely the result of man-to-man fights. They were neatly buried afterwards. That means that in the extensive burial record of Dorestad, we are not seeing unarmed people, let alone women, children or the elderly, having been hacked to death.

Swords in the Stuttgart Psalter

The Carolingian art works which show swords, usually contain singular *spathas* that are carried or presented, all of them sheathed (see Figures 17 and 18).[25] One pictorial cycle is an exception and shows swords of various types being used in various ways: the illustrations in the Stuttgart Psalter. These are contemporary with the sword finds from Dorestad, and equally exceptional in their numbers. The book of psalms was produced in 820-830 AD in the scriptorium van St-Germain-des-Prés, a royal abbey under the patronage of Charlemagne, in what is now a quarter of Paris. The codex, preserved since two centuries in the Württembergische Landesbibliothek of Stuttgart and named for that, is the most richly illustrated Carolingian manuscript known. It measures 26.5 x 17.5 cm and contains 316 colour images comprising 470 different scenes in total. Within the conventions for illustrating psalters, especially the details of these images are very realistic; Simon Coupland proved already in 1990 that these manuscripts give a reliable image of Carolingian arms and armour.[26]

44 images in the Stuttgart Psalter contain one or more swords (Figures 23-25), all of them two-sided broadswords with a hilt of guard, grip and pommel. The decorated sheaths with their carrying belts can be recognised as well. The major part, over forty pieces, are swords with a three-lobed pommel, usually silver-coloured, but in seventeen cases with a gold-coloured hilt. Swords with a triangular pommel occur as well, in gold (four times) and silver (two times). Likely, the types indicate various social ranks: for instance kings and the hand of God always hold a 'golden' sword.[27] The various swords are depicted next to each other, in one and the same scene, like the battle on horseback depicted on f 71v (see Figure 23). In the eighth century, sword fighting changed, resulting in longer, more slender *spathas* and the disappearance of the *seax*;[28] this book only shows the 'new' sword type.

In Dorestad as well, swords with three-lobed and triangular pommels have been found next to each other, for instance in the 'quartet' from the river Rhine. Besides a very luxurious sword with gilded hilt, there are pommels with copper inlays, that also results in a gold-coloured hilt, and iron hilts, that were silver-coloured. It is remarkable that in the psalter, as many as twelve swords have indications on the blade that it was decorated, by means of a interrupted line, shading and/or characters. Especially in that, the book comes close to the Dorestad swords, with their pattern-welded blades showing patterns and sometimes symbols or even letters of a name.

Conclusions

A closer look at the many broadswords from Carolingian Dorestad uncovers mixed emotions. Swords were likely manufactured in the town, and definitely bought and sold here in large numbers, simply seen as profitable merchandise. Swords were also worn and shown off by elites here, shiny hilts above safely sheathed blades. And swords were also wielded here, both in defending and in attacking the town during the many conflicts recorded at Dorestad. They no doubt saved the lives of many of its inhabitants, but the burial record shows that a few young men suffered lethal blows of the broadswords wielded by opponents. Finally, a number of luxurious swords were placed or thrown into the river from the jetties. Others were taken apart and recycled, with significant parts like pommels sometimes reused or passed on, and less significant parts dumped. And one broadsword, the most beautiful one from Dorestad, with a gilded hilt that shows its history, was carefully placed into the grave of a man characterised as a warrior, in the ninth century, amidst a town full of people buried without grave goods in Christian cemeteries.

In short, swords contributed to both the wealth and the fall of Dorestad. They defended the lives of its inhabitants but sometimes caused their deaths. They were made, sold and recycled here. And when their fighting days were over,

25 See also: Coupland 1990; Willemsen 2009, 76 (wall painting from Mals).

26 Coupland 1990.

27 *E.g.* the king on f. 105r and the hand of God on f. 147r.

28 Coupland 1990, 42.

they were often treated in death as in life: as significant, prized and highly personal possessions.

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About the author

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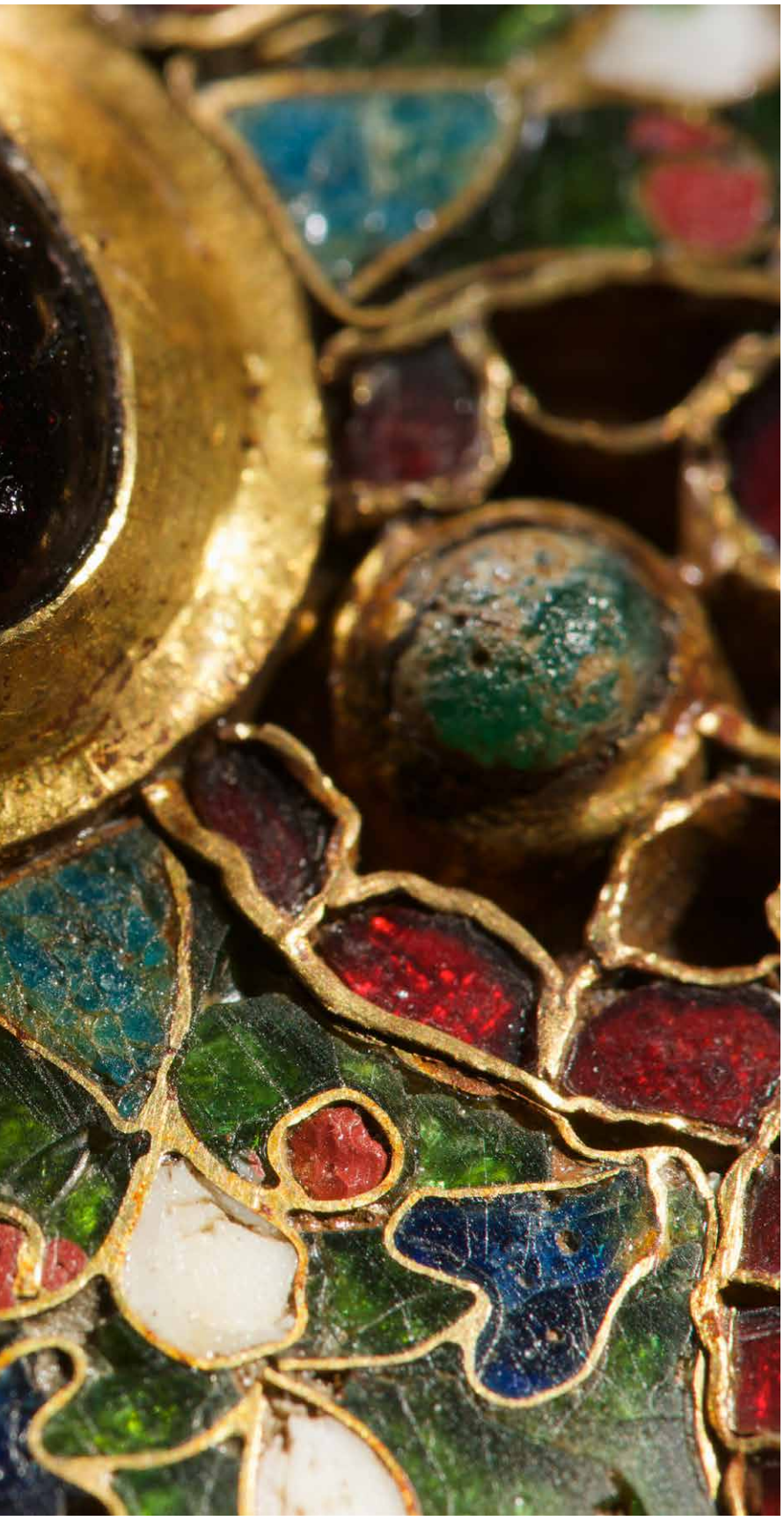

The early medieval Netherlands

Dorestad Brooch (detail), c. 800 AD. RMO Leiden inv. no. f 1978/1.1. Photo: Erik de Goederen.

A Carolingian coin hoard from Wirdum (Friesland, the Netherlands) and the Dorestad mint

Simon Coupland, with contributions by Nelleke IJssennagger-van der Pluijm and Christina Peek

Introduction

On 27th December 2014, a group of detectorists[1] searching on a terp near Wirdum, a few kilometres south of the provincial capital of Friesland, Leeuwarden, discovered a mass of coins. These were in poor condition, encrusted with thick muck which made them difficult to decipher, and often stuck together in clumps. From those that were legible it became apparent that this was a Carolingian hoard. The majority appeared to be Dorestad coins of Lothar I (840-855), most of them the familiar type with a temple on the reverse, which has turned up in its thousands in Frisian hoards, and a slightly smaller number with the mint name in three lines: DOR-ESTA-TVS.[2] Over the coming months the finders returned to the spot and undertook further searches, unearthing a total of 97 coins and the woven flax bag in which they had been buried, which still showed the impression of the coins it contained as well as the marks of a leather strap. Spread around the area of the terp the detectorists also found two coin brooch fragments made of non-precious metal, a couple of Roman coins, a simple ring of gold wire which could be Roman or early medieval, and a number of beads. It is possible that the brooches formed part of the hoard, but equally likely that they are simply further survivors from local settlement in the Carolingian period, as such objects are frequently found in the Netherlands, but not in other coin hoards of the period. The gold ring may perhaps have formed part of the hoard, but equally may not even date from the Carolingian era. The non-numismatic finds are discussed at greater length by Nelleke IJssennagger at the end of the article. The coins were reported to and recorded at the Fries Museum and were then subject to professional cleaning commissioned by the finders, which resulted in one being lost, but the others being superbly conserved and available for study

1 Thomas Menting, Sjoerd Bakker and Jildert de Boer, to whom we are extremely grateful for providing information about the hoard and images of the contents.

2 On the types see Van Gelder 1961, 15-42; Coupland 1988a, 5-26 reprinted in Coupland 2007, no. XI; Coupland 2001 157-198, reprinted in Coupland 2007, no. VII, 173-175.

(Figure 1). The total of 96 coins, all deniers, were minted by three rulers: eleven by Louis the Pious (814-840), two by Charles the Bald (840-877), and 83 by Lothar I.

By type there were:

- Louis the Pious
  - 11 *Christiana religio* deniers (MG[3] 472, Depeyrot[4] 1179), including 4 Group B (Dorestad), 1 Group H (Verdun), 2 Group L (Sens), and 4 from unidentified mints[5]
- Charles the Bald
  - 1 Auxerre temple denier (MG 987 var., Depeyrot 96)
  - 1 Laon temple denier (MG 792 var., Depeyrot 481)
- Lothar I
  - 44 Dorestad temple deniers (MG 525, Depeyrot 419)
  - 33 Dorestad deniers with mint-name in field (MG 524, Depeyrot 417)
  - 3 Aachen temple deniers (a previously unknown type)
  - 1 Metz temple denier (MG 549, Depeyrot 642)
  - 2 *Christiana religio* deniers (Depeyrot 1185): 1 of Group C (Metz: MG 581), 1 of Group F (Maastricht: MG 591 var.)

The date of the hoard and comparable Carolingian hoards from Frisia

The presence of over 30 of the later Dorestad coins with the mint name in field, which were probably minted from about 850 AD,[6] alongside a larger number of Lothar's Dorestad temple coins and eleven of the even earlier *Christiana religio* type of Louis the Pious, suggests that the hoard was buried in the latter part of the 850s. The mixture of coins is typical of what is found in many other contemporary hoards from Carolingian Frisia[7] (though the coins from Aachen are from a previously unknown mint, they are typologically similar to other temple coins of Lothar I). It appears therefore to have been concealed at one and the same time, rather than being a so-called 'savings hoard', as is sometimes found in this region.[8] Analysis of Carolingian hoards from Frisia undertaken in 2006 revealed a peak in deposits in the late 840s, but still a significant number in the 850s, the reasons for which will be discussed below. Like the Wirdum find, these hoards were dominated by Lothar's Dorestad coinage, with the most remarkable example being the second hoard from Tzummarum, which contained 2,606 Dorestad temple coins of Lothar alongside 26 of his three-line type.[9]

In 2006 I knew of 41 hoards deposited between 751 and 911 in Carolingian Frisia, of which three dated from the same period as the Wirdum find: Tzummarum II, Wagenborgen and Yde.[10] Since then I have become aware of another 13 Carolingian hoards from the region. Some of these were discovered long ago but have only recently been published, while others have been discovered since 2006. They include one which, remarkably, turned up the day after the first finds from Wirdum, and just a few kilometres away, near Goutum. That contained only ten deniers: nine *Christiana religio* coins of Louis the Pious, including one of Group A (Quentovic), one of Group K (Auxerre), one of Group L (Sens), two of Group M2 (Melle), and two of Group P (Paris?), and one temple coin of Charles the Bald, from Reims.[11] Although this hoard was found very near Wirdum, it contains no coins of Lothar I and quite different coins of Louis the Pious, and was probably concealed a little earlier, in the 840s rather than the 850s.

Overall the hoards found since 2006 are predominantly earlier rather than later. From Wijk bij Duurstede there is a small hoard of coins of Pippin III, all of the local mint (Wijk bij Duurstede V 2015: three coins), which is, remarkably, the fifth Carolingian hoard from the site of historic Dorestad. In addition, three Northumbrian copper pennies of Eanred (810-840/830-854) found at Wijk bij Duurstede in 1958 undoubtedly also represent a hoard, even though they have been listed as single finds.[12] I am unaware of any other early medieval site anywhere in Europe which has produced anything like this number of individual coin hoards. From Katwijk there is an equally small find of coins of Charlemagne (three coins). No fewer than five hoards consist exclusively of *Christiana religio* coins of Louis the Pious: the fourth hoard found at Wijk bij Duurstede, in 2002 (17-23 coins)[13],

3 MG: Morrison and Grunthal 1967.

4 Depeyrot 2017.

5 These groupings and attributions will be explained below.

6 Coupland, 1988a,21; Coupland 2001, 165-166, and see below.

7 Historic Frisia is the whole coastal area between the rivers Zwin and Weser, of which the current province of Friesland forms a part: Knol and IJssennagger 2017, 5-24.

8 Coupland 2006, 260-262.

9 All hoards mentioned in the text are listed with bibliographical references at the end of the article.

10 Coupland 2011a, 203-256, nos. 119-121, correcting the dates in Coupland 2006, 265-266.

11 These groups are described in Coupland 1990, 23-54, reprinted in Coupland 2007, no. III, 40-41, and Coupland forthcoming c, Group A; Vandenbossche and Coupland 2012, 317-320, Groups K and L, see also below; Coupland 2018, 268-269, Group M2; Coupland 2013, 362-364 and Coupland forthcoming c, Group P. Charles the Bald's coinage from Reims is discussed in Coupland 1991, 121-158, reprinted in Coupland 2007 no. IX, 138.

12 NUMIS (https://nnc.dnb.nl/dnb-nnc-ontsluiting-frontend/#/numis/) 1033672: moneyer Eadwine; 1033673: moneyer Fordred; 1033674: moneyer Monne. I am grateful to Tony Abramson for these identifications.

13 Dijkstra 2004, 47-49; Coupland 2010a, 95, 100.

Figure 1. The Wirdum hoard after cleaning. Photo: F. de Vries.

as well as others from Leiderdorp (14 coins), Moordrecht ('many coins'), Rijswijk (five coins, fused together), and Rotterdam (five coins). Three more small hoards date, like the Goutum hoard, from the 840s: Bikbergen (nine coins), Burgum (four coins), and Marssum (four coins). None of the new finds date from the same period as the Wirdum hoard, but one dates from the early 850s, 's-Hertogenbosch (22 coins), and one from the late 860s, Amerongen (six or seven coins). It is worth noting that these were both found far from Wirdum, much further inland and upriver.

The Wirdum hoard is thus an important addition to the corpus of known finds from Carolingian Frisia. Its size makes it stand out among the finds from the past 15 years: although it may not be in the same league as the huge second hoard from Tzummarum, it is significantly larger than other recent hoards, which probably each represent a purseful of coins.[14] Its composition is in one sense unremarkable: the mixture of coins of Lothar I, ruler of this region, Louis the Pious, and Charles the Bald is typical for the time. But every hoard adds to our understanding of the production and circulation of coinage in the Carolingian era, and as we shall see below, the hoard contains the largest number of coins of Lothar's Dorestad second type ever discovered. In addition, the presence of three coins of a previously unknown type minted by Lothar I in Aachen represents a significant contribution to our knowledge of coinage production in the Middle Kingdom in the 840s and 850s.

14 Coupland 2014, 214-215.

Figure 2. Denier of Louis the Pious, *Christiana religio* Group B (Dorestad), Wirdum hoard. 1.13 grams. Photo: T. Menting.

The contents of the hoard: the *Christiana religio* coins of Louis the Pious

The earliest coins in the hoard were the eleven *Christiana religio* deniers of Louis the Pious, which were minted between 822 or 823 and the emperor's death in 840.[15] They are known in huge numbers from Carolingian hoards and single finds, since precisely the same type was produced at every mint throughout the empire over this 17- or 18-year period, and not withdrawn from circulation until the *Gratia dei rex* type was introduced in the West Frankish kingdom by Charles the Bald in 864.[16] Although the coins are superficially identical, the dies were all cut by hand, and it is possible to identify a number of stylistically similar groups of coins which can be attributed to various known mints on the basis of stylistic parallels, find distribution, and the relative size of the various groups.[17]

Four of the Wirdum coins are of a group which is found in large numbers in the Frisian hoards (Figure 2). This was first recognised by Enno van Gelder in 1961, and repeated by myself in articles in 1988 and 1990.[18] As Enno van Gelder noted, the coins are recognisable by their distinctive style. The obverse cross is large, while the temple on the reverse is generally crude, with a small central cross and often a difference in the angle between the inner and outer lines of the roof. The letters and lines of the designs on both faces tend to be thick and poorly formed. The legends are frequently blundered, and the letter S is often reversed, sometimes appearing like a letter Z. The coins were struck on regular die axes of 0°, 90°, 180° or 270°, suggesting that the die shanks were square rather than round, and some were struck on unusually large flans. Certain coins include a bar beside or below the temple, while others have a single pellet beside, below, or beside and below the temple.

The large number of finds in Frisian hoards led Enno van Gelder to conclude that they had probably been minted in Dorestad, and this is confirmed by the additional finds, both hoards and single finds, which have turned up since. For instance, at least 100 of the 134 *Christiana religio* deniers of Louis the Pious at Tzummarum II were of this type, my Group B (76%), as were 18 out of 29 at Westerklief I (62%), and 195 in the more southerly Pilligerheck hoard (14%). In other sizeable hoards which I have been able to study in full the comparative figures are Emmen 41% (74 coins), Wagenborgen 29% (22 coins), Yde 16% (ten coins), Roermond 12% (90 coins), Luzancy 11% (13 coins), and Vallée de la Risle 7% (three coins).[19] In smaller hoards Group B coins were also found at Bassenheim (one out of six), Bray-sur-Seine (one out of thirteen), Leiderdorp (three out of 13), and Raalte (one out of thirteen).[20] Others were present at Aalsum (at least two), Harlingen (at least two), Lokeren (at least one),

15 Coupland 1988b, 431-433, reprinted in Coupland 2007, no. IV; Coupland 1990, 28, 35.

16 Coupland 2002, 18-19.

17 The methodology is set out in more detail with examples in Coupland, forthcoming c.

18 Van Gelder 1961; Coupland, 1988a, 16-22; Coupland 1990, 41, Group B; cf. Coupland 2010b, 307-316.

19 These figures are from my own studies of the hoards in question. Although Clemens Maria Haertle, in his book *Karolingische Münzfunde aus dem 9. Jahrhundert* (2 vols, Cologne, Weimar and Vienna, 1997), apparently followed Enno van Gelder and myself in attributing certain *Christiana religio* coins of Louis the Pious to Dorestad, he did not do so consistently.

20 Bassenheim: Coupland 2019, 144-149, no. 1; Bray-sur-Seine: Vandenbossche and Coupland 2012, no. 2; Leiderdorp: NUMIS 1130277, 1030279, 1130286; Raalte: NUMIS 1024160.

Loppersum (at least two), Oudwoude (at least eight), Rijs (at least one), Roswinkel (at least six), Saint-Même-le-Tenu (at least one), Tzummarum I (at least six), and Zelzate (at least one), but these are unfortunately only partial figures since I have not been able to study the entire hoards.[21] These figures indicate that whichever mint produced these coins must have been one of the most productive in the empire, and the distribution of the finds points strongly, as Enno van Gelder concluded, to Dorestad. This hypothesis is further strengthened by the complete absence of Group B coins from the southern hoards of Freising and Hermenches.[22] I am also aware of single finds from Aggersborg (Jutland), Andelst (Gelderland), Beusichem (Utrecht), Breteuil (Oise), Damwoude (Friesland), Deventer (Overijssel), Domburg (Zeeland, ten coins), Franekeradeel (Friesland, two coins), 'Friesland' (with no more precise location), Fulda (Hessen), 'Nord-Isère', Laon (Aisne), Leiderdorp (Zuid-Holland, in addition to the hoard found there), Mainz (Rheinland-Pfalz), 'Overbetuwe', Saint-Savin (Isère), Susteren (Limburg), Toul (Meurthe-et-Moselle), 'Valais', Vikhem (Skåne), Vraux (Marne), and naturally Wijk bij Duurstede itself (Utrecht, eleven coins).[23] This long list of single finds and its evident northerly distribution is totally consistent both with the hoard finds and with an attribution to Dorestad.

One coin at Wirdum is of a group I have attributed to Verdun on the basis of its stylistic similarity to the mint-signed temple coins produced there by Lothar I.[24] A number of Lothar's coins from Verdun have a compact cross with splayed ends, and on the reverse a broad, squat temple, which has short columns with pronounced capitals.[25] In 1990 I therefore attributed to Verdun a group of *Christiana religio* coins minted by Louis the Pious which display the same characteristic features. This included ten coins at Roermond, at least ten at Pilligerheck, and two at Yde; to these can now be added five at Luzancy, one apiece at Bray-sur-Seine and Flacey, and single finds from Alphen aan den Rijn (Zuid-Holland), the north of the Isère département, and Eske (Ærø).[26]

Two coins belong to my Group L, which is ascribed to Sens. This was first described in 2012,[27] and I have recently listed further finds of the group in a discussion of the Hermenches hoard of 1921, which contained two coins of this type.[28] The legends are neat and regular, with chunky lettering, and notably a characteristic solid S. The obverse cross is medium-sized, broadening towards the ends of the arms, with large pellets. The temple is regular, square, with a right-angled roof, and a distinct central cross. These characteristics are comparable to the style of Charles the Bald's Sens temple coinage, and the size and find distribution of the coins of Group L support that attribution. There were sizeable numbers in the large hoards from Pilligerheck and Roermond, and in the Netherlands, further Group L coins were present in the hoards from Emmen, Oudwoude, Tzummarum II, Wagenborgen, Westerklief I, and Yde, as well as Goutum and Wirdum. Numerous single finds are known, including Dutch finds from Beusichem (Utrecht), Buitenpost (Friesland), Buurmalsen (Gelderland), Groot Olmen (Noord-Holland), Leiderdorp (Zuid-Holland), Texel (Noord-Holland), and Wijk bij Duurstede (Utrecht: at least three).[29] The four other *Christiana religio* coins of Louis the Pious at Wirdum were from mints which cannot yet be identified.

The contents of the hoard: the coins of Charles the Bald

Charles the Bald minted a variety of types at a limited number of mints during the first part of his reign, until in 864 an extremely effective recoinage introduced the new *Gratia dei rex* type.[30] Auxerre was one of Charles' less productive mints. It is only known to have struck temple deniers, which have turned up in small numbers: I know of no reported single finds, and in addition to those hoards listed in Coupland 1991,[31] one was present in the Bray-sur-Seine hoard and one in the second hoard from Tzummarum.[32] The Wirdum coin is thus a welcome addition to the corpus:

21 Illustrated coins are Aalsum: Haertle 1997, pl. 11.83-84; Harlingen: Haertle 1997, pl. 9.72-73; Loppersum: Haertle 1997, pl. 8.69-70; Oudwoude: *De vrije Fries* XX.2 (1903), nos. 9, 10, 14, 15, 16, 17, 19, 26 and probably also 12, 18, 21, 22, 25 and 27, Heartle 1997, pl. 13.95-97; Rijs: Haertle 1997, pl. 10.77; Roswinkel: Haertle 1997, pl. 40.345-350; Saint-Même-le-Tenu: Coupland 2013b, 367; Tzummarum I: Haertle 1997, pl. 7.37-38 (but not 39), 7.62, and also NUMIS 1029511, 1029514, 1029515 ('Waadhoeke'); Zelzate: Haertle 1997, pl. 46.381 (but not 382).

22 Coupland, forthcoming c.

23 Most of these finds are unpublished. Those online or in print are Deventer: NUMIS 1007231; Franekeradeel: NUMIS 1029470; Fulda: Roth and Wamers 1984, 234-235; Leiderdorp: NUMIS 1130249; Mainz: Stoess 1994, 177-181, 187-188, no. 44; Overbetuwe: NUMIS 1011546.

24 Coupland 1990, 44 Group H.

25 Coupland 2001, 183-184.

26 Bray-sur-Seine: Vandenbossche and Coupland 2012, no. 5; Luzancy: Sombart 2008, nos 7, 11, 17, 18, 22; Alphen aan den Rijn: NUMIS 1113796. The other finds are unpublished.

27 Vandenbossche and Coupland 2012, 318-320.

28 Coupland, forthcoming c.

29 Of these, only the following finds are published: Groot Olmen: http://onh.nl/nl-NL/verhaal/1304/de-vroege-middeleeuwen-in-noord-holland (9.8.2019); Leiderdorp: NUMIS 1130299; Texel: NUMIS 1035488; Wijk bij Duurstede: Vandenbossche and Coupland 2012, 320.

30 Coupland 1991.

31 Coupland 1991, 126-127.

32 Vandenbossche and Coupland 2012, no. 15; Tzummarum II has not yet been fully published.

Figure 3. Denier of Charles the Bald, Laon, Wirdum hoard. 1.44 grams, 20 mm. Photo.: T. Menting.

·dum hoard. 1.57 grams, 21 mm. Photo: T. Menting.

Figure 5. Denier of Lothar I, Dorestad three-line type, Wirdum hoard. 1.49 grams, 20 mm. Photo: F. de Vries.

as on several other specimens, including the coin from Tzummarum, the mint name is retrograde.

The other coin of Charles the Bald found at Wirdum is a temple denier from Laon, another of Charles' lesser mints (Figure 3).[33] It is of the only type known from Laon at this time, with the unusual obverse formula +CAROLVSREXPIVS and a cross beneath the temple. Just one other find can be added to my survey of 1991, found in a hoard from St-Martin-sur-le-Pré (Page sale, no. 139).[34]

Coins of Charles the Bald are not uncommon in Frisian hoards of this period, and it was only after 864 that they apparently stopped circulating in this region.[35] One reason for this intermingling of the two coinages was that the plethora of coin types being minted by Charles and his brother Lothar were indistinguishable to an illiterate Frank, Frisian or indeed Scandinavian: one temple denier looked much like another, whether they were minted in Aachen or Paris, Metz or Reims.[36] They were of course equally similar to the *Christiana religio* coins of Louis the Pious, which continued to circulate in huge numbers until 864. Coins of Lothar I naturally tend to outnumber those of his brother Charles in Frisian hoards[37] as they do at Wirdum.

The contents of the hoard: the coins of Lothar I

As has already been noted, the overwhelming majority of the coins of Lothar I in the hoard were minted in Dorestad: 44 bearing a temple on the reverse (Figure 4) and 33 with the mint-name in field (Figure 5). This is absolutely typical of contemporary Frisian finds: the coins of Lothar at Westerklief I and Kimswerd-Pingjum II were exclusively from Dorestad, as were 58 out of 61 at Kimswerd-Pingjum I. At Rijs, Aalsum, and Roswinkel all but one of Lothar's coins were minted at Dorestad,[38] as they were at Oudwoude (30 of 31) and Midlaren (48 of 49). At Harlingen and Yde it was all but two (nine of eleven and 34 of 36 respectively). At Emmen and Wagenborgen the proportions were slightly lower, but still 80 out of 95 (84%) and 44 out of 71 (62%) respectively. In a league of its own is the second hoard from Tzummarum, in which there were 2,632 deniers of Dorestad alongside just 11 other coins of Lothar I. The contents of the Wirdum hoard are thus typical for this period, when the local coin stock was utterly dominated by the products of this important Carolingian port and mint.

Since none of the coins have dates on them and there is no documentary evidence from Lothar's reign indicating when the two different types were produced, only an analysis of contemporary hoards can reveal when the change of type at Dorestad took place. It is clear that the temple type was produced before the mint-name type: hoards from the 840s contain the former but not the latter, while the latter are present in hoards from the late 850s and 860s. It is likely that the mint-name type was introduced late in the emperor's reign, around 850. The hypothesis that it was the second type to be minted is strengthened by the existence of coins of Arnulf (887-899) which have the same reverse design, the mint name in three lines.[39] Although Enno van Gelder proposed that Lothar's second coinage type was minted in an unofficial mint,[40] he subsequently changed his mind on this point, and there is every reason to believe that production took place within the emporium.[41] As the figures quoted here make plain, the number of coins bearing the name of Dorestad hugely outnumber those of any of Lothar's other mints, and it is hard to imagine anywhere else in the Middle Kingdom which could have housed such a remarkably productive mint at this time. Enno van Gelder also proposed that the type with the mint name in field was minted posthumously[42] and while I am unconvinced by that argument,[43] it may well have become an immobilised type which went on being minted after the emperor's death in 855, especially as there are no known coins of Lothar II from Dorestad. Minting of the second type was on a significantly smaller scale than that of the temple type, as is evident both from the relative numbers in hoards (listed above) and the number of continental single finds: 64 temple coins and 28 with the mint name in field.[44] What is noteworthy about the Wirdum hoard is the proportion of coins of the later type: the total of 33 coins present is currently the largest number discovered together, outnumbering the 26 in the huge Tzummarum hoard, which also contained over 2,600 of the temple type, or the 24 at Raalte.

The hoard also contained a temple denier of Metz and two *Christiana religio* deniers of Lothar, one of which can likewise be attributed on stylistic grounds to Metz.[45] The other, with its diagnostic ring in one quadrant of the obverse cross, is attributable to Maastricht.[46] Neither mint

33 Coupland 1991, 130-131.
34 The coin from La Roche-en-Ardenne listed in Depeyrot 2017, no. 481, is actually of the GDR type: Coupland 2014, no. S22.
35 Coupland 2006, 252-253.
36 Coupland 2011b, 32-34.
37 Coupland 2011b, 33.
38 The precise numbers in the original find are uncertain (see Haertle 1997, nos. 37, 38 and 75 respectively).
39 Van Herwijnen and Ilisch 2006, 245-249.
40 Van Gelder 1985, 37.
41 Coupland 1988a, 18-22; Coupland 2001, 173-175; Coupland 2010a, 102-103.
42 Van Gelder 1961, 33, 36; Van Gelder 1985, 37.
43 Coupland 1988a, 21.
44 Figures correct as of 25 September 2019.
45 Coupland 2001, 180-181, 186-187, Group C.
46 Coupland 2001, 189, Group F.

Figure 6. Denier of Lothar I, Aachen, Wirdum hoard. 1.51 grams, 21 mm. Photo: T. Menting.

Figure 7. Denier of Lothar I, Aachen. 1.6 grams, 22 mm. Single find, Dreumel (Gelderland). Photo: C.-J. van der Pol.

was particularly productive, but of the two, Metz appears to have been slightly more significant. Since the coinage of Lothar I was surveyed in 2001, just one other coin of Metz has come to my attention, a single find from Domburg,[47] and one of Maastricht, in the Bassenheim hoard from Rheinland-Pfalz.[48] These three coins are thus valuable additions to a small corpus of finds.

One truly remarkable feature of the Wirdum hoard was the presence of three temple deniers from Aachen (Figure 6), a type which had previously only been known from the reign of Louis II (855-875). This was itself represented by a single specimen, which turned up in the Midlaren hoard of 1906.[49] That coin bore the obverse legend +IOTAPIVS GRACIA DI, which implies that it was minted after Charles the Bald introduced his *Gratia dei rex coinage* in 864, and the reverse legend AQVISCPANI PALACII. It is likely that coins minted by Louis the Pious and Lothar bearing the mint name PALATINA MONETA

47 Van der Veen 1994, 190-193.

48 Coupland 2019, no. 17.

49 Boeles 1915, 66, no. 92; MG (as n. 3 above) no. 1184, pl. XXXVII.

Figure 8. Denier of Louis the Pious, Aachen. 1.47 grams, 22 mm. Single find, Bakkum-Doornduijn (Noord-Holland). Huis van Hilde, inventory number: 5281-0096. Photo: K. Zwaan/Provincie Noord-Holland.

Figure 9. Denier of Louis the Pious, Aachen, 1.5 grams, 21 mm. Single find, Land van Maas en Waal. Private collection. Photo: A. van Herwijnen.

were also struck at Aachen.[50] Aachen was Lothar's principal residence, as it was his father Louis's, and of profound symbolic significance.[51] The three coins in the Wirdum hoard, all struck from the same pair of dies, read +IOTAMVS IMPIIPAT on the obverse and AQVISCPAN PALACII around the temple. The obverse legend unmistakeably refers to Lothar I, both because he was an emperor, while Lothar II was entitled to use only a royal title, but also because this somewhat debased form of the imperial name and title is also found on almost all Lothar I's coins from Dorestad.[52]

Once these coins had been cleaned and the inscriptions on both faces could clearly be read, it became apparent that a similar denier had previously turned up but not been recognised. A single find from Dreumel (Gelderland), it has a retrograde obverse inscription, IHOTANASMEPAIT, and an incomplete

50 Coupland 2001, 182; *moneta* can mean mint as well as money.

51 Schäpers 2018, 454-455.

52 Van Gelder 1961, 22; Coupland 2001, 173.

reverse legend: AQVISIIIIV[...]IA[.]IPI or the like (Figure 7). I published it in 2017 as a coin of Lothar I, but misinterpreted the reverse inscription as a garbled form of *Christiana religio*, classifying it with a group of imitations produced by the Scandinavians in the Netherlands.[53] Although struck from different obverse and reverse dies, it is now evident that it, too, is a denier of Lothar I from Aachen.

These coins are undoubtedly a remarkable discovery, but what is even more extraordinary is that two mint-signed temple deniers from Aachen in the name of a Carolingian ruler named Louis have also turned up as single finds in the Netherlands in recent years. Both of them are published here for the first time. The first was found by a Dutch detectorist, Herman Zomerdijk, in the Bakkum-Doornduijn area of Noord-Holland, and is now in the Huis van Hilde museum in Castricum. The obverse legend appears to be +IИVDOVIDVSIIMOP and the reverse AQVISCPANI PAIACII (Figure 8). The second was found by a detectorist in the Land van Maas en Waal in Gelderland (Figure 9). Struck from different dies, it reads +IИVDOVVIↃ[..]IIIP, with the mint name AQVISↃPIN PAIAↃII(?)I.

Which Louis is this? Louis the Pious is known to have produced a small number of mint-signed temple coins at the end of his reign at a limited range of mints,[54] but Louis the German also struck mint-signed temple coins[55] and ruled Aachen after the death of Lothar II in 869 and the subsequent Treaty of Meerssen. The fact that both Aachen deniers are single finds means that there is no context of other coins to help with dating. Three factors point in favour of Louis the Pious rather than his son. First, there is no question that temple coins with the mint names of Dorestad, Maastricht, and Verdun were produced by Louis the Pious, since they were all present in hoards dating to the late 850s or early 860s (Pilligerheck, Tzummarum II, and Yde), and all lay within the territory of Lothar I rather than Louis the German.[56] A mint-signed temple coin of Cologne was present in the second Westerklief hoard,[57] and its precise lettering, small pellets, and neat temple are all clearly closer in style to the Cologne coins of Lothar I than to the crude temple coinage minted there by Lothar II, or an as yet unpublished Cologne temple denier of Zwentibold (895-900).[58] Although Westerklief II dates from *c.* 880, it included coins of Louis the Pious – one of his Class 2, and three *Christiana religio* deniers – so it is not implausible that a coin minted at the end of his reign might also be present. That would mean that at least four other mints in the Middle Kingdom produced mint-signed temple coins under Louis the Pious.

Second, however crude the obverse legend may be, it definitely recognises the Louis in whose name the coins were minted as emperor rather than king, and Louis the German was never entitled to use the imperial title, nor indeed used it, whereas Louis the Pious was emperor and consistently styled himself HLVDOVVICVSIMP on his coinage. Finally, although the style of the coins is poor, with somewhat barbarous legends, there is an obvious parallel with the badly executed inscriptions on the Aachen coins of Lothar I which were described above. There are also temple coins of Lothar minted in the name of the Palace – and a group of *Christiana religio* coins which can be attributed to the same mint on stylistic grounds – which are of an equally low standard of craftsmanship.[59] To summarise, from knowing of just one coin bearing the name of Aachen, struck by Lothar II between 855 and 869, we now know of a further two coins, from different dies, almost certainly minted by Louis the Pious in the late 830s, and four coins from two different dies minted by Lothar I between 840 and 855.

The context of the hoard – Wirdum and the Vikings

In 2006 the Carolingian hoards from Frisia were plotted according to their date of deposition, averaging out the figures to give the number of deposits concealed per year.[60] In the light of the discovery of the additional hoards listed above, the redating of certain others, and also adjustments to the dates of two coin types,[61] Figure 10 offers a revised charts of all known Frisian hoards.[62] The overall picture remains the same, with the late 840s evidently witnessing the high point of hoarding in Frisia, but now the peak is significantly less marked, with deposition in the early 840s almost matching that in the second half of the decade. In

53 Coupland 2017, 103, Fig. 13.

54 Besteman 2006-2007, 49-50.

55 Coupland 2011b, 39-40.

56 The Yde coin, from Dorestad, is illustrated in Van Gelder 1965, 241-261, pl. XX, no. 2. The Pilligerheck coins, namely two of Dorestad and one of Maastricht, will be depicted in Petry and Wittenbrink forthcoming. The coin of Verdun from Tzummarum II can be found in Coupland 2001, pl. 36, no. 17.

57 Besteman 2006-2007, 56, no. 5.

58 Coupland forthcoming a.

59 Coupland 2001, 181-182, 188-189.

60 Coupland 2006, 245.

61 The redating of certain hoards is in Coupland 2011a; Charlemagne's portrait coinage is now dated to 813 rather than 812, and Louis the Pious's portrait coinage to 814-816 rather than 814-819: Coupland 2010b, 297-300.

62 Stade and Winsum have been omitted due to the uncertainty surrounding their original contents: Coupland, 2011a, p. 205, n. 17. Bikbergen and Moordrecht have been included because of additional information about them which has come to light.

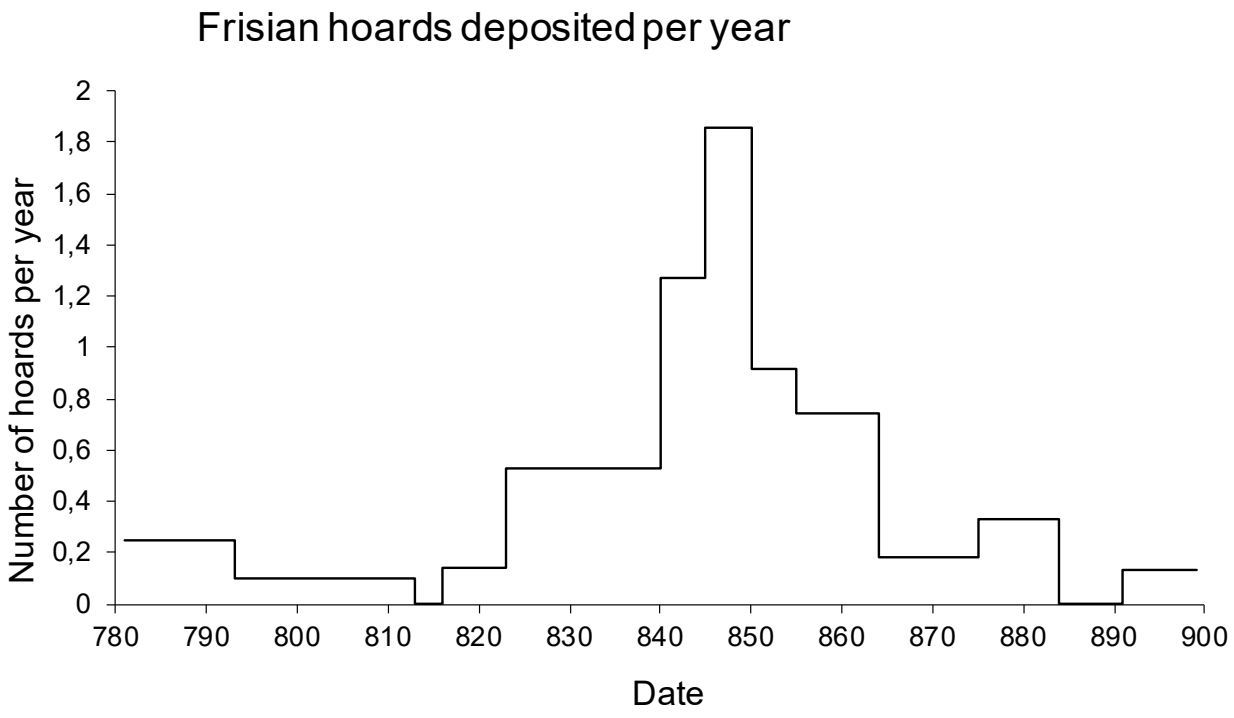

Figure 10. Frisian hoards deposited by year (compare Coupland 2006, fig. 2).

addition, the heightened level of hoarding can now be seen to continue into the 860s, whereas in the earlier chart it tailed off remarkably quickly. As was noted in 2006, this increase in hoard deposition undoubtedly reflects the fear and turmoil caused by the Scandinavian raids on the region at this time.[63]

The Frisian material thus offers a contrast with the Carolingian hoards from France, which show a lesser degree of correlation between the level of hoarding and the Viking incursions.[64] Having said that, a number of French hoards have turned up in the interval which seem to reflect the same anxiety and instability in the 840s as we see in Frisia, such as Hénouville, Lillebonne, La Vallée de la Risle and the second hoard from Saint-Pierre-des-Fleurs.[65] Some French hoards can even be linked to specific incursions, including Saint-Même-le-Tenu from *c.* 843, the year nearby Nantes was infamously ransacked,[66] or the Entrammes hoard from the mid-860s, which was concealed not far from Le Mans, the target of raids in 865 and 866.[67] There is however no such clear connection in the case of Wirdum.

Could the hoard have been concealed by one of the Scandinavians who are known to have not only raided in this region but also taken up residence? A chance remark in the Annals of Fulda for the year 873 reveals that there were Northmen who had converted to Christianity and were living in Frisia, while another entry in the same source refers to the Danish leader Rorik being granted benefices in Frisia which he 'and his men' would occupy.[68] Scandinavian presence in the Netherlands is also attested by the two Westerklief hoards from the island of Wieringen, both containing Carolingian coins alongside Scandinavian silver ingots and jewellery.

By contrast, the Wirdum hoard gives no indication of having been the property of a Northman rather than a native Frisian. None of the non-numismatic objects found in the vicinity was Scandinavian in character – the simple gold ring was for instance quite unlike the plaited bracelet of Scandinavian workmanship found at Wijk bij Duurstede.[69] There are no ingots such as are present in the Danish hoard from Rantrum, the Westerklief hoards, and Scandinavian hoards buried in England such as Croydon and Cuerdale.[70] These hoards also all

63 Coupland 2006, 243-245; for the raids see Henderikx 1995, 71-112, or at a more popular level Van der Tuuk 2015.

64 Armstrong 1998, 131-164.

65 Coupland and Moesgaard 2012, 222-229.

66 Coupland 2013b, 368-369.

67 *Annales Bertiniani* 865, 866: Grat *et al.* 1964, 124, 130-131, translation Nelson 1991, 128, 135.

68 *Annales Fuldenses* 873 and Vienna manuscript 882: Kurze 1891 80, 99, translation Reuter 1992, 72, 93.

69 Willemsen 2009, 162.

70 Kruse 1988, 285-301; though Rantrum is now in Schleswig-Holstein, it lay within Viking-Age Denmark.

contain Arabic dirhams, of which an increasing number are turning up as single finds in the Netherlands,[71] but again none of these was present at Wirdum. All this therefore suggests that the Wirdum coins were the property of a Frisian terp-dweller rather than a Scandinavian. This hypothesis is further strengthened by the fact that Wirdum is located in the historic Frisian region of Oostergo. Whereas much of Carolingian Frisia was granted in benefice to Scandinavian chieftains for long periods, Oostergo, like the neighbouring region of Westergo, evidently lay outside this area of Danish control.[72] This is apparent from a reference to the region being attacked in 873 by a Danish warlord named Rodulf who was the nephew and companion of the benefice holder, Rorik.[73] A hoard turning up in Oostergo is thus much more likely to have been the property of a Frisian than a Scandinavian, and given the numerous raids on the region by the Northmen it may well have been concealed for fear of a Viking raid.

The Wirdum hoard thus throws a shaft of light across the centuries onto the monetary economy of the 850s in the far north of the Frankish empire, and in particular the overwhelming predominance in that economy of coins produced at the Dorestad mint. It also reveals the existence of a hitherto unknown coin type from Aachen during the reign of Lothar I. That a mint was operating at the palace there was long suspected because of the coinage bearing the mint-name PALATINA MONETA, but now this discovery puts the matter beyond doubt.

Non-numismatic elements and the context of Carolingian Frisia and Viking influence

Nelleke IJssennagger-van der Pluijm and Christina Peek

Besides the raids and the benefices, the dynamic nature and extent of the Viking influence on Frisia in its broadest sense can be summarised as a structural connection in which Frisians and Vikings constantly interacted,[74] providing a more mixed picture. Instead of thinking about Frisia as Carolingian, which then is subject to Viking raids, increasingly we see Frisia as an area in which Frisians, Franks and Vikings met and mixed and therefore as an intermediary zone. This is particularly true in Central Frisia, the historic regions of Oostergo and Westergo between the rivers Vlie and Lauwers, where we do not know of any benefices, but find mixed hoards and single finds that we see as culturally Viking. This raises questions when we speak of Frisian, Carolingian or Viking finds, and what the wider context of the Wirdum hoard may be if it was buried due to Viking incursions.

Whether we speak of a Viking or a Carolingian hoard in Frisia is often determined by types and treatment of coins, as well as by the non-numismatic elements. Mixed hoards are often found in Frisia,[75] and the ones that we classify as Viking or related to the Vikings include particular objects as discussed above. Related to the Wirdum hoard, found over

Figure 11. The very fine fabric in plain weave of the bag from Wirdum. Photo: C. Peek.

71 Besteman 2006-2007, 72-73.
72 Knol & IJssennagger 2017, 18.
73 Coupland 1996, 85-114, reprinted in Coupland 2007, no. XII, at 99, 102.
74 IJssennagger 2017.
75 Coupland 2006, 257-260.

Figure 12. The imprint of the leather strap on the bag from Wirdum. Photo: C. Peek.

Figure 13. Impression of the reverse of a temple denier on the bag from Wirdum. Photo: F. de Vries.

a wider area, are a small, plain golden ring, two fragments of Carolingian pseudo-coin brooches, fragments of Roman coins, a Roman decorated jar fragment, a silver rod, various melon beads, ceramic spindle whorls or loom weights, sherds, and the remains of a small textile bag. Analysis identified the material as flax and showed that it is a very fine, strikingly regular fabric in plain weave (Figure 11). The textile was not dyed, and must have been of high quality.[76]

No starting border, selvedge or seams could be detected, implying that the material originally served some other purpose and was subsequently used to make a container for the coins. It must have been in use for some time before it was buried, to judge from the frayed edges. Microscopic analysis of the fabric reveals the imprint of a leather strap, as well as of the coins (Figures 12-13). The discovery of such a well-preserved coin bag is to our knowledge unique in early medieval Europe.

The gold ring and the pseudo-coin brooches might be associated with the hoard due to their proximity to the first coin finds. Although such objects have never been found

76 Type of weave: tabby, 1/1. Material (fibres): flax. Thread/direction I: spin z, thickness 0.1-0.7 mm, thread count 8-10/0.5 cm. Thread/direction II: spin: z, thickness 0.2-0.7 mm, thread count 8-10/0.5 cm.

Hoard	References
Aalsum pre-1885 (Friesland, NL)	Coupland 2011a, no. 106; Boeles 1915, no. VIII; Morrison and Grunthal 1967, Find 28; Haertle 1997, no. 38; NUMIS 1000847
Amerongen 2009 (Utrecht, NL)	Coupland, 2011a, no. 129; NUMIS 1113473. Pictured at http://www.museum-dorestad.nl/muntvondst.html
Bassenheim 2015 (Rheinland-Pfalz, DE)	Coupland 2019
Bikbergen 1992 (Noord-Holland, NL)	Coupland 2014, no. S10; NUMIS 1060240
Bray-sur-Seine 2009 (Seine-et-Marne, FR)	Coupland, 2011a, no. 107; Vandenbossche and Coupland 2012
Burgum 1990 (Friesland, NL)	Coupland 2011a, no. 63; Haertle 1997, nos 522-525 (as single finds); NUMIS 1006380
Emmen 1871 (Drenthe, NL)	Coupland 2011a, no. 104; Boeles 1915 no. XII; MG Find 34; Haertle 1997, no. 42; NUMIS 1011563
Entrammes 2013 (Mayenne, FR)	Coupland 2014, no. S20
Flacey 2014 (Côte d'Or, FR)	Coupland forthcoming b
Freising 1938 (Bayern, DE)	Coupland 2011a, no. 35; Emmerig 2004, 11-75; Morrison and Grunthal 1967, Find 20; Haertle 1997, no. 20 (both incomplete)
Goutum 2014 (Friesland, NL)	Coupland forthcoming b
Harlingen 1892 (Friesland, NL)	Coupland 2011a, no. 65; Haertle 1997, nos 35 and 615; NUMIS 1013625
Hermenches 1921 (Vaud, CH)	Coupland 2011a, no. 38; MG Find 22, Haertle 1997 no. 11 (with errors); Coupland forthcoming c
's-Hertogenbosch 2009 (Noord-Brabant, NL)	Coupland 2014, no. S 17; Nissen and Blok 2013, 53-58
Katwijk II 2001 (Zuid-Holland, NL)	Coupland 2011a, no. 17; Pol and Van der Veen 2008, 328-331; NUMIS 1016308
Kimswerd-Pingjum I pre-1892 (Friesland, NL)	Coupland 2011a, no. 66; Boeles 1915, no. V; Morrison and Grunthal 1967, Find 39, Haertle 1997 no. 43; NUMIS 1016937
Kimswerd-Pingjum II pre-1892 (Friesland, NL)	Coupland 2011a, no. 88, Boeles 1915, no. VI; Morrison and Grunthal 1967, Find 40, Haertle 1997, no. 44; NUMIS 1016938
Leiderdorp 2013 (Zuid-Holland, NL)	Dijkstra *et al.*2016, 285-293; Coupland forthcoming b
Lokeren 1940 (Oost-Vlaanderen, BE)	Coupland 2011a, no. 67; Haertle 1997, no. 46
Loppersum 1884 (Groningen, NL)	Coupland 2011a, no. 68; Boeles 1915 no. XX; Morrison and Grunthal 1967, Find 43; Haertle 1997, no. 34; NUMIS 1017663
Luzancy 2008 (Seine-et-Marne, FR)	Coupland 2011a, no. 128; Sombart 2008 (as n. 26 above); iNumis (Paris-Drouot) Auction, 10 October 2008, lots 1-103
Marssum 1998 (Friesland, NL)	Coupland 2011a, no. 69; NUMIS 1035380
Midlaren 1906 (Drenthe, NL)	Coupland 2011a, no. 130; Boeles 1915, no. XIII; Morrison and Grunthal 1967, Find 55; Haertle 1997, no. 57; NUMIS 1020515
Moordrecht 1600s (Zuid-Holland, NL)	Dijkstra 2011, 456, no. 148; Coupland forthcoming b
Oudwoude 1902 (Friesland, NL)	Coupland 2011a, no. 95; Boeles 1915 no. IV; Morrison and Grunthal 1967, Find 48; Haertle 1997, no. 40; NUMIS 1023654
Pilligerheck 1956-61 (Rheinland-Pfalz, DE)	Coupland 2011a, no. 118; Petry and Wittenbrink forthcoming; Morrison and Grunthal 1967, Find 53 is incomplete
Raalte 1995 (Overijssel, NL)	Coupland 2011a, no. 114; *Overijsselse Historische Bijdragen* 111 1996, 150-152; NUMIS 1024147
Rijs 1840 (Friesland, NL)	Coupland 2011a, no. 105; Boeles 1915 no. VII; Morrison and Grunthal 1967, Find 49, Haertle 1997, no. 37; NUMIS 1024736
Rijswijk (Gelderland, NL)	Coupland forthcoming b, Museum Dorestad, ref. 7646/49/50/52/54/59/61/63/67
Roermond 1968 (Limburg, NL)	Coupland, 2011a, no. 117; Van Gelder 1985; Haertle 1997, nos 50-51; NUMIS 1024817; Zuyderwyk and Besteman 2010, 73-154; Coupland 2011b
Roswinkel 1870 (Drenthe, NL)	Coupland 2011a, no. 163; Boeles 1915 no. XIV; Morrison and Grunthal 1967, Find 66, Haertle 1997, no. 75; NUMIS 1024838
Rotterdam 1965 (Zuid-Holland, NL)	NUMIS 1014512-1014516; Dijkstra 2011, 452, no. 128; Coupland forthcoming b
Saint-Martin-sur-le-Pré 1921 (Marne, FR)	Coupland 2011a, no. 56; Crinon 1992, 355-356 ; Étienne Page Auction (Paris, Drouot Montaigne), 4-5 October 1989, lots 134, 136, 139, 141-2, perhaps also 137 ; cf. Haertle 1997, 23
Saint-Même-le-Tenu 2009 (Loire-Atlantique, FR)	Coupland 2014, no. S9; Coupland 2013b
Saint-Pierre-des-Fleurs II 2007 (Eure, FR)	Coupland 2011a, no. 60 ; Coupland and Moesgaard 2012

Table 1 (continued on opposite page). Other Carolingian hoards mentioned in the text, with publication references.

Table 1 (continued).

Hoard	References
Tzummarum I 1987 (Friesland, NL)	Coupland 2011a, no. 59; Haertle 1997, no. 22 (incomplete); NUMIS 1029524
Tzummarum II 1991 (Friesland, NL)	Coupland 2011a, no. 121; Pol 1992, 66-71; Buis 2016; NUMIS 1029555; cf. Haertle 1997, 23
Vallée de la Risle 2010 (Eure, FR)	Coupland 2011a, no. 60 ; Coupland and Moesgaard 2012
Wagenborgen 1900 (Groningen, NL)	Coupland 2011a, no. 119; Boeles 1915, no. XXI; Morrison and Grunthal 1967, Find 56, Haertle 1997, no. 52; NUMIS 1032633
Westerklief I 1996 (Noord-Holland, NL)	Coupland 2011a, no. 102; Besteman 1997; Besteman 1999; NUMIS 1033081
Westerklief II 1999-2001 (Noord-Holland, NL)	Coupland 2011a, no. 171; Besteman 2006-2007; NUMIS 1035387
Wijk bij Duurstede IV 2002 (Utrecht, NL)	Coupland 2011a, no. 50; Dijkstra 2004, 47-49; Coupland 2010a, 95, 100; NUMIS 1033808, 1033826
Wijk bij Duurstede V 2015 (Utrecht, NL)	Coupland forthcoming b
Yde ('Ide') 1955 (Drenthe, NL)	Coupland 2011a, no. 120; Morrison and Grunthal 1967, Find 52; Van Gelder 1965; Haertle 1997, no. 53; NUMIS 1034483
Zelzate 1949 (Oost-Vlaanderen, BE)	Coupland 2011a, no. 154; Morrison and Grunthal 1967, Find 51; Haertle 1997, no. 86

as part of a Carolingian hoard, in Frisia or elsewhere, they could perhaps have belonged to the same owner(s). Of the other items, the association is less clear, particular where it concerns the non-metal finds. None of the non-numismatic elements indicate a particular Frisian, Viking or Carolingian nature, and the ceramic elements are very common. What they do indicate is the multi-period use of the Wirdum terp-site, something that we are very familiar with from other terp-sites.

Although this hoard does not give any indication of being related to Viking activity through its contents, it is the wider context of relatable hoards as discussed above that highlight the possibility that the deposition could be related to the unrest and changes caused by Viking activity. It is therefore still part of the story of the Viking Age in Frisia.

About the author

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Timber!

Opening up the landscape of Carolingian Leiderdorp

Menno Dijkstra

Introduction

This paper[1] focuses on recent work at Leiderdorp "Plantage", an early medieval riverine settlement site two kilometres to the east of Leiden (Figure 1). The site, part of the early medieval settlement of "Leithon", was discovered in 1950, during a small scale excavation.[2] Additional finds were made by amateur archaeologists in the late 1970s and 1980s. Plans for a new development led to an archaeological evaluation in the form of trial trenching in 2003.[3] These investigations demonstrated the presence of early medieval deposits on the banks of a small river. The decision was made to designate and thereby preserve part of the Plantage site *in situ* as a national archaeological monument. Other parts of the site were excavated by the University of Amsterdam in 2013. The excavation was funded by the municipality of Leiderdorp and the Dutch Ministry of Education, Culture and Science.

An extensive report on the 2013 investigations has recently been published in Dutch.[4] The general results of these investigations have also been summarised in English in two papers for an international audience.[5] The site is noted for the large amount of objects from daily life that were excavated from refuse layers in the crevasse channel, especially the layer dating to the first half of the ninth century AD. In contrast to those earlier papers, this paper focuses on the construction of the revetment and its organization in the Carolingian period, and the impact of tree felling on the surrounding landscape.

Settlement phases and revetment construction

The early medieval settlement was situated on splay deposits on both sides of a crevasse channel, which was the result of a breach in the northern bank of the river Rhine. Unfortunately, parts of the early medieval settlement site were damaged by post medieval clay extraction. Only those features which were dug deep into the subsoil, such as ditches, granary posts, wells and revetments, have survived to the present day.

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1 The author would like to thank prof. dr J. Symonds for commenting on this paper and correcting the English text.

2 Braat 1952.

3 Wagner and Depuydt 2009.

4 Dijkstra *et al.* 2016.

5 Verhoeven and Dijkstra 2017; Dijkstra and Verhoeven 2019.

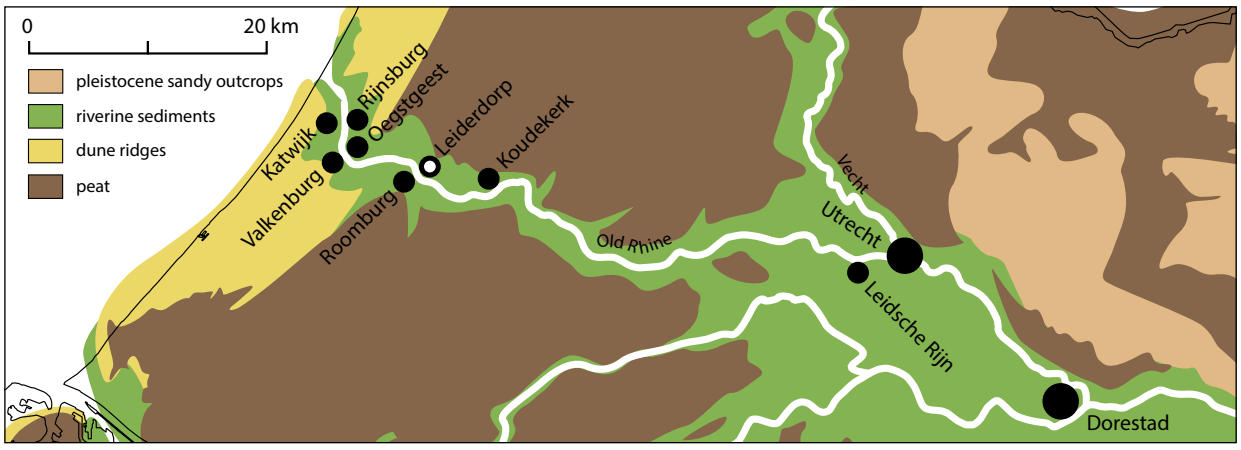

Figure 1. Position of Leiderdorp and other excavated early medieval sites of importance on a paleogeographical reconstruction of c. 800, with indication of the modern coastline.

Thanks to dendrochronology[6] three settlement phases can be discerned[7]:

- Phase 1: Late Merovingian, c. 580-750
- Phase 2: Early Carolingian, c. 750-810
- Phase 3: Middle Carolingian, c. 810-840

The constructions of the revetments became more solid in due course, but remained relatively simple. The late Merovingian revetments of c. 681-690 consisted of vertical posts placed about every half a metre to one metre. Horizontal posts or beams were placed behind these vertical posts. The vertical posts must have been driven into the ground with some kind of drop hammer.

The same is true for the two revetments structures (=STR) of Phase 2. The vertical posts were placed next to each other, with three to four horizontal posts behind them (STR 604-605 and 607-608, Figure 2, 3, 4 and 5). On the south bank perpendicular rows of smaller posts were found, separating smaller plots (STR 621-623, Figure 2).

The revetment of the middle Carolingian period (STR 610-611, built c. 811-816) was the sturdiest. Somewhat thicker and longer vertical posts where placed about every one to one and a half metre, with a line of five to six horizontal beams behind them. The surface behind this revetment had been levelled up by dumping organic rubbish and dung. Parts of a board-walk were found on the south bank (STR 609). This most likely functioned as a temporary walkway during the construction and levelling activities. A slightly different construction method had been used on the north bank. There, a foundation trench had been dug to ease the placing of the horizontal posts and beams. To prevent the horizontal posts from losing height, a perpendicular horizontal sleeper beam had been placed under them about every one to three metres (Figure 3 and 5). Our excavation did not recover any evidence of wooden joints, but it cannot be excluded that joints were used in the decayed upper parts of the riverside structures.

Interestingly, dendrochronologic analysis has also shown that some of the wood in the revetments was reused, sometimes as vertical lining, but more often as horizontal posts and beams. This probably explains the lack of horizontal beams behind the first revetment of Phase 2. These timbers were probably lifted and reused in the second revetment. A few posts from the Merovingian revetment of the 680s were also given a second use in the revetments of Phase 2 and 3. One horizontal beam in the revetment of Phase 3 even came from a tree that had been felled in 584.

Furthermore, it is clear that some wood from the revetment of Phase 3 (c. 811-816) came from dismantled buildings. Two of the sleeper beams had mortice joints at one end, suggesting that they had been salvaged for reuse from a former building. Dendrochronology shows that one sleeper beam dated from the second half of the seventh century, and was used as a collar, probably in a queen post roof (Figure 3).[8]

It is certainly no coincidence that the three revetments from the second half of the eight and early ninth century line up in construction with the ones found at the "Kastanjelaan" site, which was excavated in 2011 (Figure 6 and 7).[9] The only difference is the dating of the subsequent revetment works, which is about ten years earlier than those uncovered at "Plantage". This shows that the builders worked their way up from the Old

6 Jansma and Doeve 2016.

7 The paragraph text below is for the most part based upon Dijkstra and Verhoeven 2019, 67 and 70.

8 Dijkstra and Verhoeven 2019, 71 (Figure 7).

9 Houkes 2014.

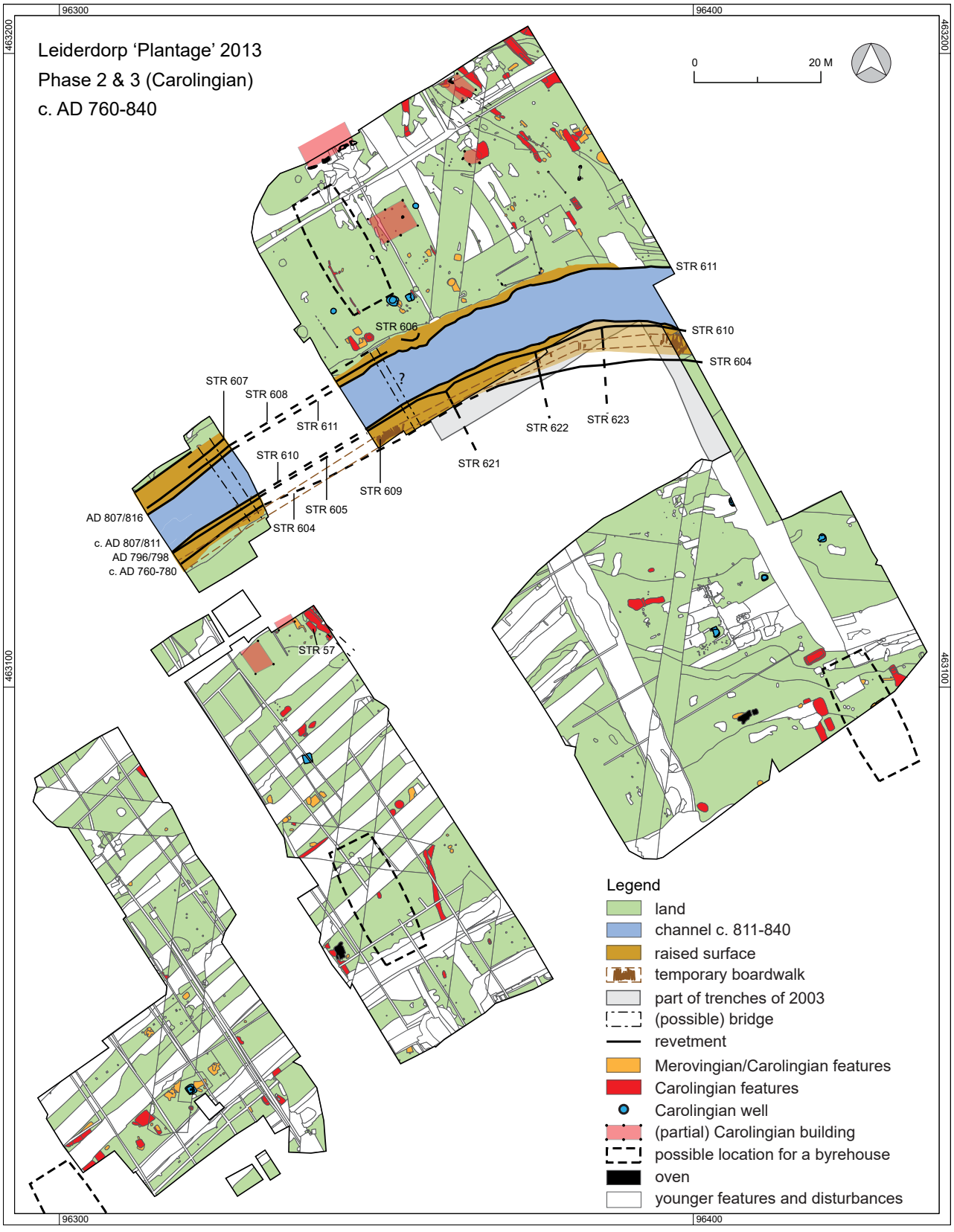

Figure 2. Plan of the Carolingian settlement phase of Leiderdorp "Plantage". The layout of the revetments is simplified (cf. Figure 3).

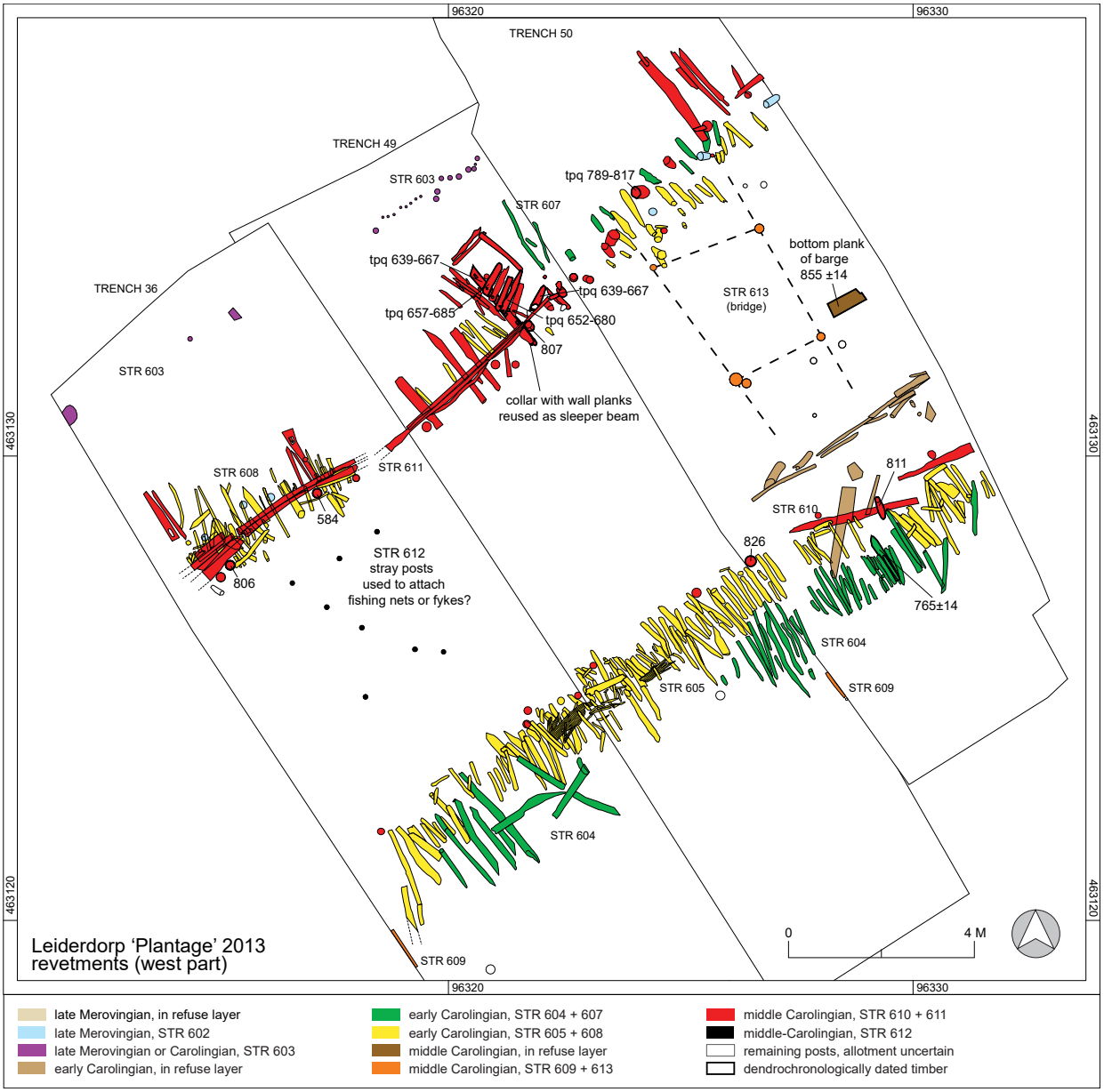

Figure 3. The western part of the excavated revetments of Phase 2 and 3 at Leiderdorp "Plantage". Figure: based on Dijkstra *et al.* 2016, appendix B 08A).

Rhine into the hinterland. The time lapses between the rebuilding of the revetments varied from about fourty years (c.750-798 AD) to fifteen years (c.798-811 AD). Only a small amount of repair work seems to have been carried out in the 820s and early 830s (Figure 8).

Thus, it appears that in the Carolingian period the channel was lined with a revetment three times for a distance of about 650 m, from the Old Rhine upstream to the "Plantage" site. Further upstream, small archaeological excavations and trial trenches gave no indications for systematic revetments along the smaller network of streams.[10] This suggests that the local inhabitants took great care to prevent the lower, deeper end of the stream from silting up. The straight course of the channel between the two excavated parts also suggests that the channel was straightened and dug out to improve drainage of the hinterland and access for (small) boats. A question for future research is whether or not the mouth of the "Leitha" was dammed, just like

10 De Koning and Hoogendijk 2012.

Figure 4. Collapsed remains of part of the revetments of phase 2 (STR 605) along the southern bank of the channel.

in the Merovingian riverine settlement of Oegstgeest "Nieuw Rhijngeest".[11] This could explain the absence of marine water influences in the channel of Phase 3.

Exploitation of the surrounding landscape

Pollen analysis of a section across the crevasse channel indicates that in the Merovingian period the surrounding area of Leiderdorp was covered with a park-like vegetation dominated by alder, but also oak, hazel and some ash, beech and birch (Figure 9). In the Carolingian period, this was transformed into a deforested, open landscape dominated by grasses and some cereals. The sharp drop of alder pollen indicates that huge quantities of alder were cut, undoubtedly for the revetments along the channel. The wood species confirm this. The main type for both the "Plantage" and "Kastanjelaan" sites was alder (80%), followed by oak, ash and some elm. Willow was used for wattle work, which was occasionally found in the revetments of Phase 2, either between vertical posts, or as separate gabion basket segments (STR 606). A local provenance of the wood is most likely, as measuring data of oak and ash fits in with the dendrochronological calendar of the Dutch Rhine levees.[12] It is no surprise alder was by far the most used tree taxon, as it has a high durability when used in waterworks.

The remaining length of the vertical posts of Phases 1-3 was c. 1.75-3 m. The diameter was on average 0.13-0.16 m, the largest post had a diameter of c. 0.24 m (oak).

Considering the huge amount of wood needed for the three subsequent Carolingian revetments, one wonders where the trees needed were felled and whether or not the local landscape had enough carrying capacity for these enterprises. The same kind of questions were addressed by Van Dinter *et al.* in 2013 about the supply for the Roman army in the Lower Rhine Delta. Because the palaeolandscape of the Roman and early medieval period was virtually identical, we can use the same assumptions and modules to answer questions about timber supply in Leiderdorp.[13]

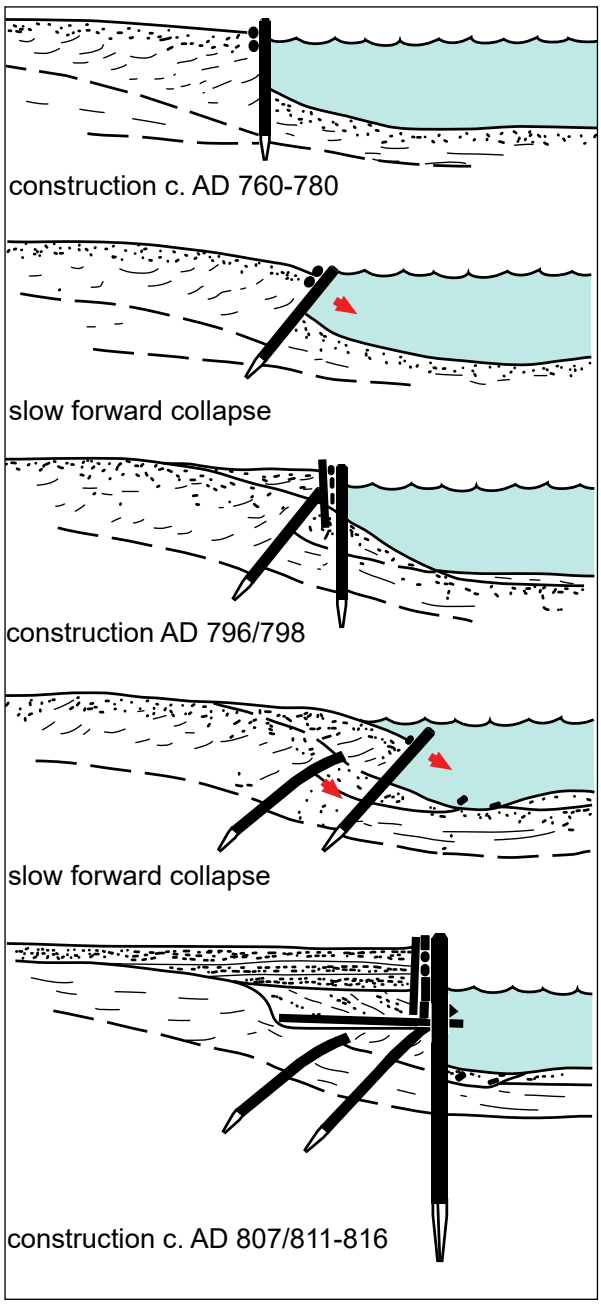

Figure 5. Schematic reconstruction of the sequence of Carolingian revetments along the northern bank in phase 2 (STR 607-608) and 3 (STR 611). The sequence almost parallels the revetments of the southern bank.

11 De Bruin 2018, 21 and fig. 2.

12 Jansma and Doeve 2016, 693.

13 Van Dinter 2013; Van Dinter *et al.* 2013.

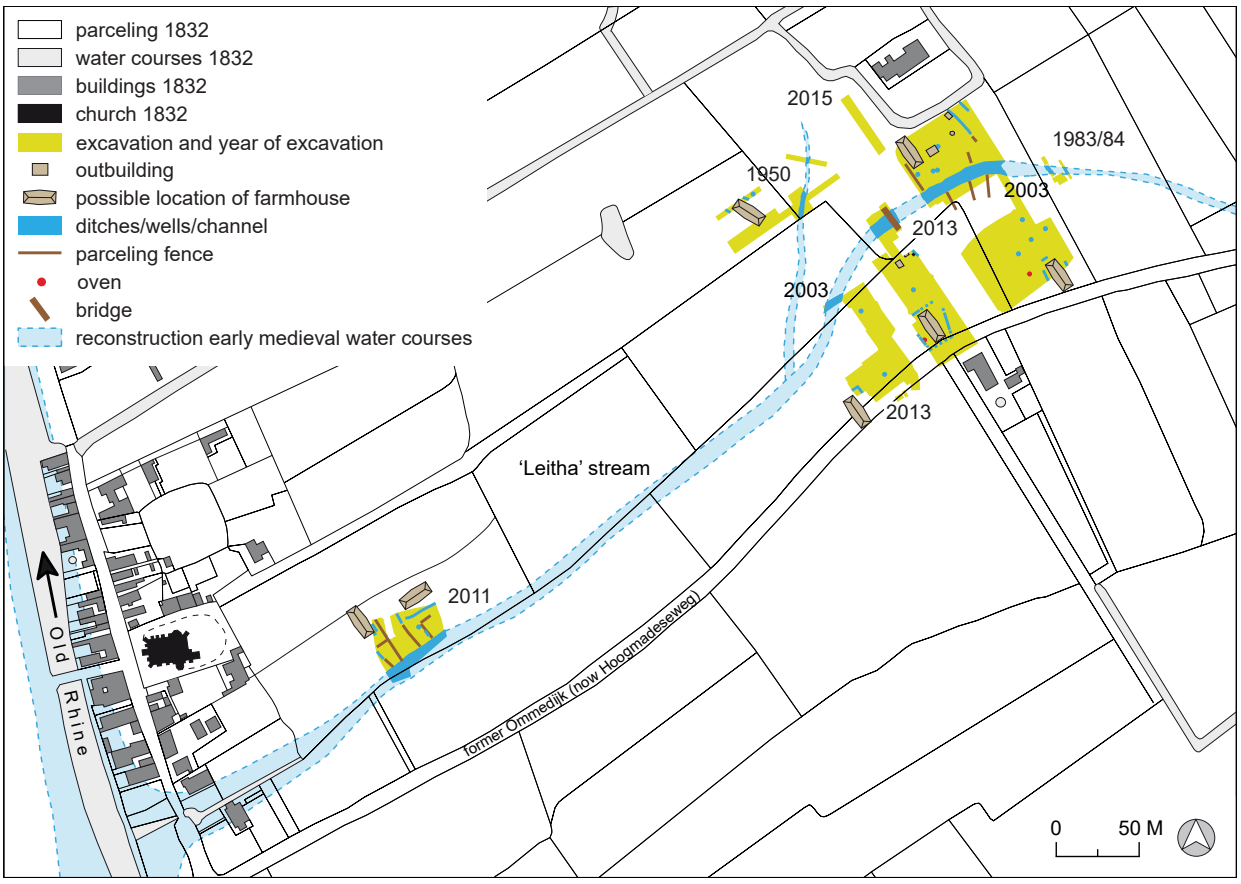

Figure 6. Reconstruction of the early medieval watercourse of the "Leitha", based on archaeological excavations and corings, projected on the topographical map of 1832.

First, we have to establish the potential catchment area and the yield of trees. The geomorphological units which were potentially most suitable for wood felling in a freshwater river region are the high and low levees, high and low flood basins and the fen woodlands (Figure 10 and 11).[14] As for yield, we must recon with early medieval natural woodlands containing slower growing and thinner trees in comparison to modern trees of the same age.[15] When we take alder as the leading taxon in the revetments, natural yields can vary between 13 to 100 m³/ha, depending on the different geomorphological units (Table 1). The highest yields of c. 200 m³/ha would have come from alder coppices located on the lowest parts of the levees or the highest parts of the flood plain.[16] The posts in the Leiderdorp revetments were not specifically studied for their provenance from wood management. Whether it was a question of reckless clear felling of trees or careful thinning and coppicing remains to be seen. The more or less similar diameters and straight stems could, however, point to the careful selection of trees and thus some form of wood management.[17]

The second step is to calculate the amount of timber needed. This is done step by step in Table 2 to 4. The calculation is restricted to the hectares needed for alder, as this taxa delivered c. 80% of the wood needed in the revetments.

According to Table 4, a maximum of nine hectares was needed to meet the requirements for alder. When we visualise this on a map (Figure 10), it turns out that even with the lowest yield plenty of alder wood remained untouched on the high and low parts of the flood basin and fen woodlands. Felling of alder could also have taken place on the lower parts of the levee. The potential catchment area for alder would have been even smaller by using coppiced alder woodlands. And as alder is a fast-growing tree, the woodlands could have regenerated in about ten to 25 years,[18] so within the time lapses of

14 Van Dinter *et al.* 2013, 10, table 1.
15 Van Dinter *et al.* 2013, 16-17.
16 Van Dinter *et al.* 2013, 16-17 and table 5.
17 Cf. Van Rijn 2017.
18 Van Rijn 2017; Van Dinter *et al.* 2013, 16-17 and table 5.

Figure 7. The settlement of "Leithon" in c. 830. In the background the remains of the Roman *castellum* of "Matilo". Artist's impression: M. Kriek/University of Amsterdam.

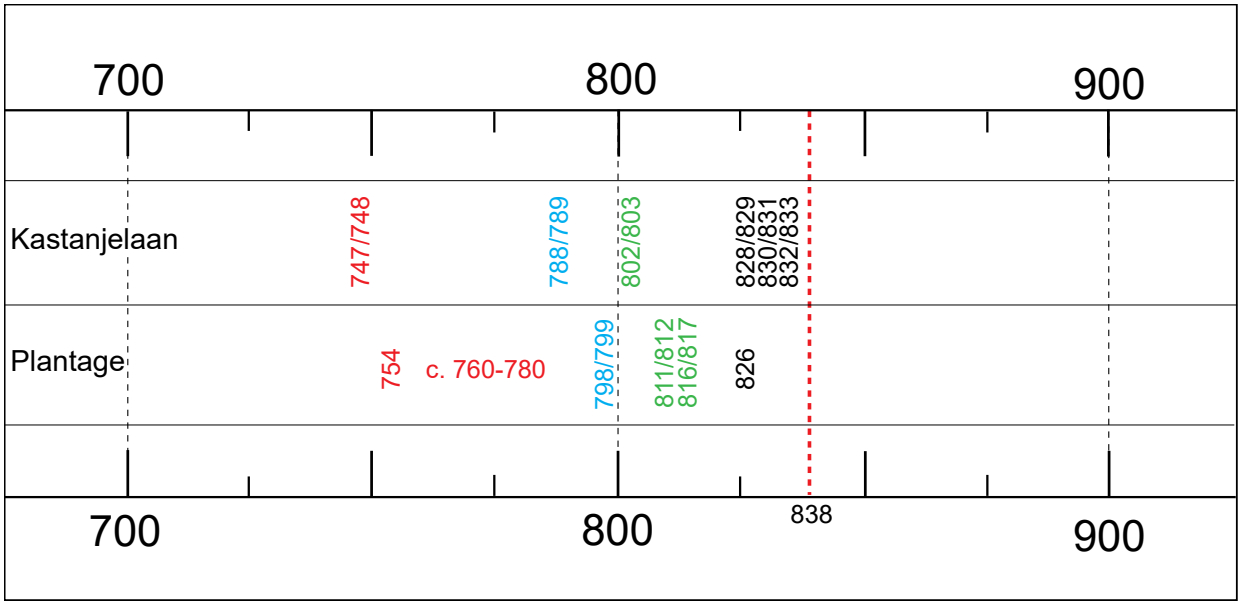

Figure 8. Time lapses of the revetment phases of the excavation "Kastanjelaan" compared to "Plantage", based on dendrochronological dates.

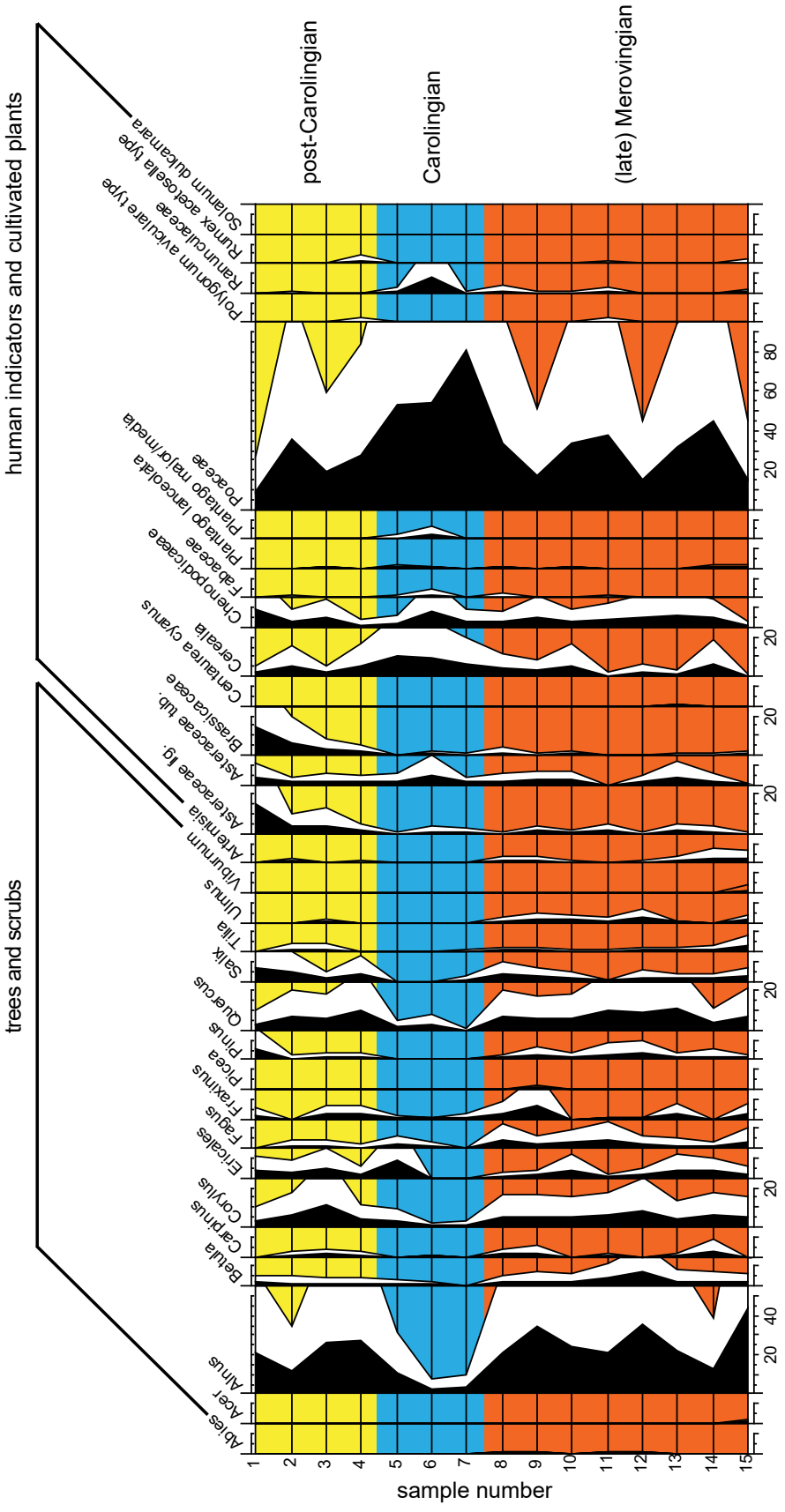

Figure 9. Pollen diagram of the silted layers of the channel at the "Plantage" site, showing a clear drop in alder trees in the Carolingian period.

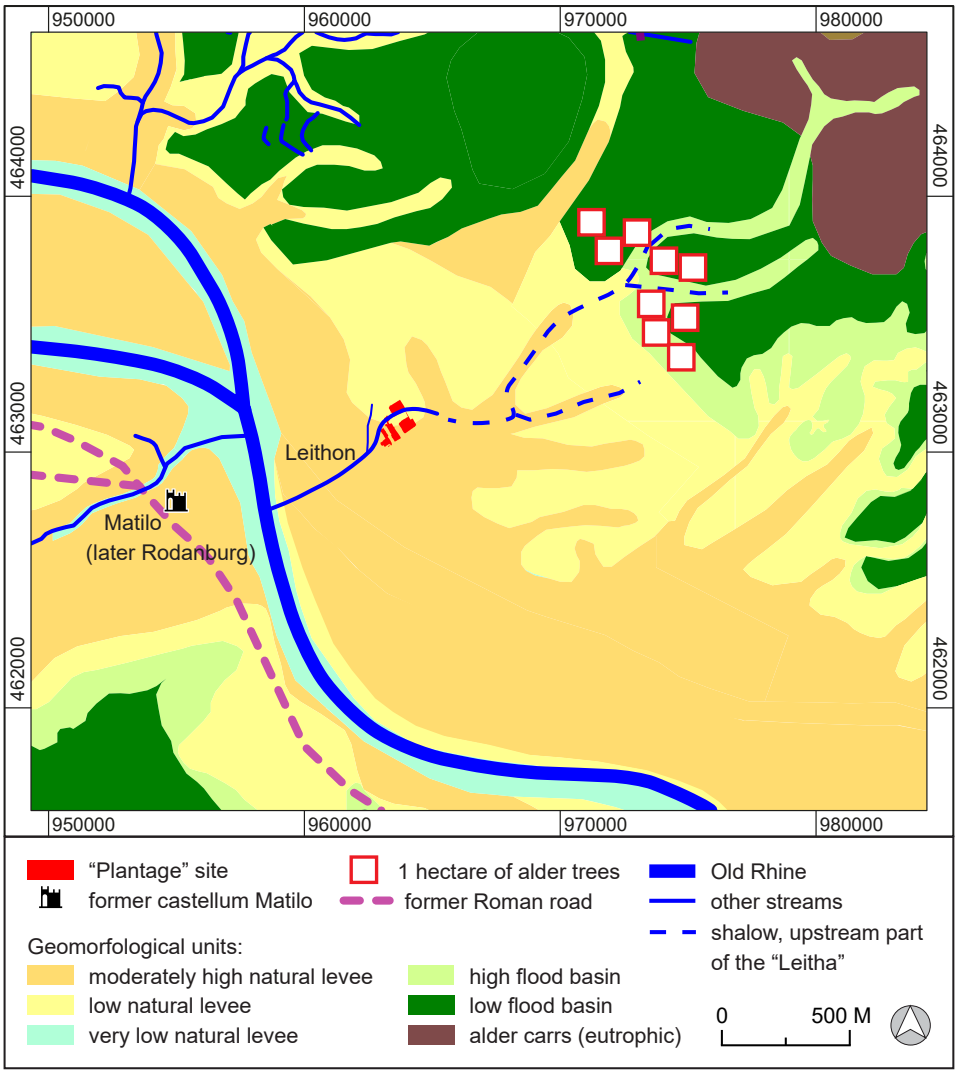

Figure 10. Paleogeographical map of early medieval "Leithon" and surroundings, with geomorphological units and an indication of the maximum of hectares needed for felling alder trees. Map: based on Van Dinter 2013, app. 1.

about fourty and fifteen years between the subsequent revetments. Thus the use of less posts in the latest, early ninth century revetment was not prompted by a lack of local timber, but a conscious choice to create a more sturdy revetment. To conclude: the local catchment area for all wood taxa must have been big enough for the use in revetments as well as for fire wood and in house construction. It is expected that, besides the banks of the "Leitha" stream, also part of the waterfront along the Old Rhine was revetted. The same conclusion is applicable to the Merovingian period. There is even a good chance the two sharp drops of alder in the pollen diagram are hinting at the construction of earlier large-scale revetments works (Figure 9).

During the Carolingian habitation the last patches of wood on the levee must have been felled to make way for arable farming and animal husbandry. The higher part of flood basin was suited for livestock farming as well, while the lower parts could be used as hay land.[19] As the inhabitants mainly focused on cattle (with a share of 78% cow bones from the excavation), the revetments were important for improving the drainage of the adjoining meadows. The partaking of Leiderdorp in the booming Carolingian economy lasted probably until the 26th of December 838, when a disastrous storm surge affected much of the Frisian coastal region.[20]

Level of communal management

The coherence in construction, dating, and length of the revetments at Leiderdorp leads to the question whether or not a central authority was involved in planning the operations. This remains an open question, because it

19 Van Dinter *et al.* 2013, 10 and table 1.

20 Dijkstra and Verhoeven 2019, 76.

Figure 11. Alder was located on the lower levees, in flood basins and eutrophic fenlands. Photo: BIAX, Zaandam.

is unclear how the settlement was organised at a local level. It is likely that the fen woodlands and marches in the hinterland of Leiderdorp were used by the local inhabitants as common land long before systematic reclamations began: not only for gathering wood and reeds, but also for fishing, hunting and – where possible – as pasture land.[21] A strong lordship controlling access to the woods was still lacking. Authority over the wild peatlands was officially a regality, but was usurped by the West-Frisian counts in the tenth century.

A property list of the bishop of Utrecht, with settlements dating in the ninth century at the latest, mentions a few *mansi* in "Leithon". The count of West-Frisia (later Holland) and also the king can be expected to have owned parts as well. Indisputable evidence for an early medieval estate is lacking, however. There is a late medieval moated site in the village centre of Leiderdorp, but its origins are unknown. The same goes for the parish church, but its patrons of St. Michael and St. Pancras do not suggest an early medieval foundation date (Figure 6).

Interestingly, the dendrochonological dating of subsequent Merovingian revetments on the opposite site of Leiderdorp "Roomburg", in a channel next to the ruins of the former Roman *castellum* of "Matilo" (named "Rodanburg" in the Early Middle Ages), suggest that these are related to activities in Leiderdorp. Repair works took place shortly after 623 and 627/628 and around 680/681 and 684. This could line up with the known felling dates of 629 and 681-691 of trees for revetments in Leiderdorp "Plantage". Younger dates of revetments at "Rodanburg" are not available, except for a repair at a date somewhere between 704-716.[22] It almost seems that Leiderdorp and "Rodanburg" were one complementary settlement, which could explain why the later parish of Leiderdorp also included part of the opposite bank of the Rhine.[23]

Were these seventh century building activities connected to the growing political interest of Merovingian kings in the Lower Rhine delta? Allegedly king Dagobert I founded a church in the former *castellum* of Utrecht in c. 623-638 and the Frankish palace mayor Pepin of Herstal defeated the Frisian king Redbad in 695 at Dorestad.[24] Or did the Frisian king take the initiative for the revetments in the 680s?

Whether the influence of central authority reached that far in these days can be questioned, however. We should not underestimate the local communal initiative of the farmer-traders who lived on the banks of the Rhine, who had to manage the water on a daily basis. Maintaining revetments was probably a seasonal activity, with felling trees in the late autumn or winter and construction in the spring or summer.[25] Maybe part of the work was undertaken by tenants who had to perform services for their lord. The size of the labour available in the Leiderdorp community is hard to estimate, but when we extrapolate the picture emerging from the excavated parts, it could have been based on as many as twenty farms. Assuming households of six to ten people per farm, with two to three adult males, about fourty to sixty men were available at the most.

21 Henderikx 1986, 495 and 497.

22 Jansma and Hanraets 1995a and 1995b, sample LRB 071, 080, 091, 122, 142, 150 and 240.

23 Blok 1986, 171.

24 Blok 1979, 40-42.

25 Cf. Van Dinter *et al.* 2013, 27 and fig. 5.

Wood management	Tree taxon	Age (from year of germination)	Trunk diameter (cm)	Yield (m3/ha)
Natural	Alder	-	6-15	13-100
Coppice	Alder/ash	12	7-15	200

Table 1. Estimates of yields of early medieval trees (based on Van Dinter *et al.* 2013, table 5).

Revetment Date	Channel length 2 x 650 (m)	Average Vertical Post Spacing (m)	N Vertical posts	Average Horizontal Post Length (m)	N Hor. Rows	N Horizontal posts	Total N Posts
c. 770	1300	0.125	10,400	3	3	1,300	11,700
c. 798	1300	0.125	5,200*	3	3	650*	5,850
c. 811	1300	1.250	1,040	3	5	2,167	3,207

Table 2. Number of posts needed for the three Carolingian revetments of Leiderdorp.
*Assumed is a reuse of 50% of the posts of the first revetment in the second one.

			Vertical posts		Horizontal post			
Revetment Date	Average Post Diameter (m)	N Posts	Average Post Length (m)	M^3 Posts	Average Post Length (m)	N Posts	M^3 Posts	M^3 Total
c. 770	0.085	8,320	1.75	82	3	1,040	18	100
c. 798	0.085	4,160	1.75	42	3	520	9	51
c. 811	0.14	832	3.00	38	3	1,734	80	118

Table 3. Number and m^3 of alder posts needed in the three Carolingian revetments of Leiderdorp, based on an alder proportion of 80%. The cubic content is calculated by multiplying the number of posts with the volume of one post, according to its length: $m^3 = N*(\pi * r^2 * h)$.

			Size of catchment area		
Wood management	Tree taxon	Yield (m^3/ha)	Revetment c. 770 (100 m3)	Revetment c. 798 (51 m3)	Revetment c. 811 (118 m3)
Natural	Alder	13-100	7.7-1.0 ha	3.9-0.5	9.0-1.2 ha
Coppice	Alder	200	0.5 ha	0.3 ha	0.6 ha

Table 4. Estimate of timber demand for the Carolingian revetments of Leiderdorp, converted into hectares of alder woodland needed according to wood management and yield.

The felled wood could have been moved to the revetment site over land by horse, but part of the posts might as well have been thrown into the "Leitha" to transport them downstream. Evidence for trimming down trees at the revetment site is virtually lacking in the refuse layers. Trimming probably took place at the felling site to make transport easier. The leaves and twigs could have been used as supplementary animal fodder.

The revetments had a communal aspect from the start, as is clearly shown by working from the Old Rhine upstream to the "Plantage" site. This does not mean individual building preferences within the communal work were completely out of order. In Phase 2 at the "Kastanjelaan" site, part of the revetment was lacking in one yard segment (because of a slipway for boats?) and at the "Plantage" site wattle works was used by one neighbour, while at the opposite bank two separate post rows were placed at one of the perpendicular boundaries. The revetment of Phase 3 was executed in a much more uniform way, but whether this implies a firmer communal effort of a central directive cannot be discerned.

Conclusion

Excavations in and around Leiderdorp have given us a clear insight into the communal investment in water management in the Lower Rhine delta in the early medieval period. Great efforts were made by local communities to construct and maintain revetment works along crevasse channels. The calculations suggest that local wood from levees, flood

basins and fenlands would have been sufficient for the construction of the revetment and for subsequent phases of repair and remodelling. Access to the woodlands must have been part of the common rights of the adjoining settlement. It is expected that some kind of wood management did take place, but this has to be confirmed by future excavations.

About the author

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Charlemagne's palace at Nijmegen

Some thoughts on the economic implications of itinerant kingship

Arjan den Braven

Introduction

Charlemagne's vast empire, which would last for over a century, reached its greatest extent in the late eighth century. Its rural economy, which mainly depended on landed property and agricultural production, was able to sustain a cultural revival known as the Carolingian Renaissance. The Carolingian "*palatium*" of Nijmegen is one of the few central places in "Charlemagne's Backyard", as our research group nicknamed the north-western rural periphery of the Frankish Empire.[1] Together with the palaces at Aachen, Paderborn and Ingelheim, the royal palace of Nijmegen is one of the architectural highlights of the Carolingian Renaissance. Besides their impressive monumental architecture, as an expression of royal power and authority, these palaces were all built or significantly enlarged during the reign of Charlemagne.[2] Later in Charlemagne's life, Aachen became his favoured royal residence, and it remained equally important to his son Louis the Pious.[3] However, other royal palaces and estates like Nijmegen were still visited quite frequently by the king and members of his court (Figure 1).[4] In this article I will share some thoughts on the economic implications of this itinerant kingship in relation to the Carolingian palace at Nijmegen.

Manorialisation and the problem of economic growth

In the nineteenth and the beginning of the twentieth century, historians like Karl Lamprecht considered the Carolingian world as an economically underdeveloped agrarian society that depended on self-sufficiency.[5] It was assumed that this society was unable to produce surpluses that could be brought to the market. Therefore, itinerant kingship was considered partly as an

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1 The author is doing his PhD research as part of "Charlemagne's Backyard. Rural society in the Netherlands in the Carolingian age". This project was funded by NWO (The Dutch Research Council) and supervised by prof. dr. em. Frans Theuws (Leiden University) and prof. dr. em. Mayke de Jong (Utrecht University).

2 Binding 1996 gives a general overview. Recently, the archaeological and architectural evidence of individual palaces have been published in more detail: Aachen (*e.g.* Heckner and Schaab 2012; Ristow 2014a; Ristow 2014b; Ley and Wietheger 2014), Paderborn (Gai and Mecke 2004), and Ingelheim (Grewe 2014).

3 McKitterick (2008, 158) has argued that Aachen's central role in Carolingian political ideology is primarily due to Louis the Pious and his heirs.

4 Brühl 1968, Itinerarkarte I; Thissen 2014, 72-73.

5 Lamprecht 1909.

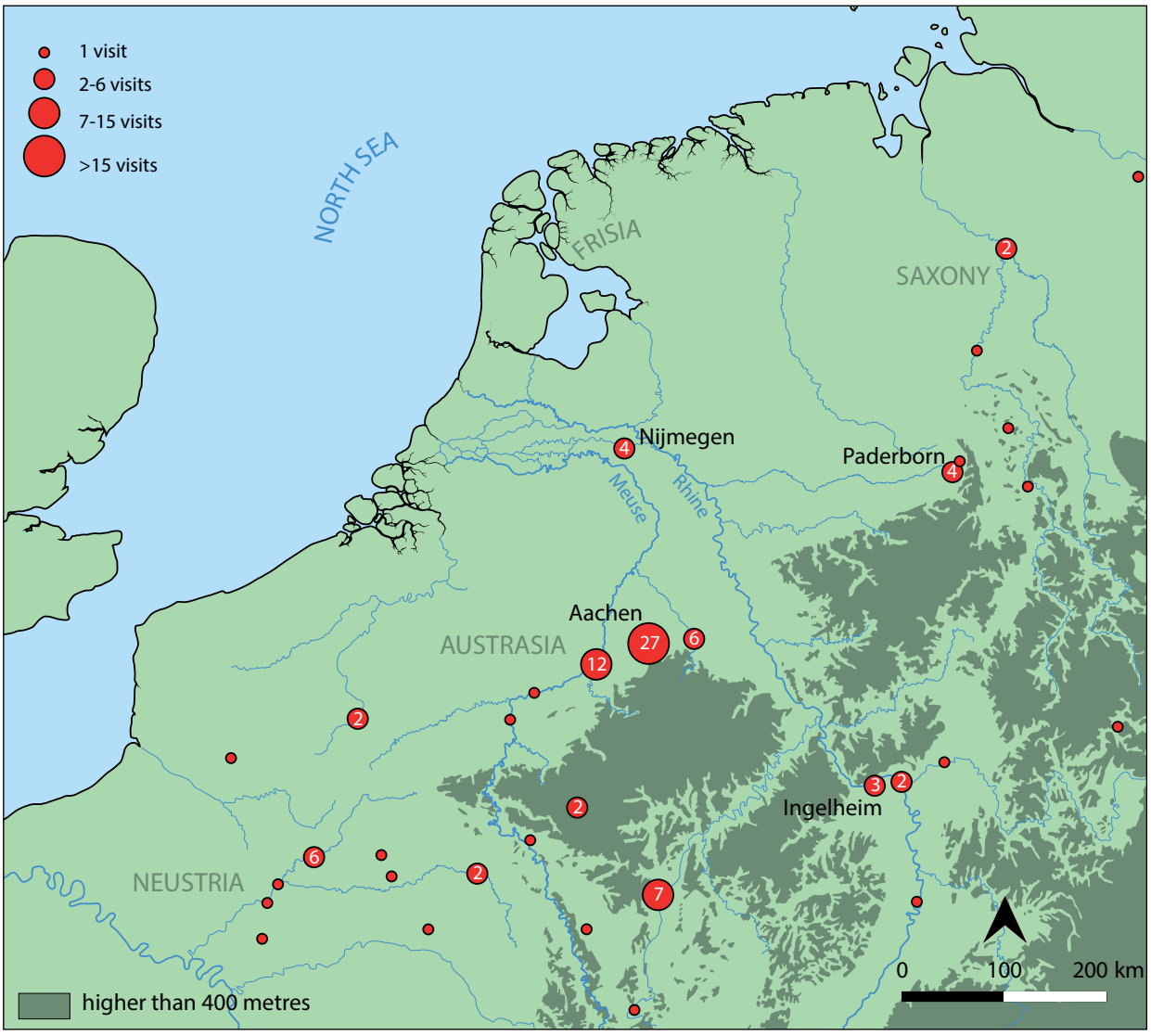

Figure 1. Itinerary of Charlemagne (768-814): number of visits on royal estates/palaces. Map: A. den Braven.

economic necessity, because of the lack of trade in foodstuffs and a limited agrarian output of individual estates. In a reaction to this agrarian-based view, Alfons Dopsch has emphasised the role of towns, money and trade.[6] Since then, historians and archaeologists have debated the nature of the Carolingian economy and question whether this was a period of economic growth or stagnation.[7]

An important element in the discussion is the role of the manor or bipartite estate. This form of land organisation gradually became dominant in the Frankish heartlands in the course of the eighth and ninth centuries. The manor rested on a twofold division of the land. One part, which is called the *demesne* and consisted of a central courtyard ("*curtis dominica*") and land ("*terra salica*"), was cultivated directly for the landlord by the dependent peasantry (tenants). The rest was mostly divided into individual plots which were used by dependent peasant households in order to support themselves in return of some kind of rent.[8] Royal estates and their ecclesiastical counterparts were in the vanguard of this process of manorialisation.[9] The spread of the manorial production system was likewise a reflection of expanding royal power under the Carolingians, which seems to be the case in the Nijmegen region. An important question is whether the introduction of the manorial production system caused economic growth. Manors are

6 Dopsch 1921-1922.

7 *E.g.* Costambeys *et al.* 2011, 258-263, 324-378; Hodges 2000; Verhulst 2002; Wickham 2005.

8 Verhulst 2002, 33; Costambeys *et al.* 2011, 253.

9 Innes 2009, 50.

often seen as the underlying factor responsible for social and economic change in the Carolingian countryside. Yet, manorialisation was not an all-defining process which created a completely new rural landscape, as demonstrated by Costambeys, Innes and MacLean in 2011. They have argued that these developments were not the result of a conscious economic policy aimed at encouraging exchange. Instead, the primary aim of ecclesiastical and royal estate-management was "the creation of a stable and predictable flow of goods and rent, not at what we would recognise as economic growth".[10]

In relation to this, it is important to think about the interaction between palaces as royal residences and the management and organisation of royal estates belonging to them. Much debated Carolingian texts like the *Capitulare de villis* and *De ordine palatii* contain useful information in this respect.[11] However, they remain normative texts that do not necessary reflect actual social and economic practices. Rosamond McKitterick assumes that all royal palaces were the (economic) centres of estates.[12] Is this the case? Furthermore, how was the royal estate or fisc used not only for sustaining the creation and upkeep of the palace buildings, but also for providing the necessary supplies for royal visits, or provisioning the army, etc.? Are there perhaps regional differences in the way royal estates functioned, and how did such functions change over time? Nijmegen is an interesting case study in regard to these questions.

The palace at Nijmegen

In written sources, Nijmegen is one of the more prominent Carolingian palaces. As Einhard mentions in his *Life of Charlemagne*: "He [Charlemagne] also began [to build two] splendid palaces, one not far from the city of Mainz, on the [royal] estate of Ingelheim, and the other at Nijmegen on the river Waal, which passes along the south side of the island of the Batavians".[13] The palace was located strategically on the far end of a moraine, the so called Valkhof plateau. From this high point one has a clear view of the Betuwe and the river Waal, a tributary of the Rhine. The old Roman roads from Nijmegen to Maastricht and also from Nijmegen to Xanten and Cologne seem to have still been in use in the Carolingian period. The creation of the palace at Nijmegen as a royal stronghold perhaps is related to the so-called Saxon Wars (772-804). Only five years prior to Charlemagne's first visit to Nijmegen, he conducted military campaigns against the Saxons in an attempt to subject them to Frankish rule and religion. In these turbulent times, Nijmegen was a place where armies could easily be assembled before going to war in Saxon territory. In addition to this, the royal estates in the Nijmegen region could have served as resource for provisioning the army.

Charlemagne visited Nijmegen at least four times (in 777, 804, 806 and 808).[14] Each time, he and members of his court stayed there for several weeks, if not months.[15] According to the royal Frankish annals, it was a place where Charlemagne celebrated Easter. He did this for the first time in 777, the same year that the oldest preserved charter is mentioning the "*palatium publicum*" of Nijmegen.[16] Charlemagne's son Louis the Pious visited Nijmegen on nine different occasions, often for several months as well. The importance of the palace is further underlined by the fact that several royal assemblies were held in Nijmegen between 804 and 870.

Unfortunately, the palace of Nijmegen was almost completely demolished in the revolutionary years of 1796-97.[17] Since then, only small parts of the palace site have been excavated and in most cases a long time ago, for example during the important archaeological excavations by Jan Jacob Weve that were conducted in the years 1910-11.[18] So far, excavations on the Valkhof has provided little knowledge on the original layout and the no doubt complex building history. What we do know from excavations is that the palace was built on the remains of a Late Roman fortification, of which a large ditch was still visible in the eighth century. This ditch was more than twelve metres wide and four metres deep, and enclosed an area of approximately four and a half hectares (Figure 2).[19] In the old churchyard in the south-eastern part of the palace site, graves dating back to the Carolingian period have been revealed, as shown by radiocarbon dating. In addition to this, a cemetery from the seventh and eighth centuries has been excavated at the chapel of St. Martin, *i.e.* the central part of the palace site.[20]

A part of a stone wall is all that remains of the original Carolingian palace (Figure 3). Its late eighth century date has recently been confirmed by architectural research.[21] During the twelfth century this wall was incorporated into the chapel of St. Martin. The Carolingian palace must have been impressive as is attested by several beautifully carved Carolingian capitals (Figure 4).

10 Costambeys *et al.* 2011, 260.
11 Metz 1960; Metz 1971; McKitterick 2008, 142-154; Zotz 2014, 81-82.
12 McKitterick 2008, 170.
13 Translation by Dutton 1998, 26.
14 Leupen and Thissen 1981, 17-19 (no. 20-21, 23-28).
15 Thissen 2014, 72-74.
16 Leupen and Thissen 1981, 17-18 (no. 20-21).
17 Langereis 2010, 137-138.
18 Weve 1925. For further discussion: Thijssen 1980, 10-13; Den Braven 2014, 26-29; Hendriks *et al.* 2014, 70-71; Thijssen 2014, 182-183.
19 Thijssen 2002, 13, 16; Hendriks *et al.* 2014, 58.
20 Hendriks and Den Braven 2015, 13-14.
21 Hundertmark 2019, 18-26: "bouwfase 1".

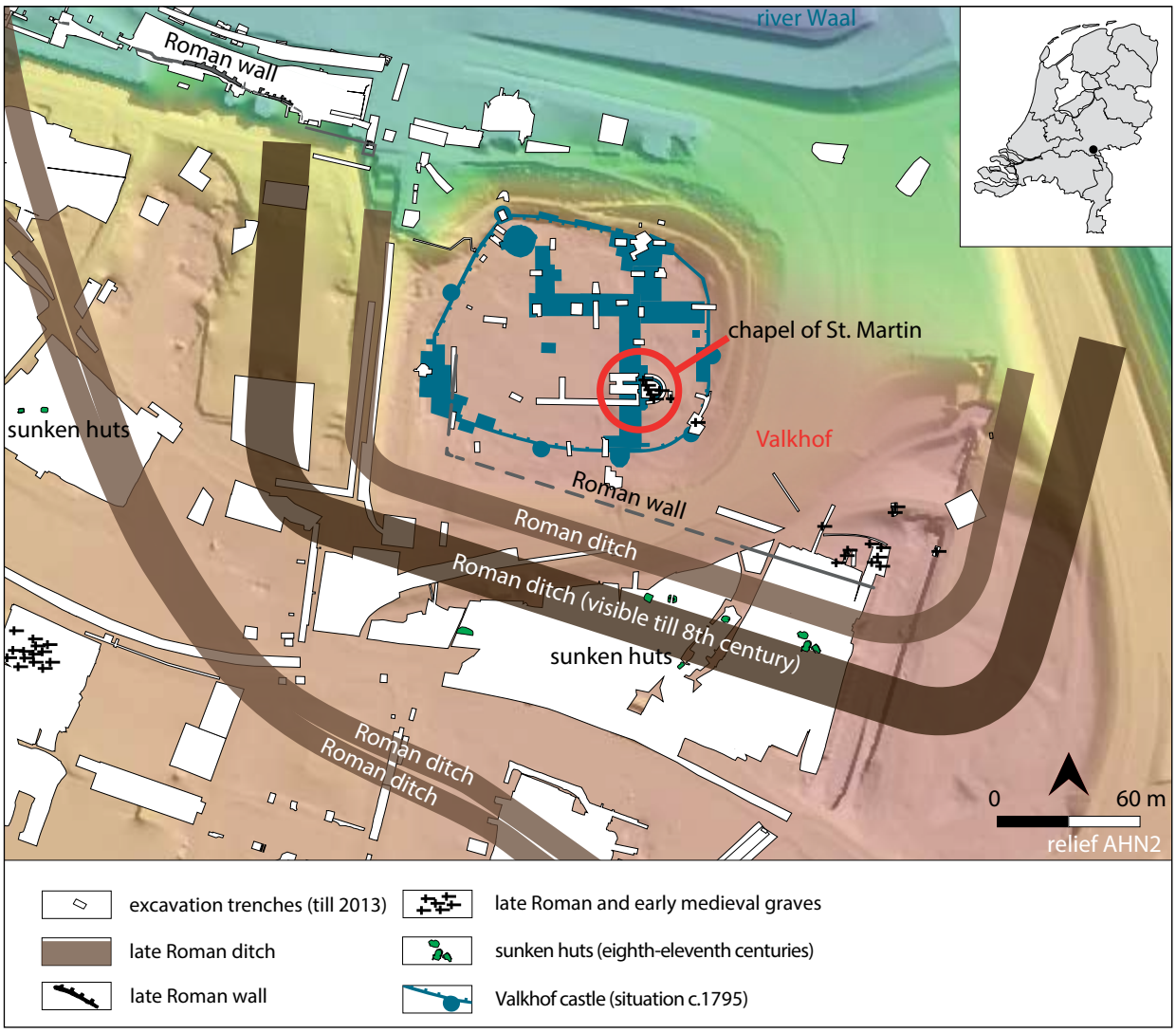

Figure 2. Simplified overview of the Carolingian palace site of Nijmegen. Map: A. den Braven.

Around the palace site, excavations have revealed several sunken huts (in German: "*Grubenhäuser*"), pits and cultural layers of a settlement which date back to the Carolingian and Ottonian periods (Figure 5). This settlement seems to be focussed on artisan production and was probably a "vicus" connected to the palace.

The royal fisc of Nijmegen

What is known about the royal fisc of Nijmegen? From 777 onwards, Nijmegen is mentioned several times as a "*villa*", *i.e.* an estate. The only preserved Carolingian text that refers explicitly to Nijmegen as a royal fisc dates from 826.[22] On the Tenth of June that year, a charter was drafted in the royal palace of Ingelheim in the name of the emperors Louis the Pious and Lothar I, Louis' oldest son. They gave some of their properties in the county of Vercelli (in northern Italy) to count Boso in exchange for a chapel and eight "*mansi*" with all their belongings including, noteworthy, a few mills in the villa Beek near the royal "*fiscus*" of Nijmegen.[23] Louis the Pious had visited Nijmegen no less than five times between 814 and 826. Therefore, it seems logical that the transaction of 826 is related to the growing importance of the palace of Nijmegen and perhaps the wish to enhance the output of its fisc.

Of the size and location of the royal fisc, only a general image can be sketched. At Aachen, where there is more historical evidence in comparison to Nijmegen, the royal

22 Leupen 1977, 378; Leupen and Thissen 1981, 21 (no. 39).

23 Leupen 1977; Leupen 1978; Leupen 1983, 66.

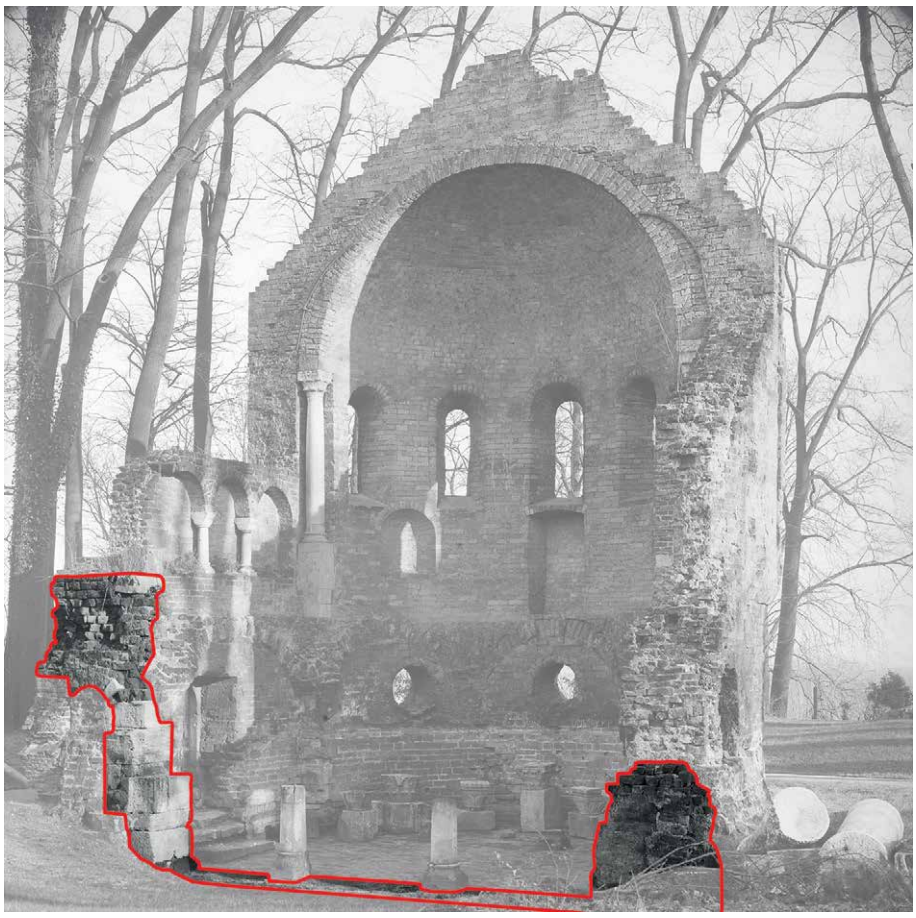

Figure 3. Chapel of St. Martin at the Valkhof, with the Carolingian palace wall highlighted. RCE-object no. 10.676. Photo: after Weve 1925, Pl. LV-2; edited by A. den Braven.

fisc more or less coincided with the parish of the palace related church of the Virgin Mary.[24] It seems that the old borders of the royal *villa* were followed when the parish was created, probably in the second half of the eighth century. Piet Leupen has argued that a similar situation could have existed in Nijmegen.[25] Figure 6 shows a historical reconstruction of the late medieval parish of Nijmegen, which is considered to be the old core of the royal fisc. Originally, the *Reichswald* (imperial forest) also belonged to the parish of Nijmegen, as might Groesbeek and Malden and some parishes in the western part of the "Rijk of Nijmegen" (Realm of Nijmegen). Recently, Bert Thissen has problematised this reconstruction. He suggests that other royal *villae* in the wider area also might have belonged to the fisc of Nijmegen.[26] Even so, the size of the villa Nijmegen is already quite impressive: a stretch of land of approximately 45 kilometres long and six kilometres wide, covering an area of no less than 240 square kilometres (Figure 6).

What is known about the physical landscape of this royal estate? It almost completely coincides with a lateral moraine and its glacial outwash plains. This is not a very fertile area, because of its sandy soil that contains a lot of gravel. In the Early Middle Ages it was mostly covered by woodland, *e.g.* the "*Reichswald*" as can be seen in Figure 6. It is generally assumed that these woods already had the status of "*forestis*" in Carolingian times, just as the large royal forests around the palaces of Aachen and Frankfurt.[27] These types of forests were reserved first and foremost to be royal hunting grounds. In the case of Nijmegen, such royal hunting parties are historically known to have taken place in 817 and 825.[28] The forests near Nijmegen were probably much appreciated for its other resources too (for example wood, charcoal and honey) and as an ideal place to keep and fatten pigs.[29]

The first early medieval reclamations appear at the edges of the woodlands. A good example of this is the village of Beek, which was mentioned earlier and is located about four kilometres east of Nijmegen. A small Merovingian cemetery is located here indicating habitation from the sixth or seventh centuries onwards. Another example is

24 Flach 1976, 159, 179.
25 Leupen 1983, 64, 66-67.
26 Thissen 2014, 97.
27 Metz 1971, 78-79.
28 Leupen and Thissen 1981, 19-20 (no. 31), 21 (no. 37-38).
29 Compare Jeitler 2008, 19-20.

Figure 4. Carolingian capital that was re-used in the chapel of St. Martin at the Valkhof in the twelfth century. RCE-object no. Photo: after Weve 1925, Pl. LVIII-1.

Figure 5. Pitcher of Badorf pottery found in a pit in the Carolingian settlement adjacent to the palace. Photo: R. Mols/ Gemeente Nijmegen.

the village of Ubbergen, only two and a half kilometres east of Nijmegen. Besides the presence of Merovingian and Carolingian habitation, it is known that in this village wheel-turned pottery was produced in the late seventh or early eighth centuries. Ubbergen pottery can be distinguished by its characteristic fabric and is often found in the Nijmegen area. Therefore, the ceramic production in Ubbergen seems to be of regional importance.

On the basis of archaeological finds, small scale wood clearings seem to have taken place on the Kops Plateau (directly west of Ubbergen) in the late Merovingian and Carolingian periods.[30] The analysis of pollen samples from early medieval layers in a section at the northern slope of the Kops Plateau suggests that the forest was not very dense and that the open clearings were used as pastures for cattle and for arable land for the production of cereal crops including rye. The low-lying, marshy lands north of the slope were covered with a swamp forest with alder trees.[31] In contrast, the central part of the forest seems to have been a rather dense mixed oak forest. In this area, hardly any early medieval sites are known (Figure 7).

Logistics

The palace at Nijmegen was regularly visited by Carolingian rulers, often for several months. We do not know how many people travelled with the king, but estimations for "normal visits" vary from several hundred to perhaps even more than one thousand persons. For royal assemblies, the number must have been even larger. The main question remains: where did all the necessary supplies came from?

The larger part of Nijmegen's royal estate consisted of nearly uninhabited forest, probably mainly reserved for royal hunting. Around 800 AD it included relatively few farmsteads. Therefore, it is highly questionable whether the agrarian output of the royal estate was enough for an adequate provisioning of the palace, which was frequently visited by the king and members of his court. Even if the more densely inhabited western part of the late medieval territory of the Rijk of Nijmegen is seen as part of the royal estate, it still could not have provided the economic basis that was needed. Therefore, we should look at the possibility that aristocratic and ecclesiastical estates in the eastern river area (*e.g.* the Over-Betuwe, Liemers and Duffelt) also played a role in the provisioning of the palace.

Some letters by Einhard give a glimpse into the practicalities that were involved with an aristocratic way of life at court. A good example is the letter that Einhard wrote to his deputy at Maastricht while preparing one of

30 Van Enckevort 2014, 99-100, 187-193.

31 Leupen 1977; Teunissen-van Oorschot 1975, 132-133 (with "pollendiagram Kopse Hof" opposite p. 134).

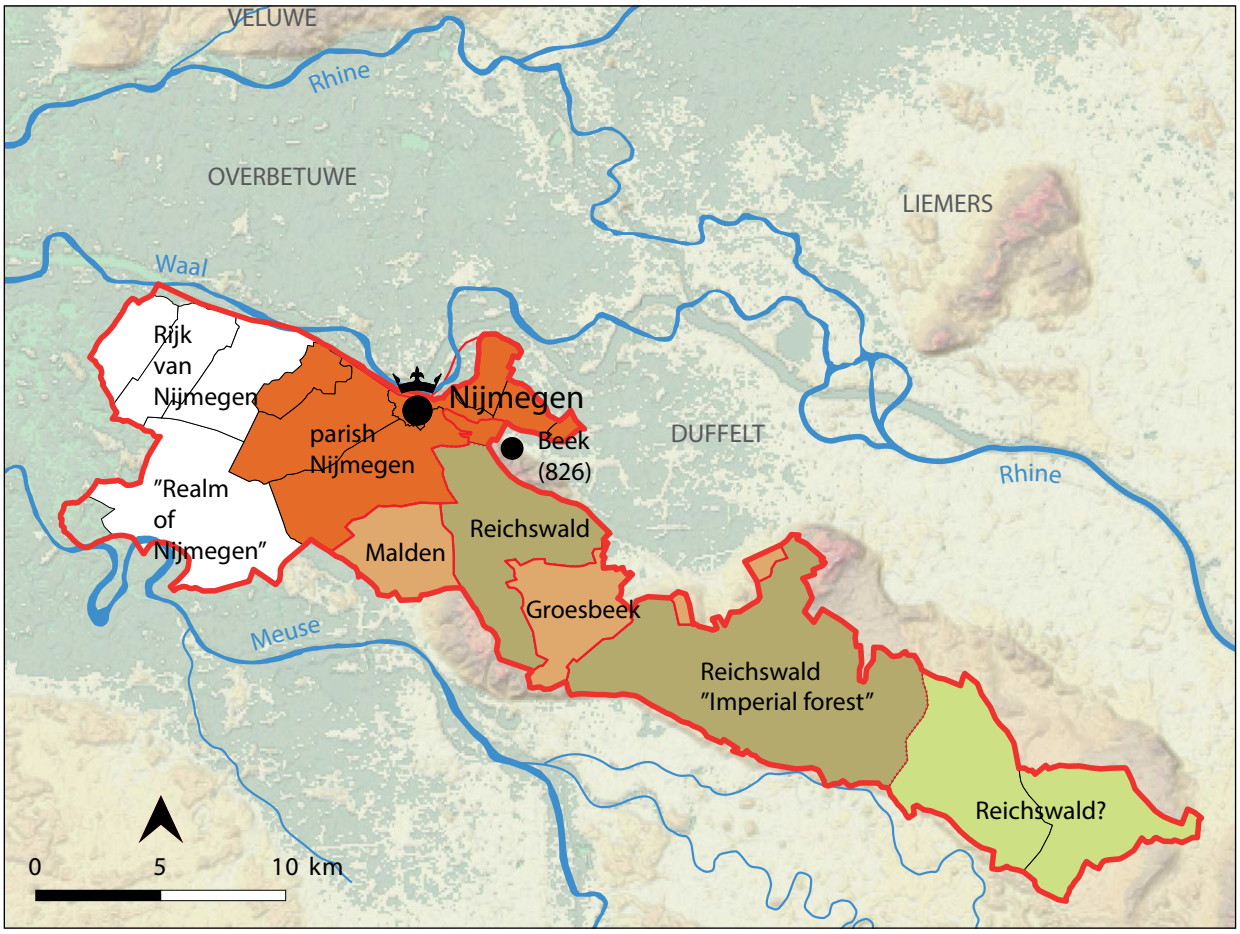

Figure 6. Reconstruction of the royal estate of Nijmegen. Figure based on Thissen 2014, 93, Abb. 10.

his visits to the palace of Aachen around 828: "You should [also] arrange (…) those things that we need to have there, that is, flour, grain prepared for brewing, wine, cheese, and other things".[32] In addition to this, we should not forget that Nijmegen was located at a navigable river that was part of a larger trading network that connected the German Rhineland with the famous emporium Dorestad, situated only 45 kilometres further to the west. So, certain goods that were locally unavailable (*e.g.* wine) could easily also be bought at the market there, or imported directly using the same river network.

In regard to the impact of the palace of Nijmegen on its rural environs, it is striking that in this region a large number of Carolingian "*villae*" are mentioned in ecclesiastical records, like those from the royal abbeys of Echternach and Lorsch (Figure 7). Erik Goosmann has argued that there are some indications that this landed property was reorganised in the Carolingian period into a manorial production system, possibly influenced by the presence of the royal fisc of Nijmegen.[33] From this perspective, texts like the *Capitulare de villis* indeed seem to be a result of the need to improve the sometimes complex logistics of royal estates. But one should also think of the palace at Nijmegen and its fisc as integrated with other estates and a wider trading network. Together, this may well have provided much of the infrastructure needed for the extensive and expensive visits by Carolingian rulers.

About the author

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32 Translation by Dutton 1998, 140: number 23 (Hampe 5).

33 As argued by Erik Goosmann in his lecture "Estate Organisation in the Carolingian Netherlands: The Textual Evidence", International Medieval Congress Leeds, session 237, Monday 3 July 2017.

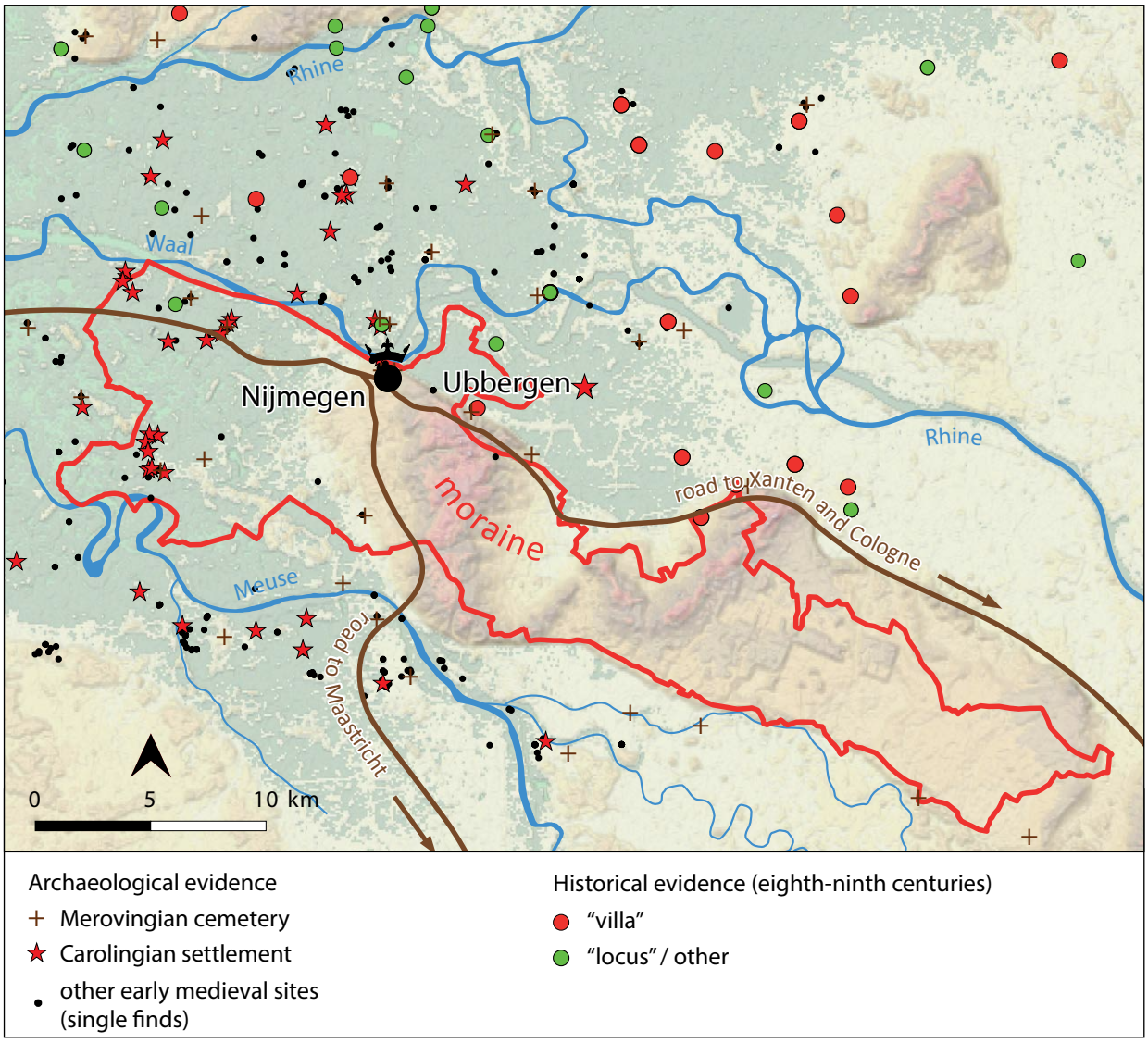

Figure 7. Archaeological and historical evidence in relation to the royal estate of Nijmegen. Map: A. den Braven.

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Beyond the planned/unplanned dichotomy

The development of the town plan of Utrecht until c. 1560

Marcel IJsselstijn

From a European perspective, the medieval urbanization of the Low Countries has been remarkable. The area developed from a peripheral fringe zone in the early Middle Ages into one of Europe's most urbanised regions at the end of the 15th century.[1] In a relatively small area along the North Sea and the lower delta of large European rivers like the Rhine, Meuse and Scheldt, a lot of towns emerged which were mostly medium or small-sized.[2] These towns are among the most important heritage of the medieval period. First, since the distribution pattern of towns as it is today largely originated in the Middle Ages. Secondly, because of the impact of the medieval period on the formation of the town plans of many contemporary historical urban cores. This is demonstrated by considering the remarkably accurate town plans made by Jacob van Deventer between 1545 and 1575. When we compare these 16th-century town plans with a modern map or an aerial photo, we find that remarkably little has changed in the town's main infrastructure of streets, squares, building blocks, waterways or lines of defence.

Given the importance of the medieval period for the formation of many contemporary historical town plans, it is striking to note how little we know of the ways in which these town plans came about in the Middle Ages and the agents and factors that were involved in creating medieval urban form. In the nineteenth century, a rather straightforward model has been developed that is still widely adhered to.[3] This model considers towns with a predominantly irregular plan to have evolved because of "organic, unplanned development", also denoted as "piecemeal or incremental growth". On the other hand, towns with a more regular plan are considered the result of "conscious planning" or "deliberate foundation". In its simplicity, the basic idea of this distinction is very powerful and a recurrent theme in debates on contemporary urbanism and planning between proponents of incremental bottom-up growth versus advocates of top-down coordinated large-scale planning. However, to comprehend and

1 Blockmans *et al.* 1980, 43-51; De Vries 1984, 39, Table 3.7.

2 Theuws and Bijsterveldt 2015; Rutte and IJsselstijn 2016.

3 Morris 1994, 8-10; Hohenberg and Lees 1995, 29-33; Nicholas 2003, 62-68; Blockmans and Hoppenbrouwers 2014, 300-302. Schofield and Vince 2003, 37-40.

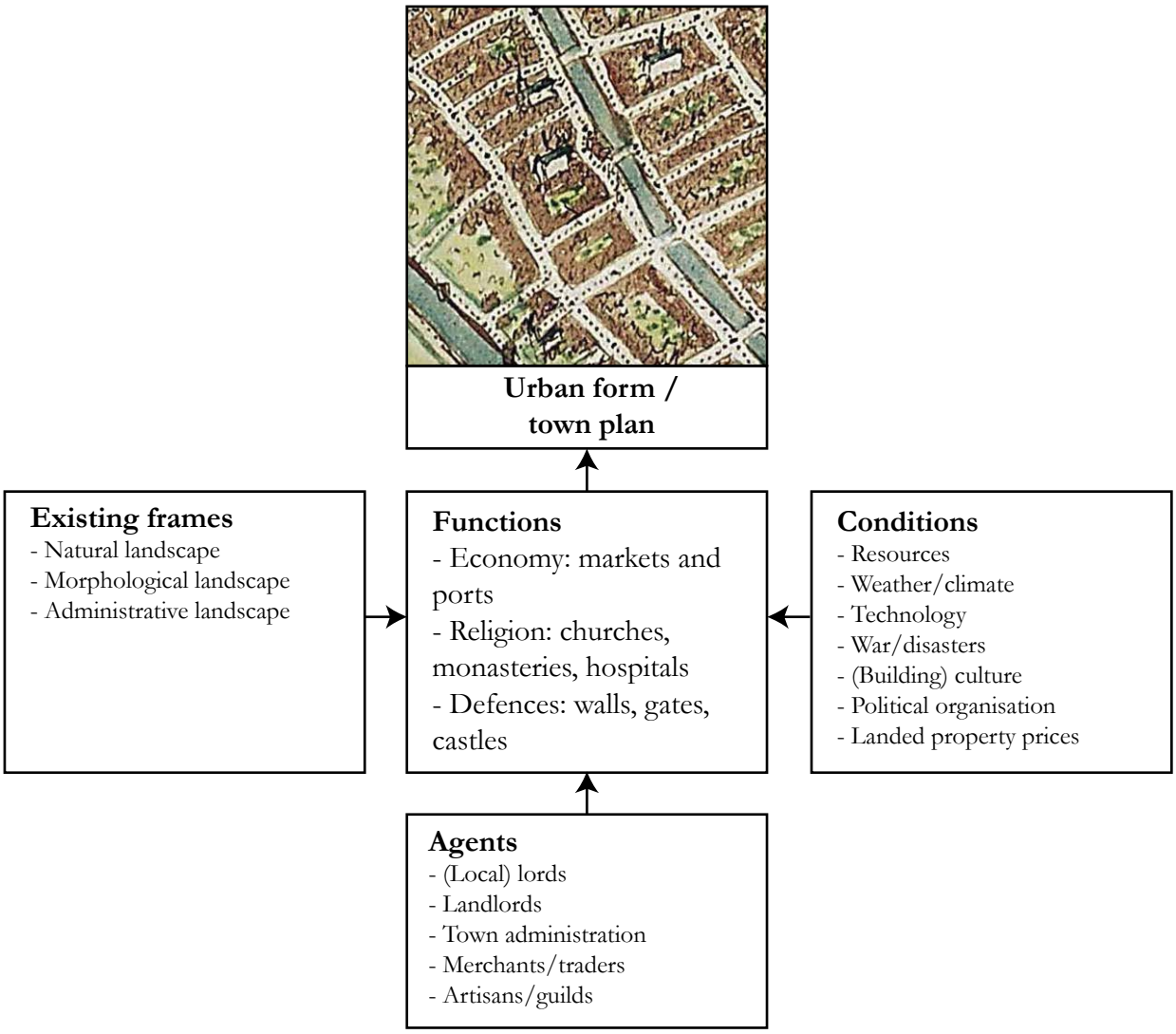

Figure 1. Theoretical model of medieval town plan development.

explain the development of medieval urban form in more detail, and consider the complexity and dynamics of the urbanization process, this planned/unplanned dichotomy is not particularly useful. Moreover, it is even false, as several scholars have demonstrated that founded towns did not necessarily have regular plans, while towns that were established over time can also have regular plans.[4]

As an alternative to the outdated and misleading dichotomy between planned and unplanned medieval town plans, a new model of medieval town plan development is adopted here, which builds upon the work of previous scholars.[5] This alternative model assumes that medieval town plans are the physical result of agents, or groups of agents, aiming to concentrate and accommodate certain functions in a particular place, under particular conditions and influenced by existing frames. It is assumed that planning was always involved to some degree as towns are made by people and do not grow spontaneously or organically. It seems a more fruitful approach to try to identify the agents involved in town-planning, and especially the functions they aimed to accommodate in the town, and the conditions and frames within which they had to operate (Figure 1).

In this paper, the alternative model is used to examine the medieval town plan development of Utrecht, the fourth largest city of the Netherlands and situated in the middle of the country. Originated as a Roman military settlement along the rivers Rhine and the Vecht, Utrecht developed into the most important town of the Northern Netherlands in the Middle Ages, with approximately 20,000 inhabitants

4 Conzen 1968, 119; Slater 1990; Kostof 1991, 43-51; Lilley 2000.

5 Visser 1964; Lilley 1994; Rutte 2002; Renes 2005; Rutte and IJsselstijn 2016.

in 1500.[6] To reconstruct the development of Utrecht's medieval town plan, an interdisciplinary approach was followed which integrated documentary, archaeological and geological evidence into a series of newly drawn maps. The maps are an essential part of the analysis that follows from the theoretical model of medieval town plan development. In the end, this methodology allows to compare towns and their plans in a way that moves beyond the simplistic planned/unplanned dichotomy.

Frames

A good starting point for an analysis of medieval town plan development is to consider the natural, morphological and administrative frames of the town. The natural frame relates to features of the natural landscape that have influenced the development of the town plan, such as watercourses, soil conditions, vegetation, elevation or drainage patterns. In the case of Utrecht, the natural frame of the town is determined by the activity of the rivers Rhine and Vecht. Both rivers have eroded the aeolian sands which had been deposited during the Pleistocene. In these levels of aeolian sands, which are present relatively close beneath the surface in Utrecht, the rivers easily shifted their course, leaving a highly complicated pattern of depositions in the subsoil, which is very hard for geologists and archaeologists to interpret. It is no surprise, therefore, that the development and topography of the rivers Rhine and Vecht has been one of the most debated topics in medieval Utrecht's history.[7]

The morphological frame refers to manmade features in the landscape, such as route ways, field patterns or previous settlement types. Utrecht's morphological frame is comprised by the Roman *castellum* in the centre of the town, which was probably called Traiectum. It was initially built in wood around 47 AD, but in the second century it was expanded to the north and built in stone. In the seventh and eighth century, Anglo-Saxon missionaries settled themselves in the former *castellum* and founded an episcopal seat there. Three churches were built inside the walls of the *castellum* in the early Middle Ages. In the eleventh century, an episcopal and a royal palace were added.[8] The outlines of the former Roman *castellum* are still visible in the town plan and the remains of the Roman fort and of the medieval churches and palaces can be visited in an underground museum.

The administrative frame refers to factors of a more intangible character, such as estate boundaries, parish boundaries or landed property ownership. Just like the tangible features of the morphological frame, these issues relate to the human agents involved in creating urban form. In Utrecht, the bishops of Traiectum were not only powerful ecclesiastical lords, they also became mighty worldly rulers as they were endowed by the Frankish kings with many goods and privileges. The rise of the town from the tenth century onwards entailed a growing autonomy for its inhabitants, which gradually set the urban community apart from its episcopal overlord. New offices and institutions were introduced, with the town council as the most powerful urban institution. Councillors were recruited among the most prominent inhabitants, which were most likely merchants or landowners. Craftsmen and retailers were not represented in the first town administration but appear to have gained political influence during the thirteenth century and managed to obtain a prominent position in the town administration since the fourteenth century.[9]

Extension of the town

Having introduced the natural, morphological and administrative frame of the town, we can start to reconstruct the topographical growth of Utrecht during the Middle Ages. The maps of the Middle Roman and Late Roman period illustrate the town's origin as a military fort along the river Rhine near the bifurcation with the Vecht, which was part of the northern border (*limes*) of the Roman Empire (Figure 2). The overall impression is that of a *vicus*-settlement around the *castellum*. The many sites in the *castellum* itself are not depicted, but the data clearly indicate that the fort was permanently inhabited until 260 AD. A graveyard has also been discovered with eight cremations and inhumations, dated to the period 50-180 AD.[10] Most of the burials were of females and children. In the Late Roman period a significant decline of population can be observed. There are some stray finds from this period, both inside and outside the *castellum*, but it is very hard to establish whether a permanent settlement existed. Another important feature on the map of the Late Roman period is the new bifurcation of the Vecht, about one kilometre upstream of the former *castellum*.[11]

In the early medieval period the pattern of rivers changed, with the Vecht increasing in importance and shifting towards the north, while the discharge of the Rhine was diminishing (Figure 3). The first churches in the former *castellum* were built and several early medieval graveyards are known. The oldest one (Pieterskerkhof, PK004) is dated to the second half of the fifth century, the other graveyards to the end of the seventh and eighth century (Oudkerkhof, OK001; Steenweg 42-44). The ninth century was a period

6 Van den Hoven van Genderen and Rommes 1995, 79.

7 Van Dinter 2017, 113-161.

8 Ozinga *et al.* 1989; De Bruin, De Kam and Van Vliet 2017, 20-21.

9 De Groot 2000; Van Vliet 2000a; 2000b; Van den Hoven van Genderen 2000.

10 Duurland in prep.

11 Van Dinter 2017, 135.

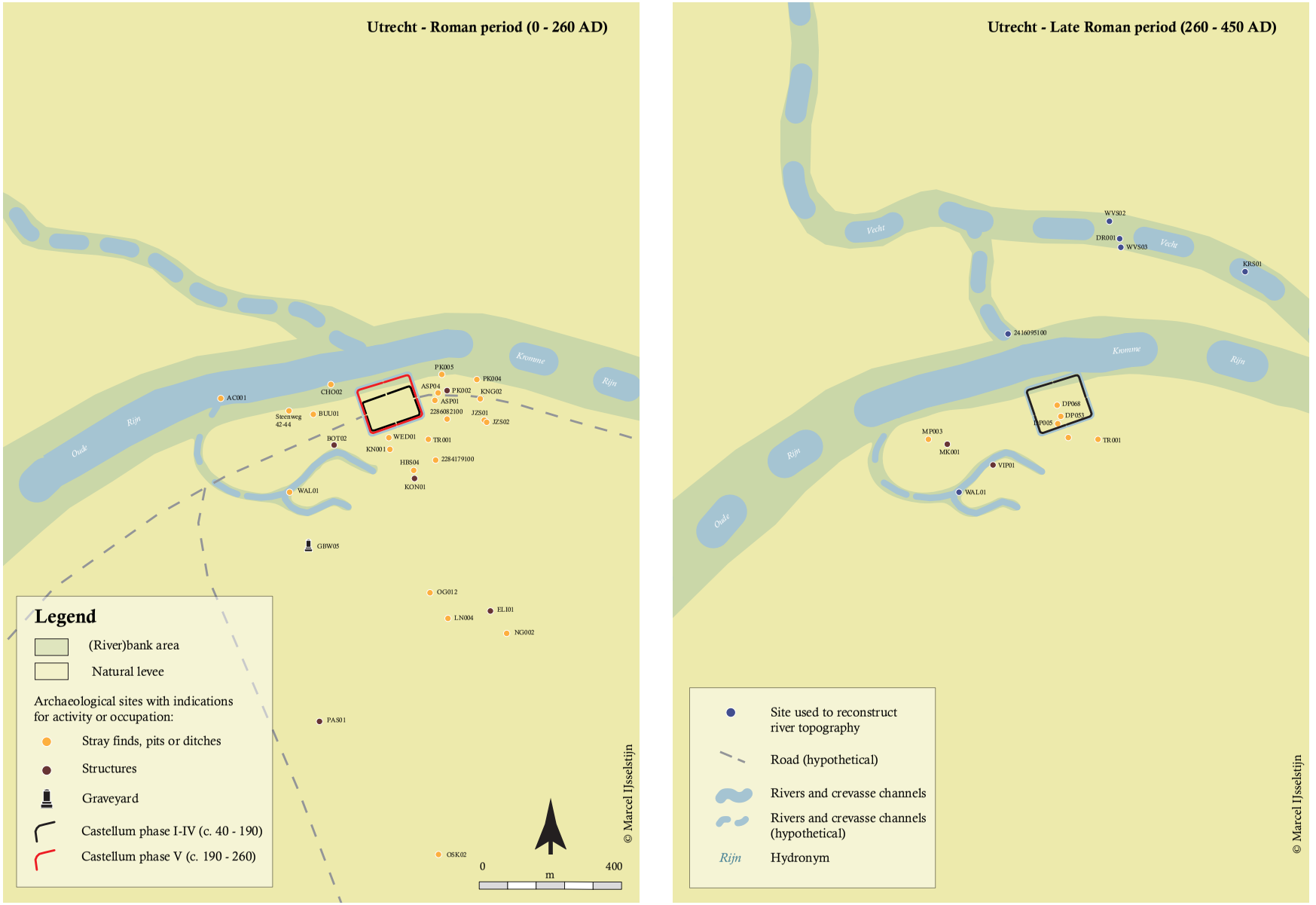

Figure 2. Reconstruction maps of Utrecht in the Roman and Late Roman period.

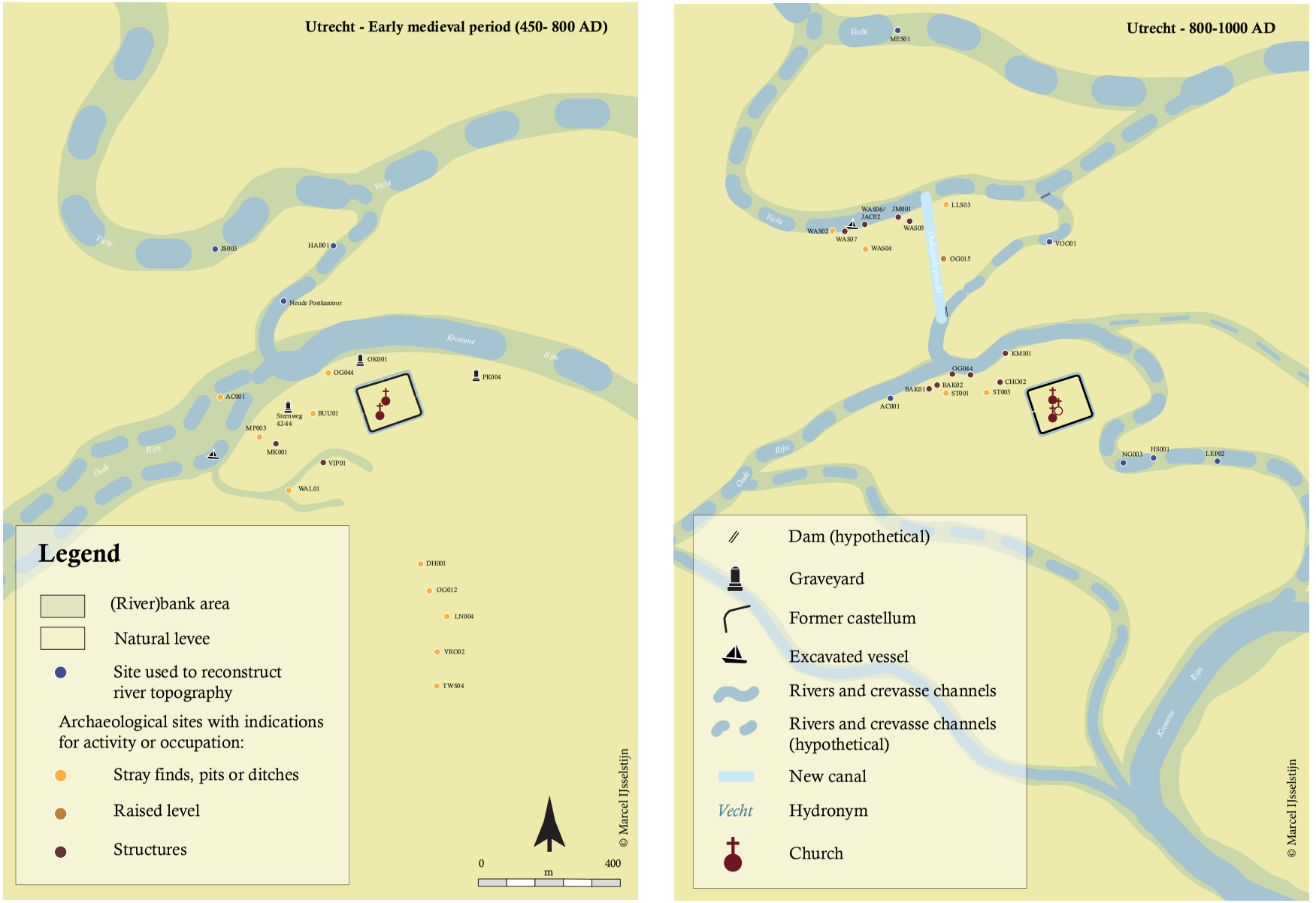

Figure 3. Reconstruction maps of Utrecht in the early medieval period and 800-1000.

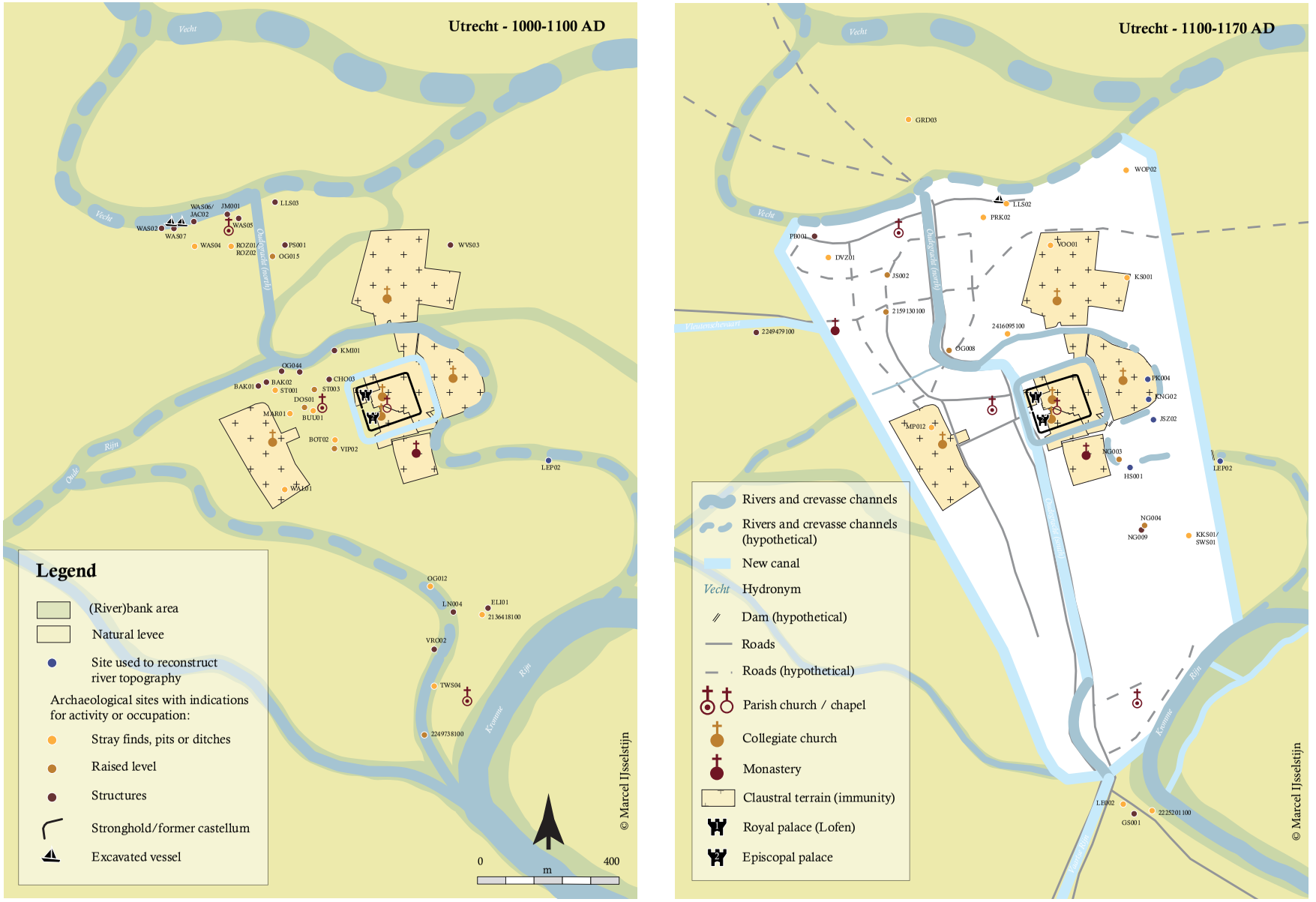

Figure 4. Reconstruction maps of Utrecht in 1000-1100 and 1100-1170.

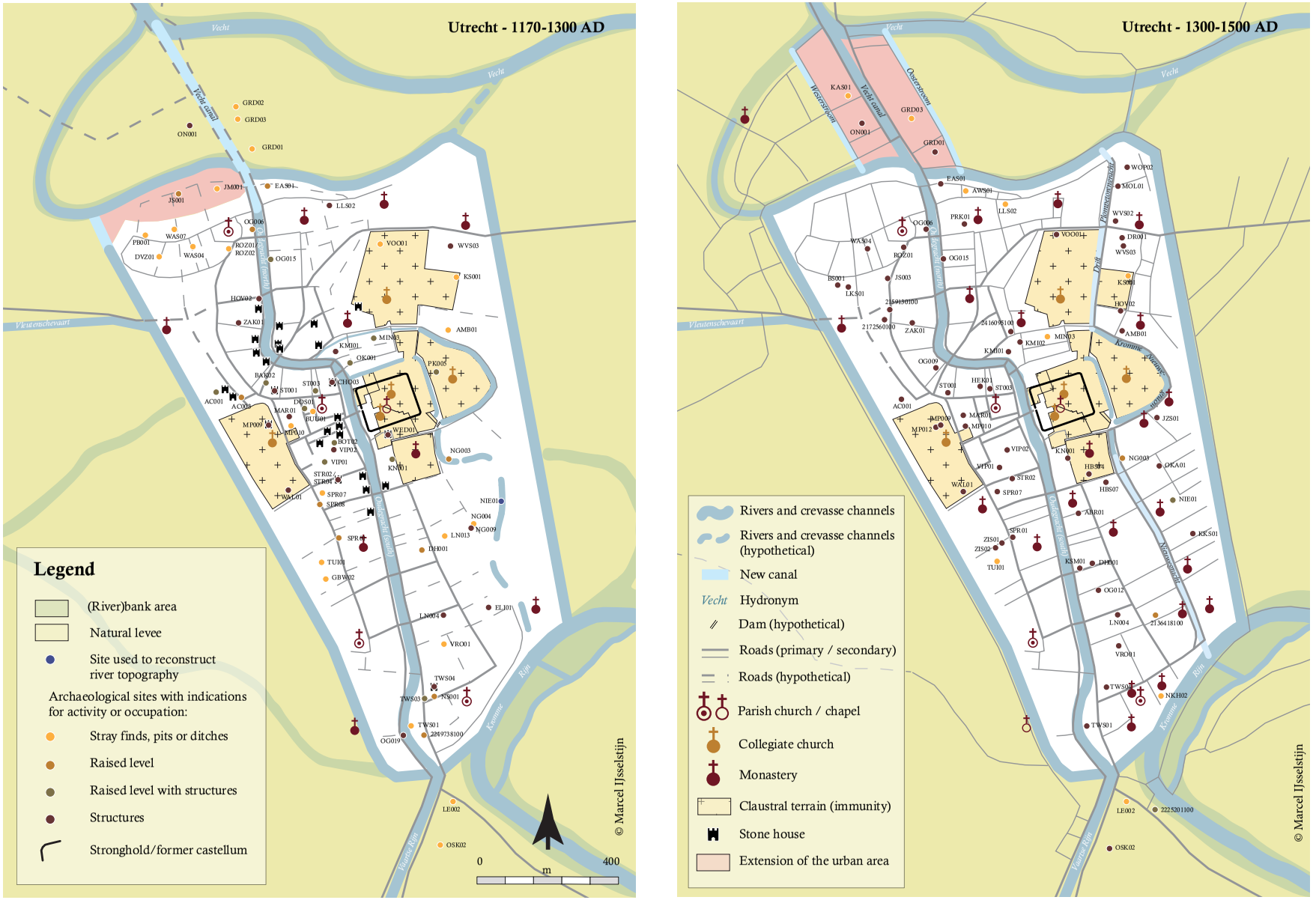

Figure 5. Reconstruction maps of Utrecht in 1170-1300 and 1300-1500.

Figure 6. Town plan of Utrecht by Jacob van Deventer, c. 1560. Source: Biblioteca Nacional de España.

of political instability. The bishops did not permanently reside in Utrecht between 857 and 925.[12] Most of the sites depicted on the map date from the tenth century, after the return of the bishop when the settlement started to grow again. One can observe a cluster of sites west of the former *castellum*, along the Rhine, and another cluster of sites along the Vecht in the north, where extensive evidence of harbour infrastructure has been found: revetments, jetties and vessels, dating from 975 onwards.[13] It is also assumed that a first canal was constructed, to cut off a meander of the Vecht. This canal is the northern part of what is now the Oudegracht, which means 'old canal'. The canal was probably constructed around 975, so it coincides with the development of the Vecht harbour.

12 Van Vliet 2002, 136-137; 164-165.

13 De Groot 1997.

Lots of developments can be seen on the map of the eleventh century (Figure 4). The former *castellum* was redeveloped and extended, with new churches and two palaces, one for the bishop and one for the German emperor. Outside the former *castellum*, three new collegiate churches and an abbey were built with large local immunities around them. Next to the two clusters of sites along the Rhine and Vecht, there is now a third cluster of sites near a crevasse channel of the Kromme Rijn in the south. In the twelfth century, these different settlements and ecclesiastical sites were amalgamated into a single, fortified town. The outlines of the town were partly determined by the natural courses of the Rhine and Vecht, as parts of these rivers were incorporated in the defence moat around the town. The Kromme Rijn was dammed upstream at Wijk bij Duurstede in 1122, and a new canal was dug from Utrecht to the Hollandse IJssel, to maintain the town's connection with the Rhine system.[14] This canal is the southern part of the present-day Oudegracht, which continues as the Vaartse Rijn outside the town.

The final maps of this series depict the town in the Late Middle Ages (Figure 5). After the construction of the town wall in the twelfth century, only two small extensions have been realised in the north.[15] At the same time, the twelfth-century town was further developed as is evident from the unfolding street pattern, the development of the eastern part of the town with the canal of the Nieuwegracht and a proliferation of monasteries. This was the late medieval town that Jacob van Deventer depicted around 1560, except for the construction of several bastions and a citadel after the political transition of the town in 1528 to emperor Charles V.[16]

Functions

After the concise overview of Utrecht's topographical growth, which necessarily left out lots of details and nuances, we can move on to the assessment of the functions that were accommodated in the town plan. We are considering three types of functions: economic, religious and defensive ones.

The map of Utrecht's economic functions of markets and ports (Figure 7) illustrates a peculiar interweaving of both functions. The harbour canal of the Oudegracht clearly was the economic backbone of the town. It was already pointed out that the canal was formed in stages, but from the twelfth century onwards this was the central axis of the town. Most of the medieval markets were held at the streets, quays and bridges along the Oudegracht.[17] At first, most of the market activity was taking place around the entrance to the former *castellum*, later most of the markets were held around the Plaatse, where other functions also appear, such as the town hall, the town crane, a weigh house, and a butcher's hall. The importance of the harbour canal is also reflected in the town plan, as many streets and plots are oriented towards the canal. The same phenomenon can be observed by looking at the ground levels. Comparison of an interpolation model of the ground levels in the Roman period, with a modern LIDAR-image of Utrecht, clearly shows the elevated ground levels along the canal (Figure 8). It is known from excavations that most of these raised levels have been brought up in the late Middle Ages, which indicates that those were the most prominent areas of the town where people have continuously lived and worked and built their houses on.[18]

The map of the religious functions (Figure 9) highlights the many churches, chapels, monasteries and hospitals that were built in the medieval town. Without considering all these religious functions and the agents that were involved in establishing them, it is informative to point out one example, which concerns the political and economic cooperation between the bishop of Utrecht and the German king in the eleventh century. With support of the German king, the bishops were able to realise extensive building projects which had a great impact on the town plan. Next to the Dom cathedral that was already built inside the former *castellum*, three collegiate churches and one abbey were built in the second half of the eleventh century. An intriguing debate concerns the question whether these four churches have been deliberately planned in a cross-shaped configuration. There is no direct evidence in the documentary sources, but several historians have argued that deliberate planning was involved here, while others are less convinced and regard this as retrospective projection.[19] The four churches have been built in a relatively short period of time, in the second half of the eleventh century, most likely to honour and commemorate king Conrad II, who died in Utrecht in 1039 and whose heart and entrails were buried in the cathedral. Conrad's son, king Henry III, stimulated and enabled bishop Bernold to build the churches by endowing him with royal properties and revenues.[20] Apart from the cruciform configuration of the churches, there is also a remarkably wide and straight thoroughfare between St Mary's Church and the Dom cathedral in the former *castellum* (Figure 10). The original width of the street of approximately 30 metres is only recognisable at the eastern end, as most of the street has been filled with later building blocks. This street might originally have been a *viae triumphalis* or

14 Dekker 1980.
15 De Bruijn 2017.
16 Hoekstra 1997; Klück, Hemmes and De Kam 2004.
17 Van Vliet 1991; 1995.
18 Smit 1989.
19 Mekking 1988; Van Berkum 1989; Broer 2001.
20 Van Vliet 2002, 293-311.

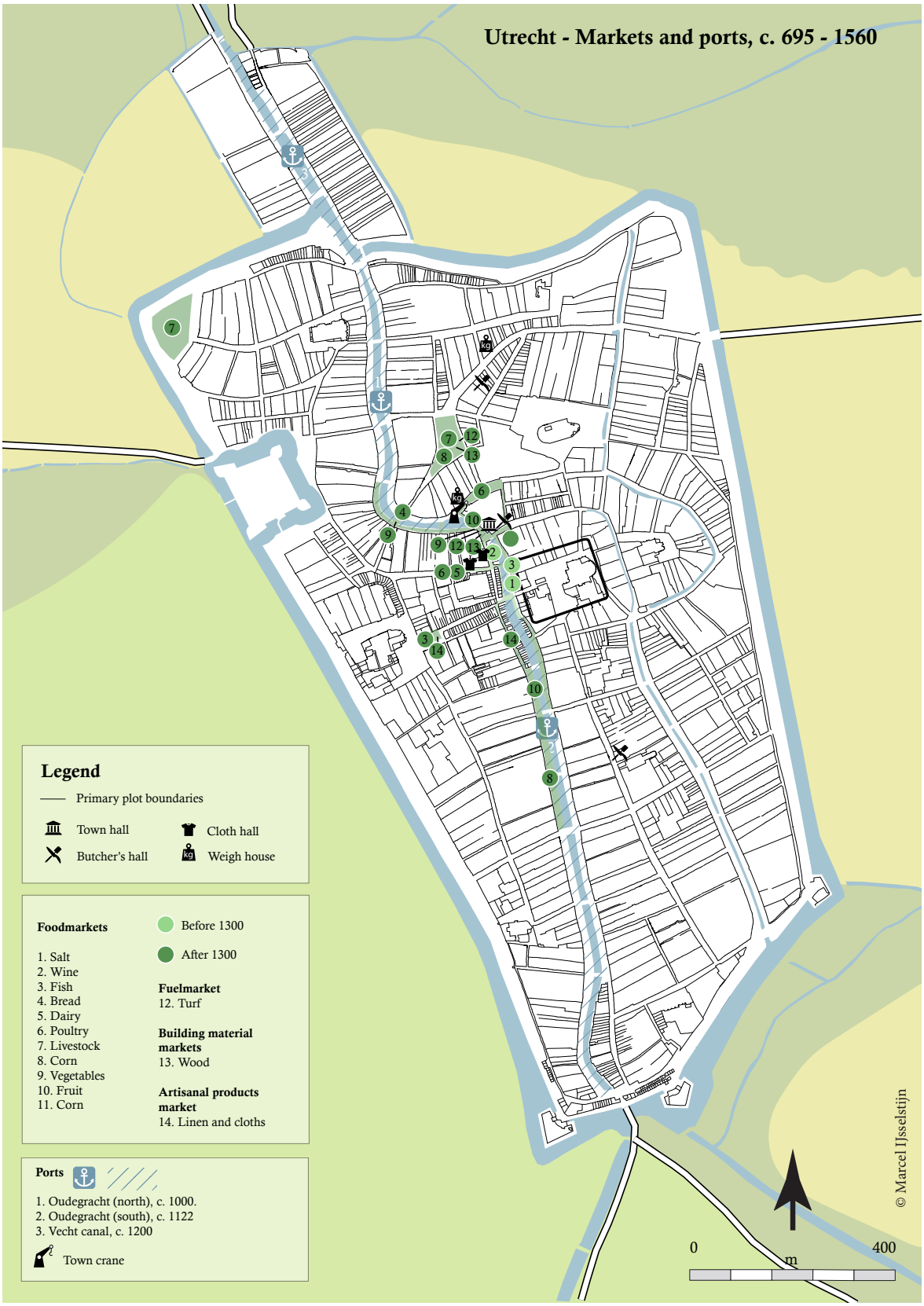

Figure 7. Thematic map of markets and ports in medieval Utrecht.

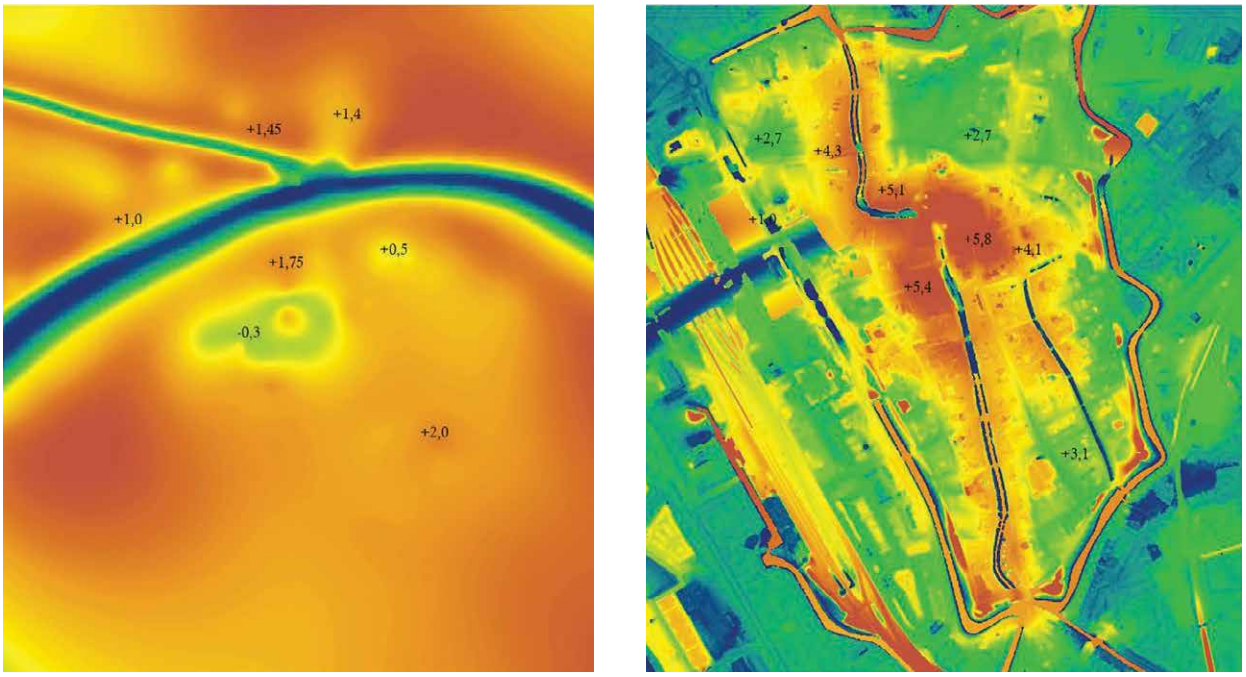

Figure 8. Interpolation model of the ground levels in the Roman period (left) and present ground levels according to a LIDAR image of Utrecht (AHN3).

procession street, which are known from several German episcopal towns in eleventh century.[21] It had a ceremonial function during the event of a royal coronation and served to lead the king, after he was crowned and dressed in the coronation church, to the main church of the town, where he attended the celebration of the liturgy of one of the ecclesiastical feasts. This presumed procession street could have been part of the extensive building program of churches employed by the Bishop and the German king, which obviously had a profound impact on Utrecht's medieval town plan.

Defensive functions were also accommodated in the town plan (Figure 11). The town walls that were built in the twelfth century determined the outlines of Utrecht for the centuries to come. But they were not the only relevant fortifications of the medieval town. The oldest surviving town seals from the thirteenth century are very illuminative in this respect (Figure 12). We observe a central tower that is surrounded by three walls. The outer wall represents the twelfth-century town wall, while the two inner walls refer to the former *castellum* and the episcopal palace from the eleventh-century. The central tower on the seal was the Bishop's Tower, the strongest tower of the episcopal palace.[22] Thus, the oldest seals present Utrecht as a strongly fortified town, with the overlord, the Bishop, residing amidst the inhabitants in a well-protected palace. Later in the thirteenth century, the image of the fortified town was replaced by a seal that depicted Saint Martin, the patron of both the Dom cathedral and the town.

Conditions and agents

Finally, to distinguish some of the human agents involved in town planning and the conditions they were confronted with, it is informative to consider the development of Utrecht's medieval harbour canal, the Oudegracht. From the quick overview of Utrecht medieval town plan development, it is already clear that the Oudegracht was not a single intervention, but a canal that was formed over time in stages. The northern part was already dug at the end of the tenth century, the southern part in the twelfth century. Moreover, for the construction of the canal several older structures have been used, such as the residual channel of the Rhine between the Bakkersbrug and Stadhuisbrug, a defence moat west of the former *castellum* and a crevasse channel of the Kromme Rijn near the Twijnstraat. So, natural and manmade features of the landscape were used to determine the course of the new canal.

But what about the unique wharfs and wharf cellars along the Oudegracht? These could only be built because there was a significant difference between the water level of the canal and the street level of the Oudegracht, which allowed for digging cellars underneath the street

21 Noack 1957.

22 De Bruijn 1994, 115.

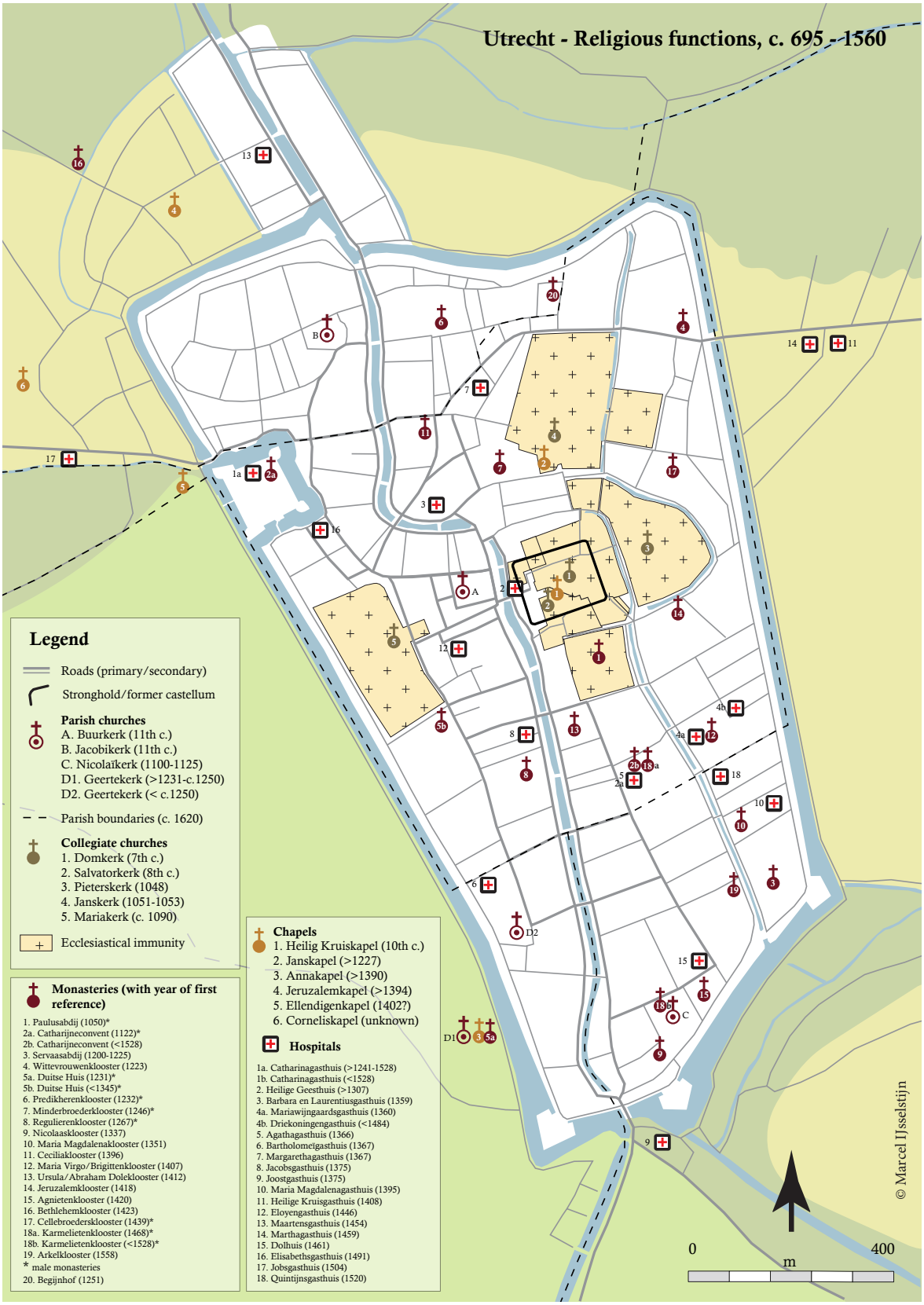

Figure 9. Thematic map of religious functions in medieval Utrecht.

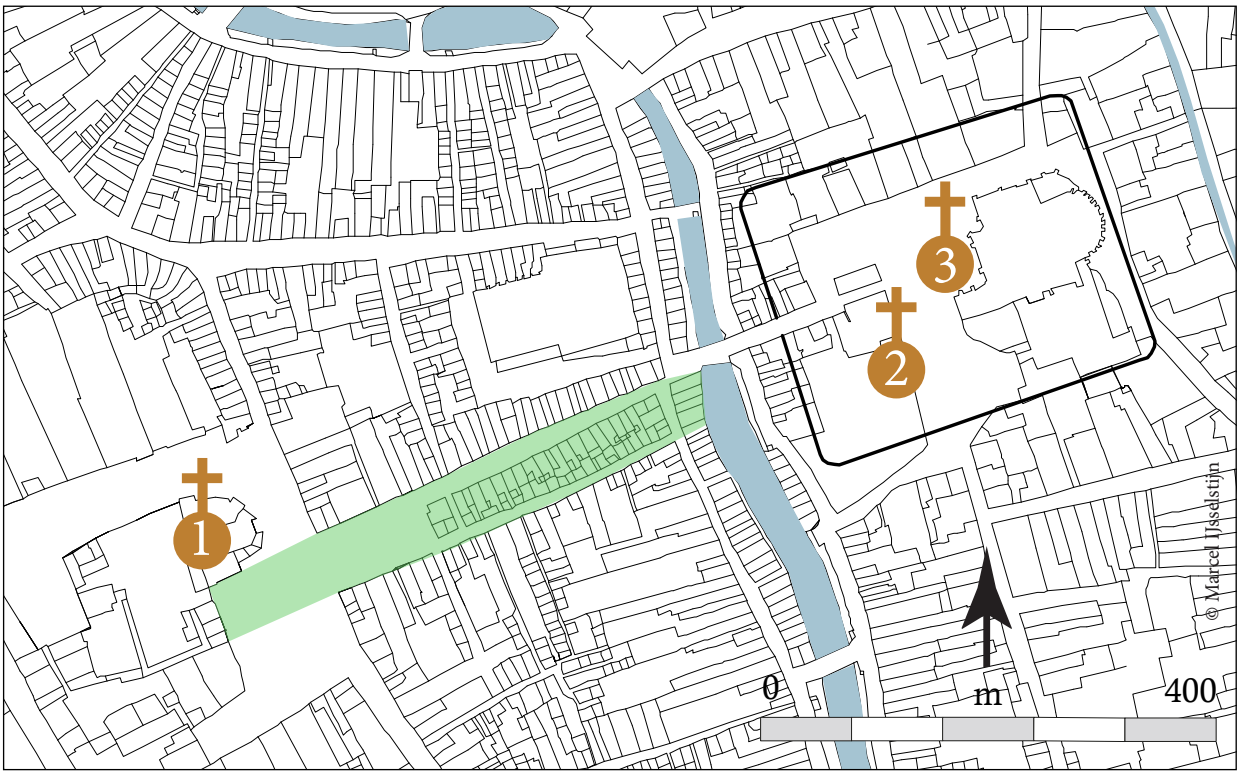

Figure 10. The presumed procession street of the Zadelstraat/Boterstraat/Mariaplaats (highlighted in green) between the church of St Mary (1) and the churches insides the former *castellum*, St Saviour (2) and the Dom (3) (Basemap: cadastral plan, c. 1823).

to the wharfs along the canal (Figure 13). This difference in levels had two causes: a reduction of the water level, and a raising of the ground levels along the canal. Archaeological research indicates the oldest wharf cellars were built at the end of the twelfth century.[23] It follows that the difference in water level and ground level must have existed then. But how did this difference originate?

The Kromme Rijn had already been dammed upstream of Utrecht in 1122. This event would have reduced the water level in Utrecht significantly. But there was also the river Vecht which connected Utrecht to the expanding Zuiderzee, an inland sea. A huge storm surge in 1170 pushed the sea water all the way to Utrecht and caused significant damage in the town.[24] Archaeological evidence suggest increased raising of the ground levels along the Oudegracht after the storm surge of 1170. Most raisings seem to have been carried out on individual plots, as a logical "bottom-up" reaction to avoid such damage in the future.

At the end of the twelfth century, however, the Vecht was dammed a few kilometres upstream of Utrecht.[25] The construction of the Vecht dam ensured a stabilised, reduced water level in the Oudegracht. This must have been the time when the first individuals realised they could build tunnels from the wharf along the canal underneath the street to their houses. Others will have soon followed their successful examples, and eventually nearly all the houses along the Oudegracht were provided with wharf cellars. The construction of a dam in the Vecht can be seen as a "top-down" intervention. Even if the dam was not initiated by the regional authority in the first place, the count or the bishop, it surely could not have been built without consent of these royal representatives. The example of the Oudegracht therefore shows how a particular urban form, the wharfs and wharf cellars, originated as the result of both collective bottom-up responses and top-down initiatives to the threatening condition of flooding.

Conclusions

In this paper, a new theoretical model was adopted to analyse Utrecht's medieval town plan development using geological, archaeological and documentary sources. Although the analysis left out lot of issues and details, it nevertheless demonstrates the complexity of topographic development which can not be reduced to a simple

23 Hundertmark 1997.
24 Buisman 1995, 360-364.
25 Fockema Andreae 1950, 11-12; afb. 3.

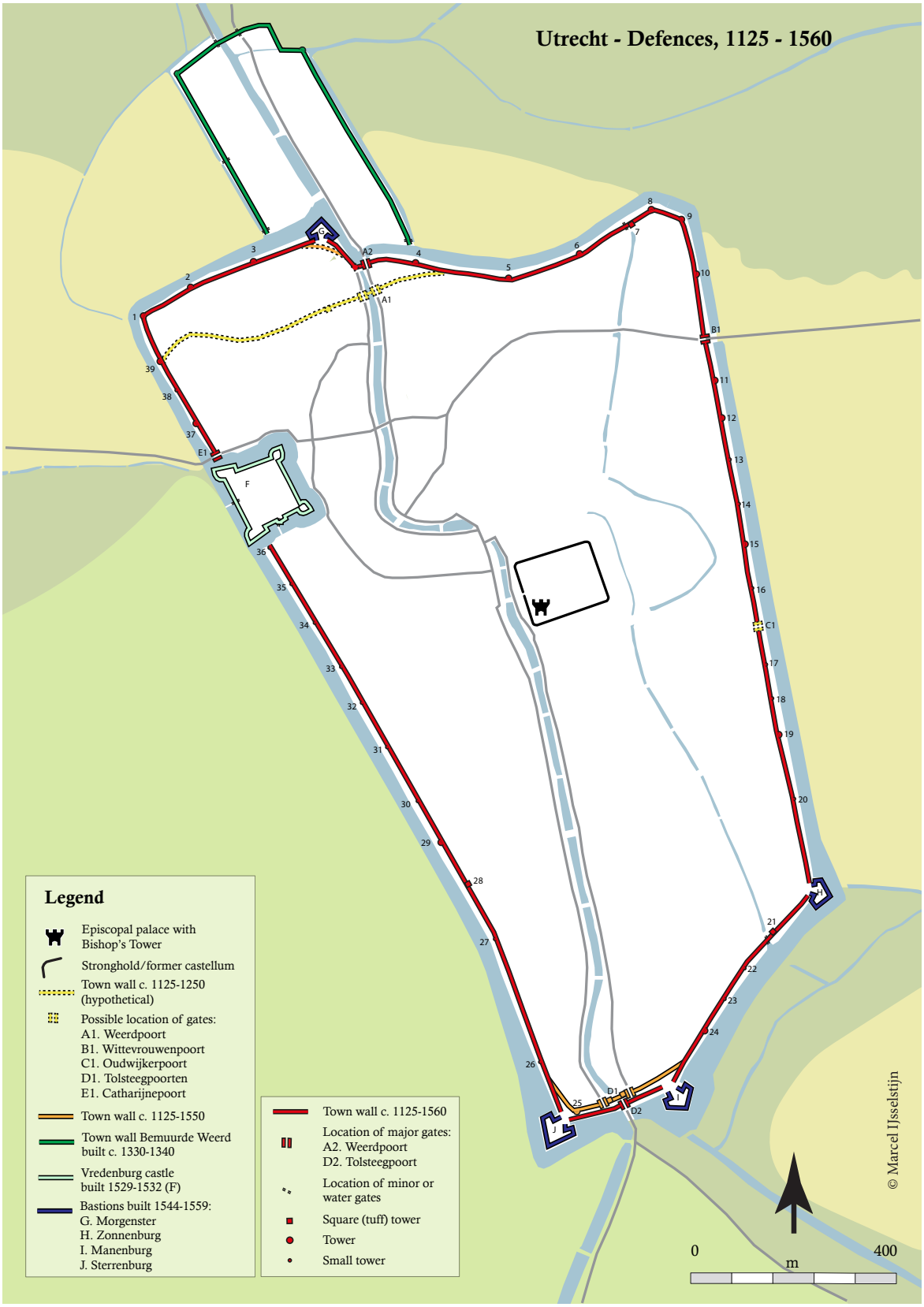

Figure 11. Thematic map of defensive functions in medieval Utrecht.

Figure 12. Utrecht's town seals from 1227, 1251 and 1267 (NL-UtHUA, toegang 222 (Kapittel van Sint Jan te Utrecht), inv. no. 395-1; NL-UtHUA, toegang 701 (Stadsbestuur van Utrecht 1122-1577), inv. no. 2 and 5).

Figure 13. Reconstruction of wharfs and wharf cellars along the Oudegracht, c. 1300. Figure: D. Claessen/Erfgoed Gemeente Utrecht.

explanation of top-down planning or bottom-up organic growth. Utrecht's town plan did not grow spontaneously but neither was it entirely planned.

The alternative model might help to disentangle some of the main agents and factors involved in this complex process of town plan development. People with varying motives and agencies aimed to concentrate and accommodate particular functions in the town, but they were influenced by social, economic and geographical conditions, and their interventions were always embedded in existing frames.

The harbour canal of the Oudegracht provided a case in point. As far as we can establish, some interventions were likely to have been the result of instantaneous, top-down decisions, such as the construction of the canals, or the damming of rivers. Other forms came about over time as

a result of the combined actions of individuals, such as the raising of the ground levels and the construction of wharf cellars. All of the agents contributed a part to urban form of the Oudegracht, but none conceived or designed the whole in advance.

Finally, the alternative model could be helpful for comparative research, because it offers a framework which helps to acknowledge similar generative processes behind medieval town plan development but also to recognise the differences in resulting urban forms and try to explain these.

About the author

Marcel IJsselstijn (1985) was trained as a historical-geographer and urban historian at Utrecht University and the Free University of Amsterdam. He initially worked as an independent researcher on the long-term spatial development of Dutch towns and regions. In 2015, he started as a PhD Candidate at Leiden University, supervised by prof.dr. Frans Theuws and dr. Reinout Rutte (TU Delft). His PhD-research focuses on the origin and development of medieval town plans in the Low Countries.

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Commerce and Conflict

Coloured vessel glass from Dorestad. RMO Leiden various WD-nos. Photo: RMO.

Production of early medieval Glass in Cologne and its export via Dorestad

Michael Dodt, Andreas Kronz and Klaus Simon

Cologne was a centre of glass making not only in Roman times, but also in early medieval times. Most of the products of the Roman glass workshops – especially glass vessels – were made for export, and we find them not only in Cologne and its surroundings, but also in the Germanic regions to the East and the North.[1]

The early medieval glass production of Cologne and its export arise some questions: Who were the traders of the glass objects? Did the merchants use the same routes as the Roman merchants in the first (Merovingian) period and changed the routes in later (Carolingian) times? What was the proportion of the products of Cologne at trading or settlement centres compared to the products of other places? For example in Late Roman times, there was a strong competition in the production of glasses with Trier.[2] For the Early Middle Ages, Kordel near Trier was considered as a production place for a long time, but meanwhile the site is dated by Lukas Clemens and Peter Steppuhn to the High Middle Ages.[3] Two other early medieval production places in the Rhine-Meuse-region are Huy at the Meuse river[4] and Hasselsweiler[5] near Jülich (30 km west of Cologne). In Hasselsweiler few workshops produced only in the second half of the fifth to the beginning of the sixth century AD and in Huy there were workshops at different sites from the late fifth to the seventh century. Huy with its situation at the Meuse river has the same advantages for export via a river as the glass workshops at the harbour of Cologne using the Rhine.

Looking at the early medieval glass finds from the harbour of Cologne, we can characterise a major centre of the production of glass vessels through archaeology and chemical analyses and trace out their glass products along the routes of trading.

Early medieval glass workshops at the harbour of Cologne

The early medieval glass workshops of Cologne (fifth-tenth century AD) were at the harbour, different from the Roman glass workshops (first to fourth century AD), which were so far excavated in the surroundings of the city, to the North, Northwest and South. From the

1 Lund Hansen 1983, 65; 208 Taf. 10; Kunow 1983.
2 Goethert 2010/2011.
3 Clemens 2012.
4 Péters and De Bernardy de Sigoyer 2016.
5 Päffgen and Wedepohl 2006.

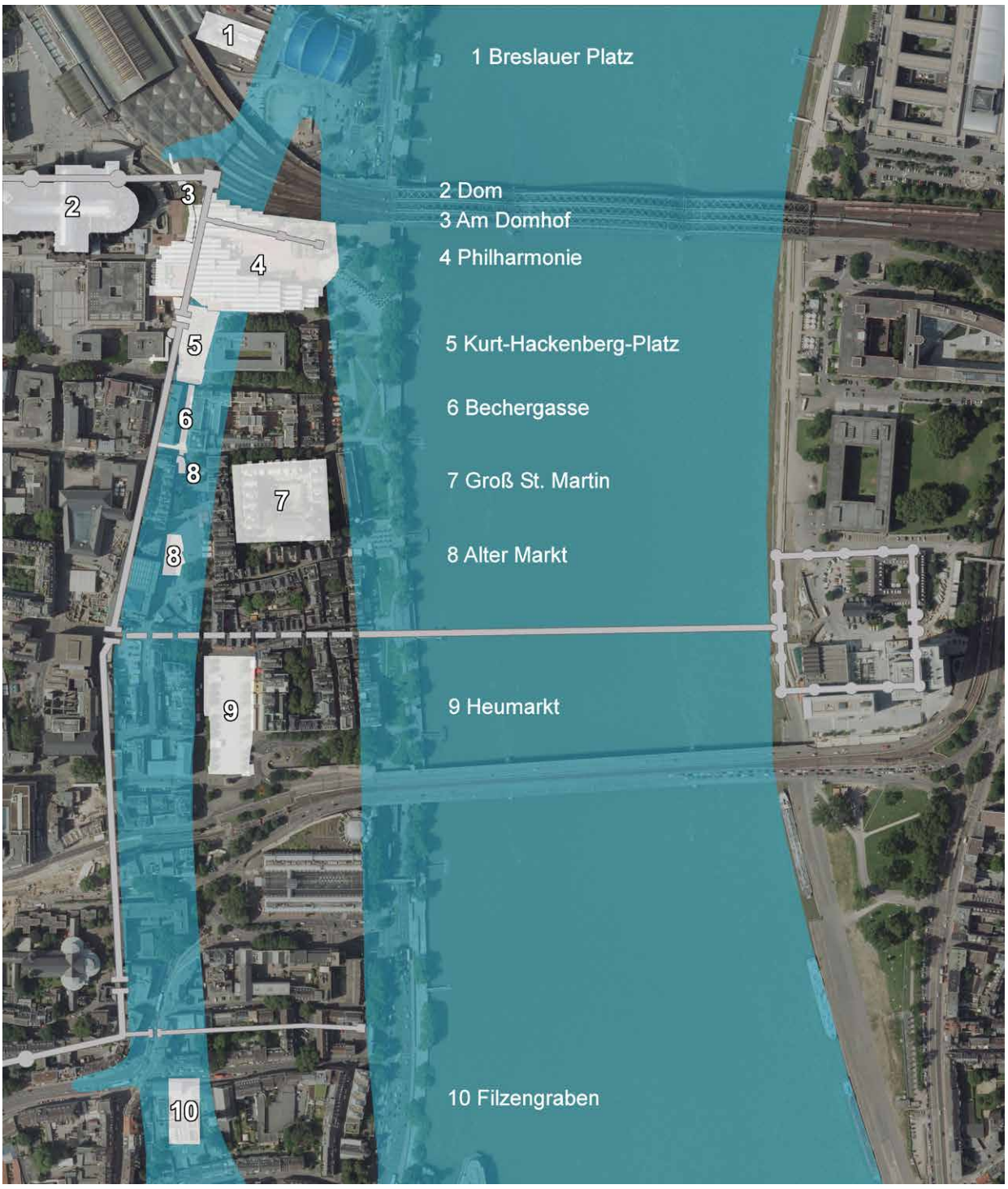

Figure 1. Map of the harbour area of Cologne with excavation sites. Figure: Geobasis/K. Otten.

middle of the second century, the quay was at the eastern side of the island in the Rhine, where warehouses (*horrea*) were erected and harbour activities took place. The type of merchant ships that transported wares like glass over the Rhine in Roman and Frankish times were barges with flat bottoms. These ships could travel downstream, but close to the sea mouth the wares (glass) had to be loaded onto seafaring ships. Therefore, Dorestad as a loading (shipping) harbour was important for the glass trade from Cologne to the North Sea in Carolingian time. Traders from Cologne

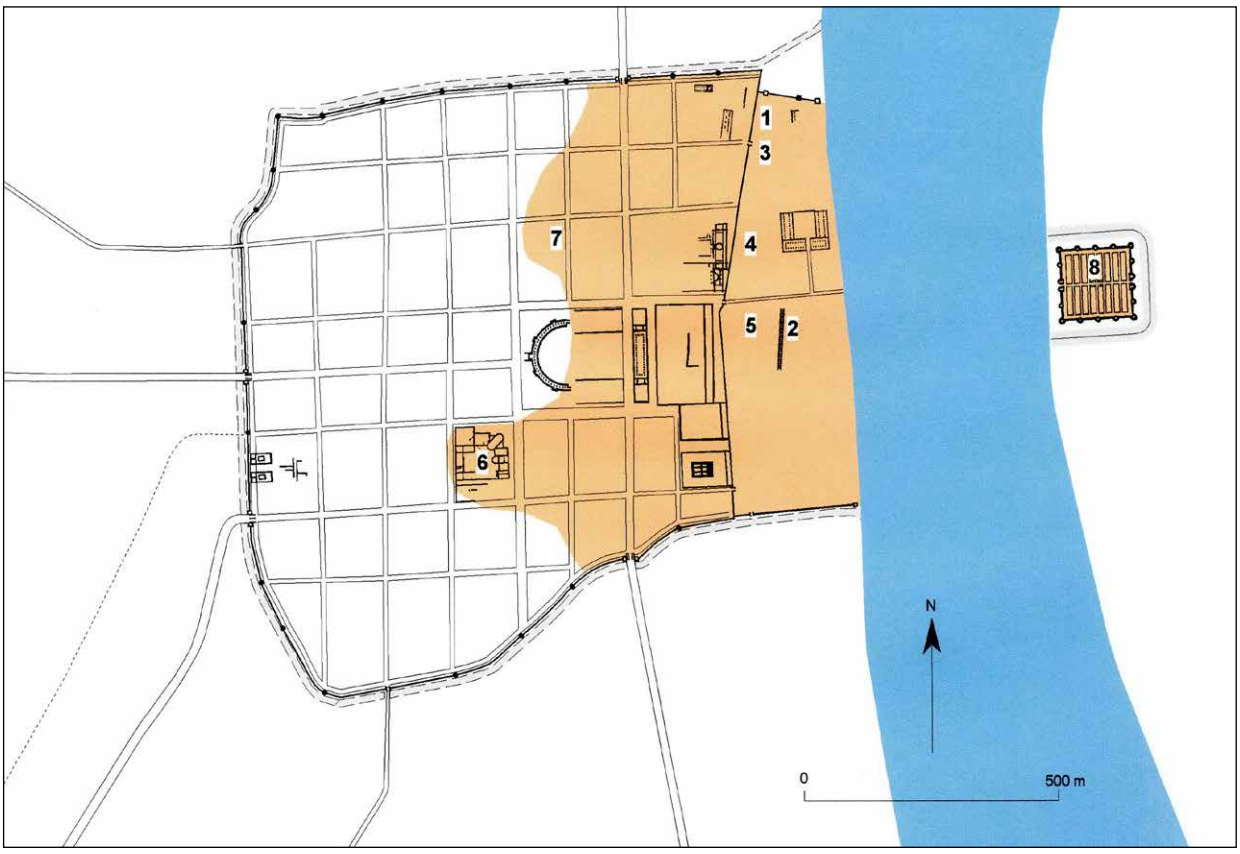

Figure 2. Area of settlement of Cologne in the 5th century AD. Figure: Trier/Dietmar.

via Dorestad to Kaupang were Franks, as Dagfinn Skre pointed out at the first Dorestad-Congress,[6] and Frisians, who were the inhabitants of Dorestad and skilled in both river and sea shipping.[7] At the beginning of the fourth century AD, the harbour area of Cologne was reduced and protected by additional walls in the North and South (Figure 1). In the middle of the harbour a bridge led to the *Castella Divitia* on the right side of the Rhine; south of the bridge a long building was constructed, probably for the government of the harbour. After Roman times, one of the storehouses was transformed into a church (forerunner of the church of Groß St. Martin). In the fifth century AD, the area of settlement of the town was reduced to the eastern half of the city with the harbour (Figure 2), where Franks and other Germanics had been established since the first half of the century, building sunken houses and manufacturing metal objects, weaving and carving bones.

Figure 1 shows the development of the harbour as well as the areas of excavation of early medieval sites. The most important excavation of the early medieval settlement at the harbour took place at the Heumarkt twenty years ago. From this excavation a continuous settlement from the first half of the fifth century – when Cologne was still under Roman rule – until the middle of the tenth century AD could be proved. In the first half of the fifth century, the Franks did not yet produce glass, but learnt the skills of glassblowing from the Romans, as described by Theophilus.[8] Vessels with glass thread decoration were still produced, and from *conchilia* beakers the claw beakers were derived in medieval times,[9] but the technique of engraving glass, that was famous in the fourth century, was no longer continued in Frankish glass workshops.

The glass workshops worked in an interconnected area at the harbour of Cologne (Figure 3). The large production area might be evidence that the produced glass objects were not only intended for a local market but even more for export. Evidence of glass blowing at the early medieval harbour of Cologne includes furnaces, crucibles and raw or recycled glass, shown by the diffusion of glass fragments. There were only a few furnaces for glass production found

6 Skre 2010.

7 Lebecq 1983; Trier 2012, 70; Höltken 2012. From Roman to Merovingian and Viking times merchants accompanied the wares by themselves: Kunow 1980, 7 (with further references).

8 Theophilus Presbyter II, 12.

9 Fremersdorf 1933/1934; Follmann-Schulz 1995.

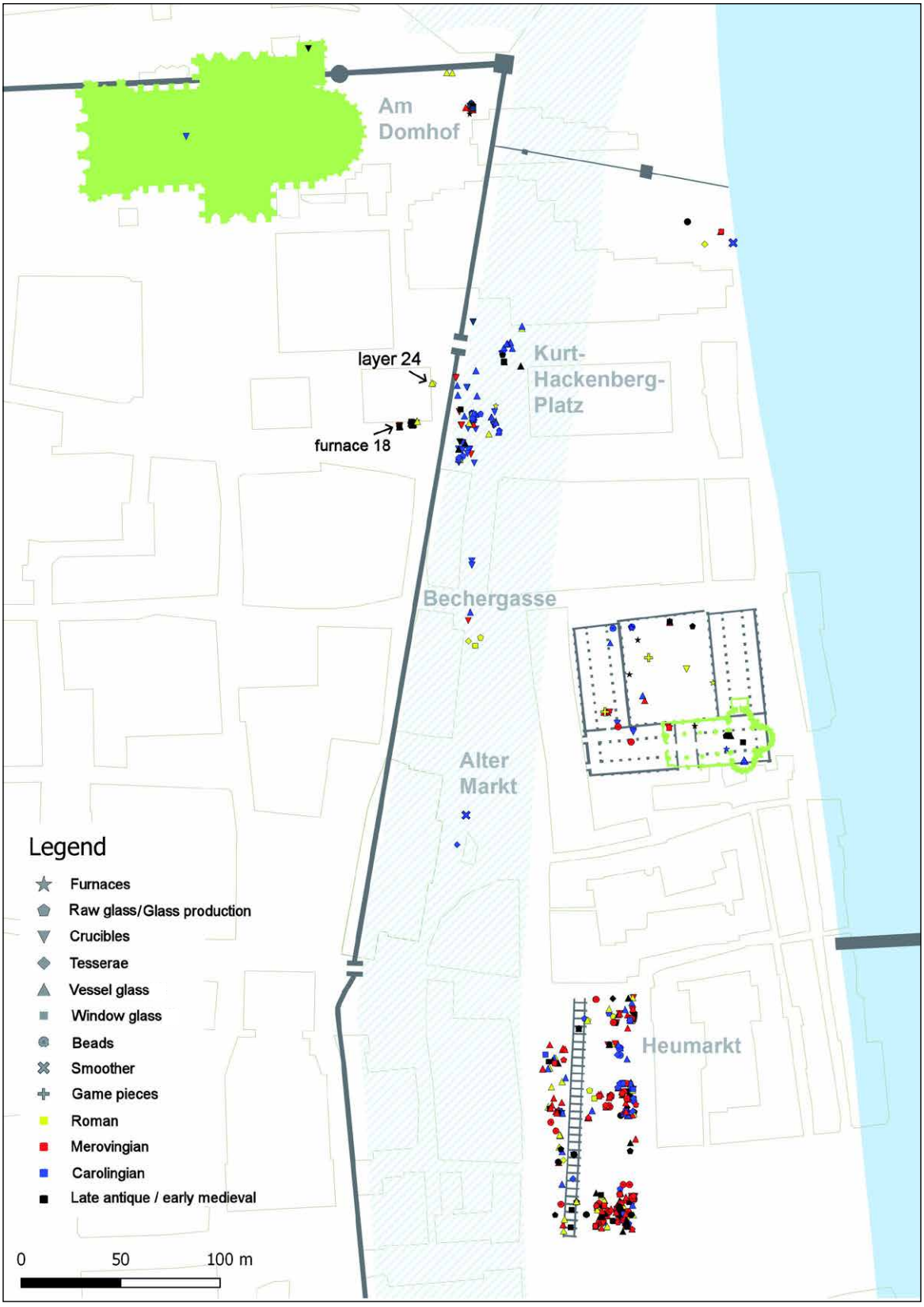

Figure 3. Diffusion map of glass fragments at the early medieval harbour of Cologne. Figure: K. Otten.

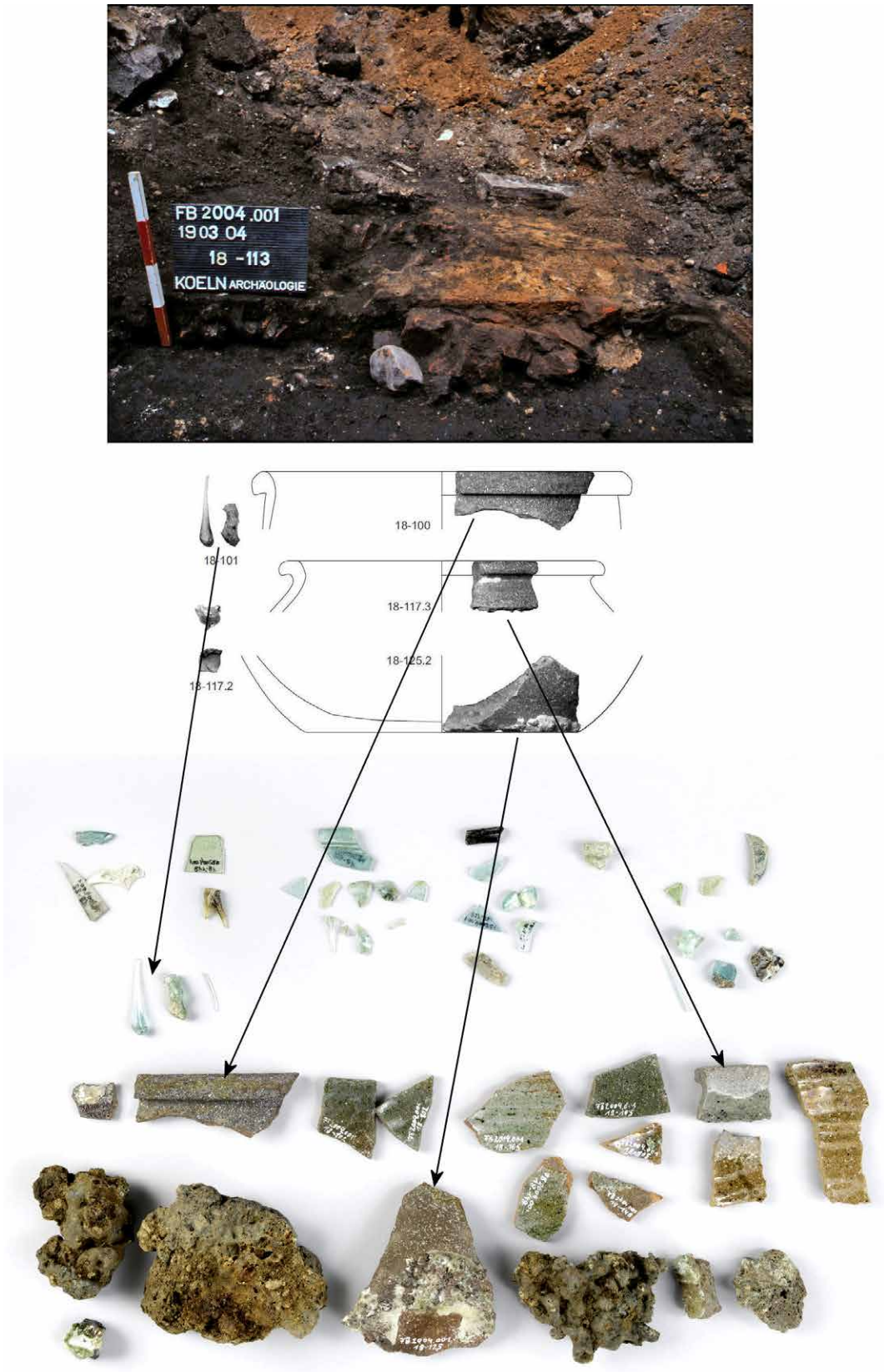

Figure 4. Kurt-Hackenberg-Platz, furnace, fragments of crucibles and glass. Figure: RAB/A. Wegner.

Material-groups	Crucibles (fragments)	Raw glass/ production	Tesserae	Scrap glass (roman)	Vessel glass (prbabl. Production)	Beads	Window glass	Total
Excavation	Rs/bs/ws		(bl./gr./r.)	Rs/bs/ws	Rs/bs/ws	Gr./sm.	Total (rs)	
Heumarkt	6/4/14	Mind. 200	72	8/10/18	89/32/138	5/72	54 (2)	**722**
Kurt-hacken-berg-platz	15/7/64	94	2	2/2/10	17/8/60	0/05, + chain	12 (2)	**298**
Bechergasse	1/0/2		2		1		1	**7**
Gr. St. Martin	$^{2}/_{3}$ vessel, 5/0/3	3	1?		5/2/7	1/4	5	**37**
Am domhof	3/0/2	2			7		1	**15**
Philharmonie			1		3			**4**
Total	**127**	**Ca. 300**	**78**	**50**	**369**	**87**	**73**	**1.084**

Table 1. Overview of glass finds from various excavation sites at the early medieval harbour of Cologne.

Figure 5. Heumarkt, hypocaust 4266, remains of glass production. Figure: RBA/A. Wegner.

in situ and dated to Carolingian times (Figure 4), but there were also fragments of furnaces in the form of glassed clay in Merovingian contexts. The best furnace *in situ* was found just inside the still intact Roman wall (position 18), when excavations for the metro line at Kurt-Hackenberg-Platz (KHP) 2004-2012 took place in front of the wall. Figure 4 shows the remains of the floors of the furnaces, crucibles of eighth-century Rhenish pottery as well as raw

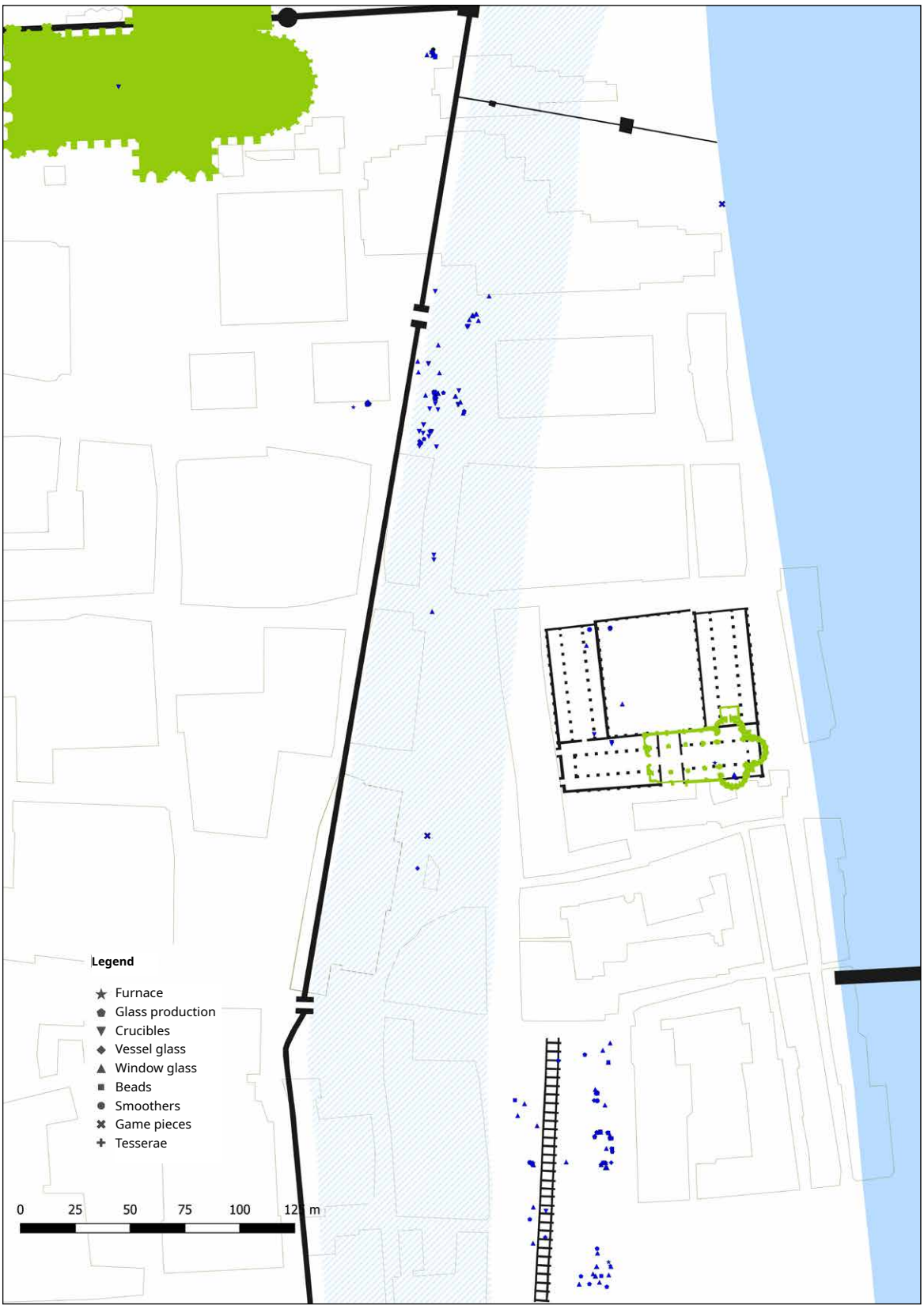

Figure 6. Diffusion map of glass fragments at the harbour of Cologne in Carolingian time. Figure: K. Otten.

Figure 7. Groß St. Martin, Carolingian crucible. Photo: RAB/A. Wagner.

and recycled glass. Fragments of older furnaces in the floor are indications of a long-time workshop at this site.

The table of glass finds (Table 1) gives an overview of the Frankish glass finds from the various excavations at the harbour of Cologne. The most important excavation has the largest number (722) and a well-balanced selection of glass objects, that can be dated from the fifth to the tenth century. The site with the next largest amount of glass objects, in the northern part (KHP) yielded 86 fragments of crucibles within a total number of about 298 glass objects. The northern and western part of the harbour were on top of a silted arm of the Rhine and could not have been settled before Carolingian times. 126 fragments of early medieval crucibles and two-thirds of a whole vessel are more than the total of Roman crucibles in all of Cologne.

Production[10]

The main product was vessel glass, while only two types of beads were produced in the Merovingian period and none at all in Carolingian times. That there was production of beads at the early Merovingian harbour (second half of the fifth or sixth century AD), can be proved from the following. There are large beads with a swirling decoration (Figure 5a) that have cracks and are not finished entirely.[11] The small beads of opaque blue or green colour (Figure 5b) had the same colour, size and chemical composition as the *tesserae*. Two of the large beads were found in the biggest glass complex (70 pieces) in an abandoned Roman *hypocaust* (4266) in the northeast of the Heumarkt excavation area (Figure 5). Translucid and opaque raw glass, *tesserae* and glass vessels have been found too. The glass vessels were produced in a workshop here at the same time, that means in the second half of the fifth and first half of the sixth century: stemmed beakers, bowls with a simple white thread under the rim or feather decoration, simple cone beakers and beakers of the Kempston type with loops.

All glass finds of *hypocaust* 4266 consist of one chemical (glass) type (samples KHa 6, 62-77): HIMT-2 or weak HIMT, which is the main type of the analysed glasses (about 120) of the harbour (90%). Few glassed analysed are HIMT-1, which in the Late Roman glass workshops in Hambach form the largest group together with HIMT-2, and Levantine 1.[12]

According to the diffusion maps of Ursula Koch, these vessel types are concentrated along the Rhine.[13] The concentrations are further indications to assume the production site was at Cologne.

From the Middle and Later Merovingian periods, the finds of glass vessels – bell beakers and palm cups – together with production remains (crucibles and raw or scrap glass) are fewer. Later, there are more find assemblages of Carolingian bell tumblers and funnel beakers (Figure 6), especially at the site 'Am Domhof', while the best-preserved Carolingian crucible has been found at the church of Groß St. Martin (Figure 7). In two pits (3893 and 4269) at the Heumarkt (Figure 8), which seem to contain production waste, pieces of *reticella* were found next to funnel beakers and bell tumblers. But the low numbers and the chemical analyses suggest that these *reticella* vessels (KHa 78-Egypt-2 type, and 97) and also the funnel beaker with the dark green rim (KHa 13-Egypt-2) were not produced in Cologne.

Export via Dorestad

How was the export of the Cologne products organised? Direct trade is assumed along the water routes: the easiest way seems to have been downstream the Rhine and onwards to the open sea. But there was also considerable export to the south, via the Upper Rhine, Mosel and Main. On Figure 9, the trade routes are shown for Merovingian and Carolingian times; the trade with England is assumed, but not yet clear.[14]

10 Additional information in Dodt *et al.* 2019.

11 The separation means in the holes were not filed away.

12 Freestone, Gorin Rosen and Hughes 2000; Freestone, Degryse, Lankton, Gratuze and Schneider 2018; Foster and Jackson 2009; Foster and Jackson 2010.

13 Koch 1987, Abb. 31 (cone beaker), 47 (beaker type Kempston), 66 (bell beaker), 88 (bowls with white trail), 99 (bowl with feather decoration).

14 There were also glass workshops in Britain and export which reached the early medieval settlements at the Rhine. For the glass production: Harden 1956, 132-167 (Faversham); Willmott and Welham 2013, 71-83 (Glastonbury Abbey); Hunter and Heyworth 1998 (Hamwic/Southampton). Anglo-Saxon products in settlements at the Rhine for example (Rhens): Saal 2014, 359-360.

Figure 8. Heumarkt, glass finds from Carolingian pits (3893 and 4269). Photo: RAB/A. Wegner.

In Merovingian times, Dorestad was not as important as it was in Carolingian times. But some Merovingian glass vessels were found there too. I would like to focus on a fragment of a bowl with loops from Dorestad[15] (Figure 10). In our research project we included one of only two glass vessels from the migration period (Merovingian time) found in Berlin,[16] although it is not sure that the vessel got there by trade.[17] The analyses (KHa 223) show chemical similarities with a fragment from Cologne (KHa 17), but not with a fragment from Kamen-Westick (KHa 221) and a recent find from Amrum (KHa 268). Another glass object from Dorestad that could be produced in Cologne is the fragment of a large bead with marbled white festoons.[18] Without analyses it is not sure whether the bowl from Dorestad was produced in Cologne.

From Dorestad the route may have led via Medemblik and Wijnaldum in the Netherlands to the Frisian shore and the places at the North Frisian isles Sylt, Föhr and Amrum mentioned. At the old harbour site (Oude Haven) at Medemblik,[19] two fragments of bell tumblers were found in a Carolingian layer, one with a spiral thread beneath the rim and loops for decoration, one with oblique channels. Both types, typical for the eighth century AD, were found in Cologne too, but not in context with production. At the excavation of the Tjitsma mound at Wijnaldum, almost 200 fragments of glass were found, most by water sieving.[20] From the Late Merovingian and the Carolingian period, Yvette Sablerolles identified a minimum of 15 out of a total of 37 vessels.[21] Most of the fragments belonged to deep palm cups or funnel beakers, and two fragments were probably from a bulbous beaker or squat jar and a pouch shaped or cylindrical beaker.

Dorestad and the export from Cologne in Carolingian times

In the Carolingian period, the most common glass vessels were bell tumblers and funnel beakers, which could be used as drinking vessels or as lamps.[22] In Cologne only simple funnel beakers and bell tumblers were produced; there are no fragments of funnel beakers with horizontal hollow moulding or gilded decoration like in Dorestad;[23] the few finds of funnel beakers with a differently coloured rim at the harbour site were obviously not produced there, nor were the few finds of vessels with *reticella.*[24] The most successful way to trace the routes

15 Isings 2009, fig. 226,3.
16 Dodt, Kronz and Simon 2018.
17 The bowl could even more got there as gift or loot.
18 Isings 1980, 226 fig. 153,1. I would not agree with the dating, but suggest the second half of the fifth to the first half of the sixth century AD.
19 Besteman 1974, 96.
20 Sablerolles 1999; Henderson 1999.
21 Sablerolles 1999, 133 Abb. 1; 138.
22 Finds of funnel beakers in Dorestad: Isings 1980, fig. 153,1-37; Isings 2009, fig. 222-225; Isings 2015(without figures).
23 Isings 2009, fig. 222,8-17; 225; Isings 1980, fig. 153,26 .
24 Funnel beakers with trail in Dorestad: Isings 1980, fig. 153,4-6, 10, 30, 37.

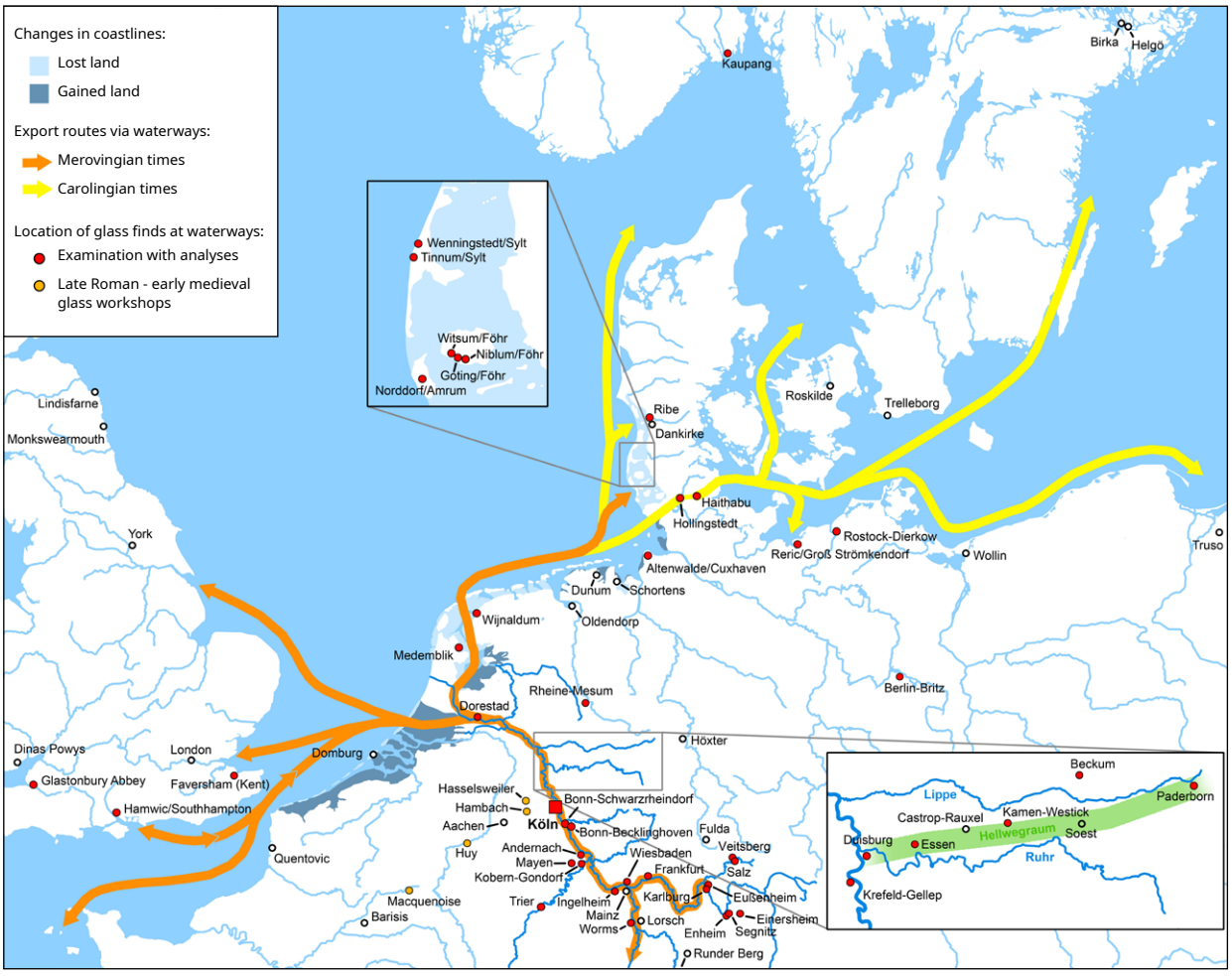

Figure 9. Map of probable routes of export with find spots of analysed glass finds. Figure: K. Otten and M. Dodt.

of export of glass products from Cologne in Carolingian times seemed to be comparing the finds of funnel beakers at the harbours with those at market places near rivers and shores. Most of the glass fragments we compared by archaeological and chemical analyses came from Viking sites at the coast of the North Sea and the Baltic Sea: Cuxhaven, Föhr and Sylt; Hollingstedt, Haithabu, Reric/Groß-Strömkendorf and Rostock-Dierkow.[25] The coastal markets and beach harbours could be reached from Cologne via Dorestad. We did not (yet) compare them with glass vessels from England, because there are other scholars who deliver the results of chemical analyses. The glass vessels at Birka[26] cannot be analysed, because they are well preserved. The funnel beakers, which we have researched, were not so well preserved as some found in Dorestad; they could be identified by the rim or (more often) by the bottom.

It is worth to compare the analyses of funnel beakers and bell tumblers from Wenningstedt (Sylt; KHa 116), Hollingstedt (KHa 134) and Reric (Groß-Strömkendorf; KHa 204, 205, 207 and 208) (Figure 11) with the glass signatures of funnel beakers and bell tumblers from the harbour of Cologne: Heumarkt (KHa 21, 40 and 45), Kurt-Hackenberg-Platz (KHa 108-110) Groß St. Martin (KHa 172) and Am Domhof (KHa 200). All analyses show the glass type to be HIMT-2, like half of the investigated twelve funnel beakers from Haithabu (Hai 135-140, 143, 144). The Viking settlement at Reric ends about 806 AD and the Vikings (from Reric) settled in Haithabu. Most of the analysed glass falls within the big group of HIMT-2, that was used for the production at the Harbour of Cologne. One of the Cologne finds (KHa 13a) plots in the Egypt-2 group and was not a production of Cologne. One (KHa 21)

25 In these excavations most glass objects were found by water sieving.

26 Arbman 1937, 36-45; Arbman 1940/43, 26-86, Taf. 189-194 (funnel beakers Taf. 190-192); Arwidsson 1984, 201-212.

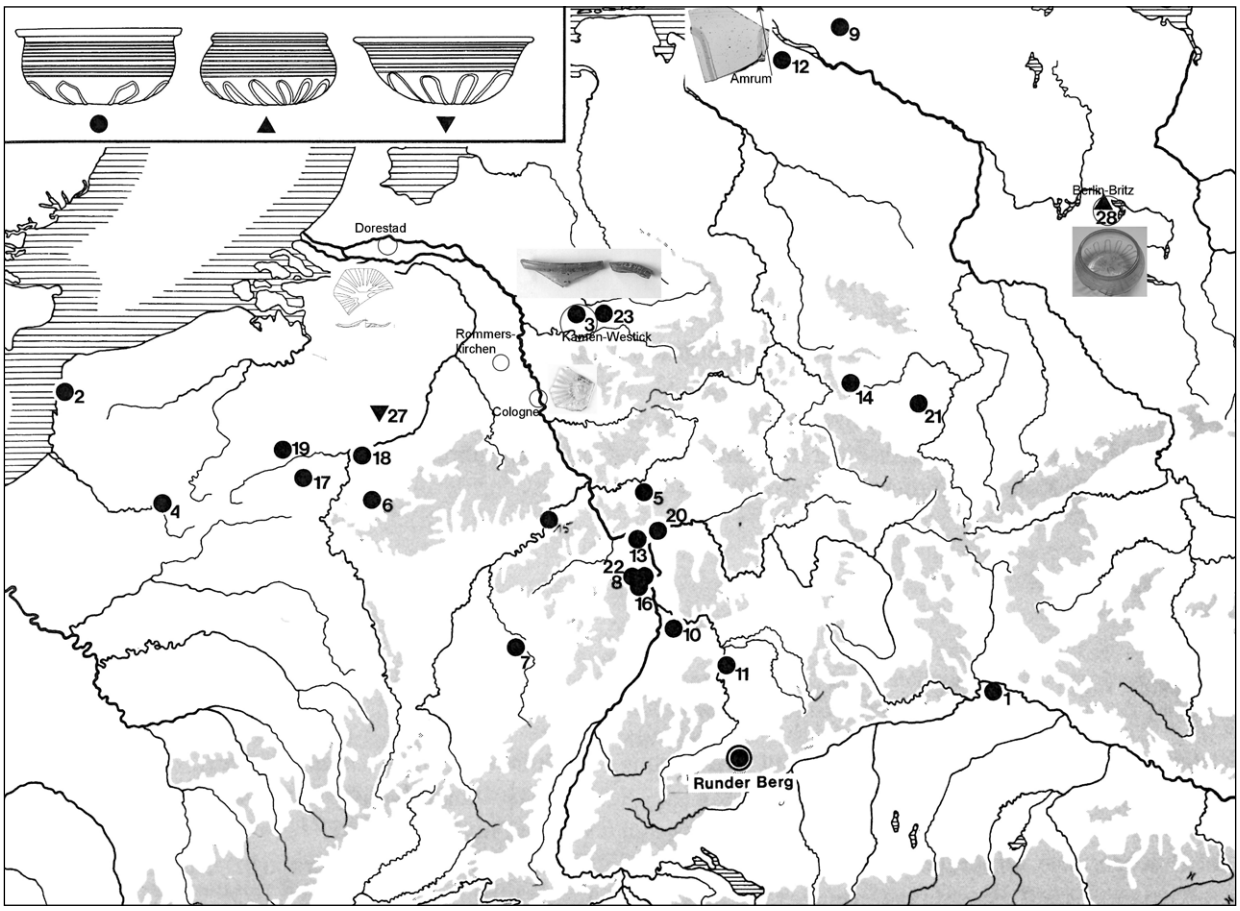

Figure 10. Diffusion map of bowls with loops with new finds added. Figure: U. Koch 1987, C. Isings 2009, M. Dodt.

is in the margin of the HIMT-2-group and similar to one specimen of Haithabu (Hai 143). It is not sure if they were produced in Cologne; but the glass of Am Domhof, that was produced in Cologne at the northeastern corner of the Roman wall, is similar to one of Haithabu (Hai 138) and plots at the margin as well. KHa 172 is Roman blue-green but plots over Levantine-1 glass type, of which there was a small production in Cologne especially at Groß St. Martin. Most of the specimens of the funnel beakers or bell tumblers which are assumed to have been exported from Cologne are inside the HIMT-2-group, especially the glass vessels of Reric (Groß-Strömkendorf) as well as some of the funnel beakers of Haithabu. Examples from Reric and Wenningstedt are dated in the eighth and the beginning of the ninth century AD, the funnel beaker of Hollingstedt, the 'North Sea harbour of Haithabu' in the later Viking time (ninth/tenth century) and has no sure hint of a Cologne production, together with the funnel beaker of Essen (KHa 272). Even further away is the vessel of Paderborn (KHa 214). Essen and Paderborn belong to a different route (Hellweg; see Figure 9) and will be treated in a different paper. In Haithabu a bigger group of funnel beakers and bell tumblers of soda-lime-glass have more and closer signatures of Egypt-2. That means that in the ninth century AD, less glasses from Cologne were traded to Haithabu, but some still were. While there was no export to the Hellweg, it seems to be obvious that there was still a trade from Cologne via Dorestad and the North Sea to Haithabu.

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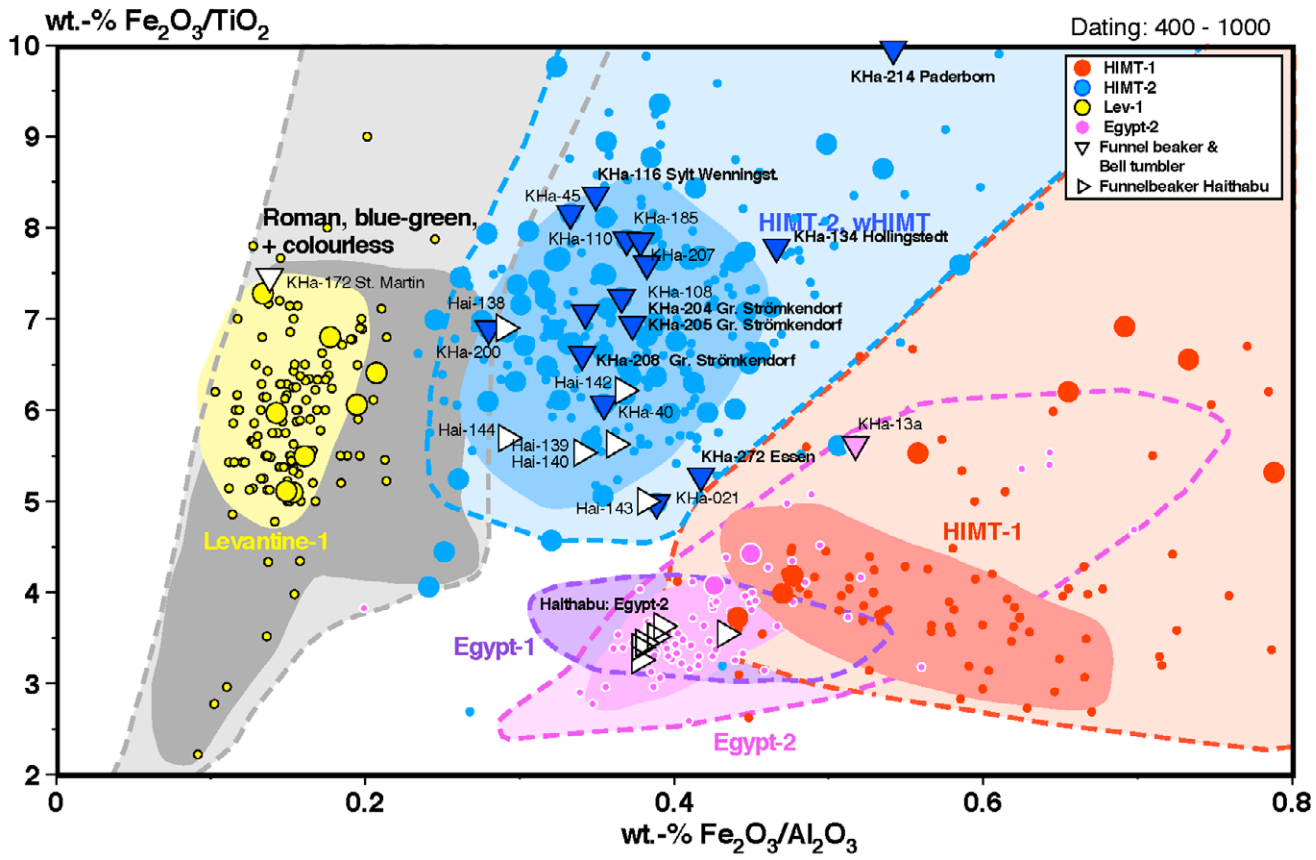

Figure 11. Chemical composition of funnel beakers and bell tumblers from Cologne and adjacent areas (coloured triangles) and Haithabu (white triangles). The data are displayed in a double ratio plot of Fe_2O_3/Al_2O_3 versus Fe_2O_3/TiO_2. These oxides are characteristic impurities of the sandy material and therefore specific for the region of origin of the raw glass. Small symbols represent data from the Göttingen database, which now contains more than 9000 glass analyses in total. Large circles represent data from the Cologne harbour project. For the sake of clarity, the time range is limited to 400-1000 AD and only soda-lime glasses of the production groups HIMT-1, -2, Levantine-1 and Egypt-2 are shown. Figure: A. Kronz.

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Glass vessels from the early medieval emporium at Ipswich

Rose Broadley

The total assemblage of early medieval (mid-seventh to tenth centuries AD) vessel glass fragments from Ipswich, Suffolk, contains approximately 332 fragments[1] at present, and is from one of the principal trading settlements of early medieval England. It is second only to the group of early medieval glass from Southampton (Hamwic) in England, in terms of both number of fragments and importance. The Ipswich archaeological archive has been a great untapped resource of early medieval archaeology in England until recently, but new work is now underway.

The context of Ipswich and its glass vessel fragments

Ipswich is located on the eastern coast of East Anglia, 65 miles north-east of the Thames Estuary and around 200 miles west of Dorestad, directly across the North Sea. The current interpretation is that there was a pre-urban trading site there from c. AD 640-720, which was perhaps occupied seasonally, followed by the permanent emporium with a grid iron street plan from AD 720.[2] Ipswich was one of the earliest emporia to appear in early medieval England, and was the hub of England's only large-scale wheel-thrown pottery industry, Ipswich ware, from the early eighth century to c. 875 AD. Ipswich ware pitchers are found in areas well beyond East Anglia along the eastern seaboard of eighth and ninth century England, although cooking pots and other vessels are concentrated close to Ipswich, rarely travelling more than twenty miles.[3] Meanwhile, pottery imported from overseas to Ipswich reveals that the majority of trade was with the Rhineland, Flanders and northern France,[4] with Badorf ware pitchers and amphorae, black-burnished wares, and a small quantity of Tating ware present. A Frisian presence in Ipswich, with associated strong cultural and economic links, and material culture travelling across the North Sea from Frisia to Ipswich either as personal possessions or trade goods, appears likely based on the current archaeological evidence, including the information available so far from the glass assemblage. Ipswich was a trading partner of the settlement at Dorestad and probably other emporia around the North Sea, and it is likely that at least some of the glass in use at Ipswich travelled via Dorestad.

1 Broadley 2019, 62-4.
2 Keith Wade, pers.comm.
3 Binkhorn 2012, *e.g.* Fig. 36.
4 Wade 1988, 93, 96.

The vessel glass currently under review dates approximately from the mid-seventh to late-tenth centuries, and was excavated from sixteen different sites between 1974 and 1990. It does not include the glass from the Buttermarket[5] or Stoke Quay cemeteries, or the 39 vessel fragments found in settlement contexts at Stoke Quay in 2012.[6] The 1974-1990 excavations totalled 17,500 square metres, which is only 3.5% of the 50 hectares of middle Anglo-Saxon occupation. All early medieval deposits were screened through a one-centimetre mesh, and flotation columns through a much finer mesh. However, very little vertical stratigraphy survived except in places at the waterfront, and there were a large number of discrete features that could not be related to each other stratigraphically. Ipswich has a much smaller vessel glass assemblage than Dorestad, although the settlements were about the same size (approximately 100 hectares). Ipswich's 332 fragments compare to an estimated at least 1355 vessel glass fragments from Dorestad in the collections at the Rijksmuseum van Oudheden, with the possibility of a few hundred more in the external store and some in other museums.[7] It is also a smaller assemblage than that from Southampton (Hamwic), where 1678 fragments were found:[8] the Ipswich glass is the equivalent of about 20% of either the Hamwic or Dorestad vessel glass assemblages. The rough measure of fragment counts helps to characterize and contextualize the group, as does the overview below of the range of forms and dates present, the quality of some of the fragments, and the very unusual fragments that were imported, probably via Dorestad.

Figure 1. Body fragment of completely destabilised wood ash glass, with a thick applied trail. 'Early medieval' context (c. 1000-1150). IAS 3104 (St Stephen's Lane/Buttermarket 1987-88). 2757.

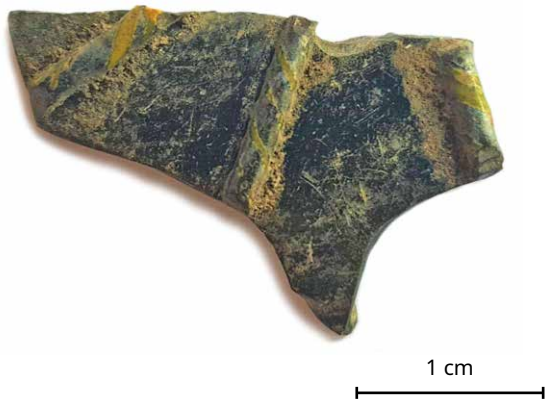

Figure 2. Opaque black base fragment decorated with three self-coloured and opaque yellow reticella trails. Probably from a globular beaker. Residual in 'medieval' context (c. 1150-1450). IAS 3104 (St Stephen's Lane/Buttermarket 1987-88). 3288.

Vessel forms

The majority of early medieval glass vessel forms are drinking vessels. These divide into two groups, stable vessels like globular beakers and most claw beakers, and unstable ones like cone beakers, palm cups, and funnel beakers. As with the other English emporia and Dorestad,[9] Ipswich has a form profile dominated by the palm-funnel series, which are unstable drinking vessels.[10] This indicates a different drinking culture to other contemporary sites with vessel glass assemblages in England, usually monastic sites, where globular beakers dominate.[11] Globular beakers can be set down on a table and picked up, sipped from and set down again repeatedly while dining in a classical style. Although it is hard to say exactly how cone beakers and palm or funnel beakers were used, their unstable forms mean that their contents must have been completely consumed before the beakers were put down. Whether that was usually by one person or the beakers were passed around, the forms lend themselves to drinking as a activity distinct from dining, and perhaps drinking more quickly. The percentage of palm cups found at Ipswich is significantly above the national average for England, but there is probably a temporal factor involved: palm cups broadly date from the late sixth to late seventh century, and their presence in significant quantities (12% of the fragments) indicates that they were in use in the possibly seasonal pre-urban trading site from c.640-720 AD, and not just placed in burials such as the burials containing complete cups found at the Buttermarket and Stoke Quay cemeteries.

5 Scull 2009, 129-301, Fig. 3.38, 3.59; Evison 2009, 250-251.
6 Jarrett forthcoming.
7 Willemsen, pers.comm.
8 Broadley 2019, 60.
9 Isings 2015, 422.
10 Broadley 2019, fig. 3.6.
11 Ibid., *e.g.* 100-102 and fig. 3.82.

The only glass vessel form present at Ipswich that was probably not a drinking vessel is the bowl. How bowls were really used is also unknown. Valsgärde bowls (decorated with both vertical and horizontal *reticella* trails) in particular were highly decorative, and were relatively stable, so a function serving delicacies in small quantities is possible. The percentage of bowl fragments from Ipswich is above the average for sites in England, although still small, with fourteen fragments presently identified.

In addition to the seventh to ninth century glass, the Ipswich assemblage contains a few late Anglo-Saxon fragments, which are very rare in England. Evison mentions three fragments from wide-mouthed globular beakers and a claw from Falcon Street,[12] all made from plant ash-based 'non-durable' glass from the late ninth century onwards, whereas the late seventh to mid-ninth century glass was dominated by durable soda-based glass. So far, one fragment has been identified during cataloguing for the current project, and that is a body fragment, probably from a globular beaker that was decorated with a thick, self-coloured trail (Figure 1). Globular beakers had the greatest longevity of all early medieval glass vessel forms, being in use from the fifth to eleventh centuries. The glass has corroded extensively, and the fragment now has an opaque appearance that obscures the original colour of the glass, which would probably have been an olive-green colour caused by impurities rather than deliberate colourants. This fragment is from a context dated by Thetford ware and early medieval pottery to 1000-1150 AD and extends evidence for use of glass vessels in Ipswich from the mid-seventh to the tenth to eleventh century AD.

Colour and decoration

Colour is a useful attribute of glass fragments. On the one hand, even the smallest undiagnostic fragment can supply colour information. On the other, there is a connection between deep colours and the globular beaker vessel form and some colours may have geographical foci in terms of find spots. Also, colourants and de-colourants can be useful for interpretation when compositional analysis is possible. In this case, red, green and black vessel glass fragments are present at Ipswich in above average quantities for England.[13] Deep red and green fragments are concentrated in the south in England, with a lack of both in the north. Black fragments[14] (*e.g.* Figure 2) are only found in significant quantities at Southampton (Hamwic), Brandon and Ipswich, with the numbers at Brandon being particularly noticeable, given that the total assemblage size there is smaller than at Ipswich and Brandon has not been categorized as an emporium. This distribution of black sherds provides clues to some of the regional connections of Ipswich.

Decoration is interesting as a general indicator of forms present, the visual tastes of both producers and local consumers, the complexity of production, and the quality and rarity of vessels present. It is another feature that can be used to extract information from fragmentary assemblages, especially relating to fragments that are not diagnostic in terms of form. There is great variety in decoration types, patterns and colours between the seventh and ninth centuries AD, which makes this aspect of early medieval glass studies rich in possibilities. Decoration can help to identify vessel forms, especially with claws and claw beakers, the moulded grape decoration on grape beakers, and the patterns of yellow *reticella* trails on Valsgärde bowls. The Ipswich assemblage is more decorated than average in England, and has more moulded decoration and gold foil glass in particular.[15]

It is also often the decoration that is the rare feature of a fragment. Amidst tough competition, the most luxurious glass vessel from Dorestad is the funnel beaker decorated with gold foil, now on display in the Rijksmuseum van Oudheden in Leiden.[16] Early medieval glass vessel fragments decorated with gold foil have been found in only approximately 13 places in north-western Europe, and their presence illustrates exceptional wealth. This also applies to three fragments from Ipswich, which are three of the four fragments known from early medieval England, while the fourth is from a residual eleventh-century context at Lyminge in Kent.[17] Of the three Ipswich fragments, it is especially true of the fragment that is opaque white, because of the rare colour of the glass, and because the gold foil design is by far the most elaborate, and may even feature a small section from an unreadable band of lettering.[18] Diamond motifs link all of the Dorestad fragments[19] with two of the three from Ipswich.[20] Those in Ipswich are probably from the same source and likely travelled via Dorestad, perhaps from further up the Rhine, *e.g.* Lorsch.[21]

Fragments decorated with bichrome untwisted fragments are also very rare in early medieval England. Two from Ipswich (Figure 3) are the only two opaque yellow and white fragments from England, and are two of only eleven fragments decorated with bichrome untwisted

12 Evison 2000, 89.
13 Broadley 2019, fig. 3.8.
14 Ibid., fig. 2.41 for black; 2.43 for deep green and 2.44 for deep red.
15 Broadley 2019, figs. 3.9 and 3.10.
16 Willemsen 2010, fig. 153.
17 Broadley 2016, 155-162.
18 Broadley 2019, Plate 4.
19 *E.g.* Sablerolles and Henderson 2012, fig. 6.14.
20 Broadley 2016, fig. 1A and C.
21 Isings 2015, 424.

Figure 3. Two blue-green body fragments decorated with rare opaque white and opaque yellow bichrome untwisted trails. Both were residual in 'early medieval' contexts (c. 1000-1150). IAS 5003 (Wolsey Street/Franciscan Way 1990, 2002, 2006). 0361 and 0124 (0117).

Figure 4. Blue-green vessel glass fragment, decorated with rare red reticella trails with a yellow reticella trail alongside. Probably from a funnel beaker. Residual in an 'Early Late Saxon' context (c. 850-900). IAS 4601 (Wingfield St-Foundation St 1985). 0385 (0372).

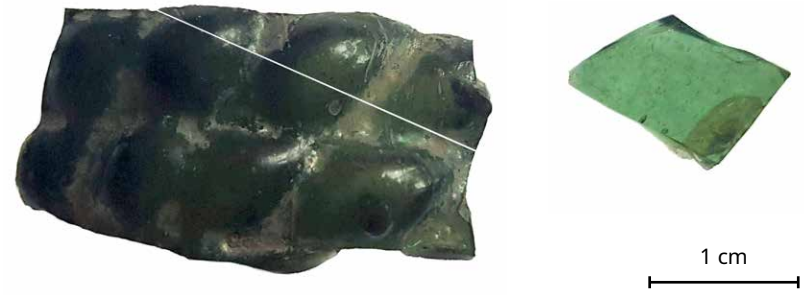

Figure 5. Two deep green grape beaker (*Traubenbecher*) fragments. Residual in an 'early medieval' context (c. 1000-1150) and a 'Middle Late Saxon' context (c. 900-1000) respectively. IAS 4801 (School Street 1979 and Foundation Street/School Street 1983-86). 0719 (0788) and 1747 (1137).

trails from England. The others are from Jarrow, Tyne and Wear (5), Flixborough, Lincolnshire (2), and Barking, Essex (2), which are all on the east coast of England.[22] Furthermore, the glass currently under review includes a funnel beaker fragment with a trail applied to the rim, that is either an opaque white trail containing some streaks of a darker colour, or an untwisted *reticella* trail. The only parallels to this in England are seven fragments from Southampton (Hamwic) with opaque white trails applied to the rims.[23] Finally, the only known example of opaque red *reticella* trails from England has been found amongst the Ipswich vessel glass – the fragment is pale blue-green and features three probably vertical opaque red on self-coloured *reticella* trails, and one opaque yellow on self-coloured trail, positioned second from right (Figure 4). This fragment has been provisionally identified as being from a funnel beaker with vertical r*eticella* decoration on the body of the vessel, similar to a small number of examples from Southampton (Hamwic),[24] Dorestad[25] and Ribe, Denmark,[26] although whether there is a close parallel of the colour combination and design is yet to be established.

Finally, the two grape beaker fragments from Ipswich (Figure 5) are two-thirds of the national collection in England, as there are only three known in total, and the third was found at Brandon, also in Suffolk (*c.* forty miles north-west of Ipswich). Similarly, there is also a potential link between a deep blue-green fragment from an island settlement at Butley in Suffolk (c. 15 miles up the coast to the east of Ipswich), decorated with a mould-blown trefoil design, and a fragment from Dorestad, which reportedly has one too.[27] It is likely that the grape and trefoil beakers were imported from the continent, and that the Butley and Brandon vessels either travelled through Ipswich or via a coastal and riverine trade route linking Ipswich, Butley and Brandon with North Sea networks.

Conclusions

Overall, the vessel glass from Ipswich shines some light on the economic and social connections of the early medieval emporium, its drinking culture, and the identities and nature of the communities present. The assemblage features a number of forms and decoration types that are otherwise rare in England, notably the bichrome *reticella* fragment, the bichrome untwisted trailed fragments, the gold foil glass,

22 Broadley 2019, 33.
23 Hunter and Heyworth 1998, 12, fig. 7.
24 Ibid., 14, fig. 11, Plate 7.
25 Isings 2010, 116; Isings 2015, 423.
26 Lene Feveile, pers.comm.

27 Isings 2015, 422

and the grape beaker fragments. The gold foil and bichrome *reticella* funnel beakers in particular are similar to glass from Dorestad, although one clear feature regularly present in the Dorestad assemblage that is so far absent at Ipswich is the *in calmo* rim sections, which are blown separately in a different colour and applied to the main vessel.[28] The gold foil glass tells us of a wealthy place receiving the most luxurious imported items from north-western Europe. The glass as a group shows us a relatively large trading settlement with an assemblage of glass vessel fragments to match; home to a vibrant drinking culture with a Northern rather than Mediterranean flavour, dominated by good quality glassware that could not be put down until empty. The distribution of some glass forms and colours like grape beakers and black glass in England allows us glimpses of Ipswich's regional networks as well as international ones: links between the emporium and its hinterland. The temporal range shows quality glassware in use at Ipswich throughout its early medieval existence, from its inception in the mid-seventh century until at least the tenth century. The Ipswich assemblage is already significant for glass studies and early medieval settlement archaeology, and has great potential for the future. Approximately 43% of the fragments were securely stratified in contexts dating to between 700 and 900 AD, and future study of the horizontal and vertical distribution of these and their contextual groups and associations would be very useful. A publication summarising the excavations and their findings is in preparation, as is a full catalogue of the early medieval glass.

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About the author

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28 Isings 1980, fig. 154; Isings 2015, 423.

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Non-funerary sword depositions in Carolingian Europe

Dušan Maczek

Introduction

There is quite an extensive body of scholarly literature dealing with early medieval swords, with traditional archaeological research focusing on typology and chronology or on the technical aspects of these offensive weapons. A substantial part of this research has also dealt with swords bearing inscriptions, such as the well-known ULFBERHT blades. When archaeologists comment on the social and cultural aspects of swords and their wielders, burial finds are consistently the focus of their attention. Drawing from weapon burials and written records, swords are commonly viewed as the markers, or symbols, of status. The sword is being perceived as a symbol of power and as a weapon of the men of wealth and position.[1] From a strictly archaeological perspective, medieval swords are preserved in two ways. The first group are swords preserved in private collections. These may be part of castle or family collections, cathedral treasures, royal regalia, etc. These are archaeologically 'invisible'. The second group consists of sword depositions. Two types of depositions are dominant in the archaeological record from the fifth to the tenth century AD: those in graves and those in rivers or other watery contexts.[2] Grave finds, as already mentioned, have been studied in more detail than the water deposits, which have largely been overlooked. This is particularly the case with continental early medieval finds. Even though the continuity of water deposition of weapons is widely attested in the archaeological record,[3] there is much discussion on the motivations of this behaviour and its causality. Scholarly interpretations of this phenomenon differ considerably. In this paper, attention will be drawn to the many swords retrieved mainly from the rivers of north-western Europe in the Carolingian period, *i.e.* from the eighth to the tenth century AD.

From Prehistory to the Middle Ages

The intention of this article is not to discuss all the ongoing debates on water deposition in Europe, but rather to have a brief look at some of the main ideas associated with these finds. Prehistoric deposits were extensively analysed in a long sequence by

1 Wilson 1971, 109.

2 Theuws and Alkemade 2000, 401-476.

3 See for example Bradley 1990; Bradley 2017; Torbrügge 1972.

Richard Bradley (1990), however the pioneering work is considered to be Walter Torbrügge's 1972 study of river finds from north-western Europe. The prehistoric river deposits were often dominated by what has been characterised as "male" equipment.[4] These assemblages seem to have most in common with the contents of rich male graves. An interesting pattern from prehistory, recurring in the Early Middle Ages and identified by Torbrügge, is the mutually exclusive deposition of swords in graves and rivers. When swords disappear from the burial record, they seem to be deposited in rivers, and vice versa. Consequently, one of the explanations of river deposits is that of funeral hoards. Another explanation is that weaponry was deposited at a certain stage of life, maybe when the warrior became an elder.[5] A further suggestion is that the deposition of valuables such as weapons can be understood as a means of gathering prestige.[6] In a competitive gift-exchange system, where debts are constantly created and discharged, votive offerings can provide an accumulation of prestige, since the objects are taken out of circulation.[7]

It should also be considered that weaponry might have been disposed of not because it signalled one's own identity, but rather that it derived ambiguity from the fact that it belonged to the enemy.[8] Most of the weapon deposits from northern Europe dating to the Late Iron Age, the Roman period and Late Antiquity (400 BC-500 AD) are interpreted in line with these terms. These depositions are believed to have arisen from the religious practices of the Celtic and Germanic tribes. Collections of objects were left in wetland locations after they had been taken from the deceased of the defeated enemy.[9] The artefacts include a large number of weapons, as well as clothes, ornaments, tools, pottery, etc. Some of the objects show deliberate signs of destruction, having been burned, torn, bent or broken apart.[10] This is also reported by Julius Caesar as a practice of the Gauls, when he described piles of booty taken in war left on consecrated ground. An account of the Kimbri by Osorius describes them as wildly destroying all they have captured and throwing gold and silver into the river.[11] The famous locations of these sacrifices are Thorsbjerg, Vimose, Nydam, Illerup and Kragenhul. It must be said that these deposits represent some of the most spectacular wetland finds.[12]

4 Fitzpatrick 1984, Fontijn 2005.
5 Fokkens 1999; Fontijn 2002.
6 Bradley 1990.
7 Bradley 1990, 39.
8 Fontijn 2005, 151.
9 Ellis Davidson 1962; Hedeager 1992.
10 Ellis Davidson 1962, 5-7.
11 Ellis Davidson 1962.
12 Lund 2010, 51.

With the transition into the medieval period, Britain, Scandinavia and continental Europe all experience a decline in wetland depositions.[13] It is not until the eighth century AD that wetland deposits start to reoccur.[14] These deposits are of a quite different character than those of the previous period: successive large-scale depositions at the same find spot are relatively rare, and most of the material consists of single stray finds or small hoards.[15] Nevertheless, the discussion of ritual deposition concerning medieval finds has intensified in recent years, particularly due to studies from Scandinavia and Britain. The idea that swords held a special place in medieval rituals is undeniable (*e.g.* ceremonial swords, burials) and the phenomenon of swords deposited in watery locations is now gradually starting to be viewed as a deliberate ritual act rather than accidental loss.[16] Evidence for this in Scandinavia has been discussed by Julie Lund.[17] British finds of this type have been the focus of several archaeologists, including Andrew Reynolds and Sarah Semple,[18] Ben Raffield[19] and John Naylor.[20] Continental river finds, such as those from northern Germany, have been studied by Jette Anders[21] or Normen Posselt.[22] The most recent study of swords found in rivers has been undertaken by Andrej Gaspari,[23] who analysed the high medieval finds from the river Ljubljanica in Slovenia. In general, research into the river deposits in continental Europe is usually confined to micro-regions. As has been the case with the German finds, they are more often than not considered to be the remains of accidental loss.[24]

The river swords

The fact that a high proportion of the medieval swords that fill our museum collections come from watery locations has, naturally, been noted by many scholars studying medieval weapons. Even though these finds have generally been dismissed as losses, as pointed out above, David Wilson[25] as early as 1965 concluded that since they are found in such large numbers, at least some of these finds must be seen as votive offerings.

13 Hedeager 1999; Lund 2010; Raffield 2014.
14 Geisslinger 1967; Lund 2005; Lund 2008; Hedeager 1999.
15 Lund 2010, 52.
16 Androshchuk 2010; Brunning 2019; Raffield 2014.
17 Lund 2005; Lund 2008; Lund 2010; Lund 2015.
18 Reynolds and Semple 2011.
19 Raffield 2014.
20 Naylor 2015.
21 Anders 2013.
22 Posselt 2016.
23 Gaspari 2017.
24 Posselt 2016.
25 Wilson 1965, 51.

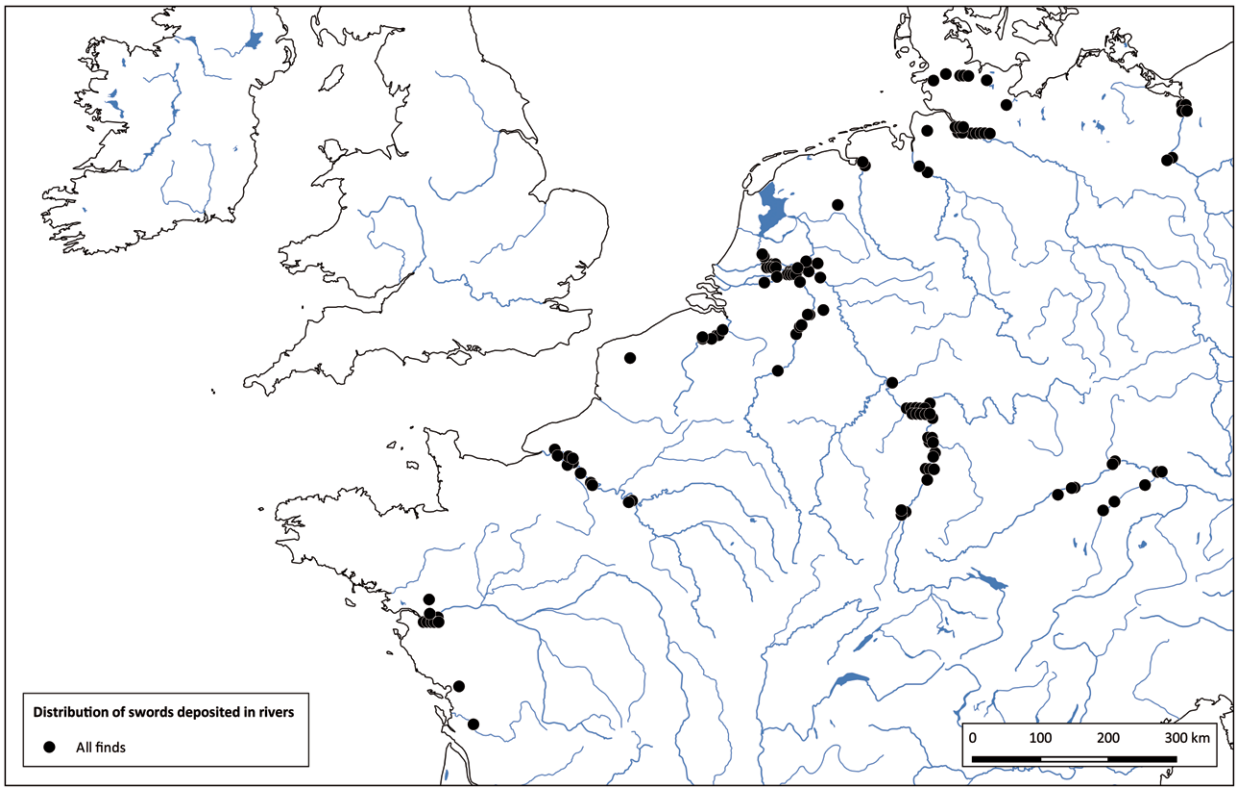

Figure 1. Early medieval swords deposited in rivers of north-western Europe. Map: D. Maczek.

What needs to be emphasised when discussing numbers, however, is the circumstances of discovery. The majority of the swords found in European rivers came to light as a consequence of dredging activities due to construction work, deepening of the riverbed, or exploitation of gravel or sand. As a result, many of the single-item water-finds, especially weapons, flowed into private collections and were reported without any appropriate archaeological documentation or precise find-spot. This, together with the nature of the wet contexts, adds to the ambiguity of the evidence. The question that I ask, one with which other scholars have felt uneasy when analysing water-finds,[26] is whether the data available can really be considered as a representative sample of the original total volume of the deposited objects. Needless to say that many objects still await discovery, it must be borne in mind that some artefacts found in rivers under these circumstances are not reported, and there is the potential that a great number of finds will remain undetected. Furthermore, the geographical distribution might be distorted due to localised dredging activity along the river. Larger rivers with lots of traffic where big agglomerations are located will certainly be subject to more intensive dredging and construction activity than others. Based on the data available and known to me at the time (2015) of collecting these finds, 129 early medieval swords recovered from water were plotted on the map of north-western Europe (Figure 1). Nine of these are of an earlier Merovingian type, which brings us to a number of 120 swords from water dated to c. 750-1000 AD. This number is nowhere near conclusive, since new finds come to light almost continually.

The observations and peculiarities

Back to the numbers, a good start is the juxtaposition of the total number of Carolingian or Viking age swords and the number of water-finds. Approximately 185 swords were found in areas belonging to the Frankish empire, as water finds or in other contexts. Seemingly all seven Carolingian swords found in Belgium come from rivers. At least 25 out of 37 swords found in France, and at least 28 out of 42 swords found in the Netherlands (see example Figure 2, 3 and 3), also come from water contexts. According to Anne Stalsberg and Oddmunn Farbregd,[27] Norway has produced over 3000 swords,

26 Geibig 1991, 159; Schulze 1984.

27 Stalsberg and Farbregd 2011.

Figure 2. Broadsword found in the river Meuse near Aalburg, the Netherlands. Length 86.5 cm, 775-825 AD. RMO Leiden inv. no. k 1948/12.1. Photo: RMO.

Figure 3. Broadsword with decorated hilt, found during dredging near 's-Hertogenbosch, The Netherlands. Length 93.3 cm, 750-850 AD. RMO Leiden inv. no. RSH 1. Photo: RMO.

however I failed to find a single valid example of a sword found in a watery context (assuming there must be some) while from the c.700 Swedish finds, I was able to confirm only eleven with certainty.[28] The most illustrative example of this pattern can be observed in the territory of Germany. Based on the map published by Geibig,[29] in the 'pagan' northern areas of Germany, only seven out of the 106 swords found are from river deposits. The majority of the remaining 99 swords were retrieved from burials. On the other hand, from the Christian areas of the Frankish kingdom, 53 out of the 87 swords are found in water contexts, the rest being single stray finds or finds associated with settlements. Grave finds are completely absent. The same pattern can be observed in southern and eastern Europe, where burial customs that include placing objects in graves are maintained until the tenth century AD and swords from wet contexts are a rarity. This changes in the later medieval period.[30] When discussing deliberate deposition in early medieval Europe, the connection is usually made with the so-called pagan practices of the north.[31] Many who have considered the medieval water-finds to be intentional deposits link them to the resurgence of pagan beliefs or to the presence of Vikings in those areas. However, the question is then why these supposedly pagan offerings are so underrepresented in northern and Eastern Europe?

Regarding the discussed numbers, several distribution patterns can be observed in the sample of swords from north-western Europe. The majority of the swords come from coastal areas or within c.100 km of the sea. There are several obvious concentrations. These are in the Loire, Seine, the Dutch river area, the middle Rhine and the upper Danube. Several sites also yielded a larger number of swords dating to the Carolingian period. These are, among others, Dorestad (see Willemsen in this volume), Nantes or Mainz. Another observation that can be made is that many of the swords come from major navigable rivers. There are only a limited number of swords found in small streams or tributaries of major watercourses, although this picture might well be biased due to localised activities (research, dredging, etc.) that shape the archaeological record. Furthermore, many of the clustered finds were dredged up at or near the confluences of rivers. Whether these swords entered the water at these specific locations is hard to determine due to often unreliable and uncertain find circumstances. Finally, a considerable number of finds come from at or near the river mouths. Swords have been found in the estuaries of rivers such as the Seine, Scheldt, Ems or Elbe.

Figure 4. An +ULFBERHT+ sword found in the river Meuse near Lith, the Netherlands. Length 99.5 cm, 950-1000 AD. RMO Leiden inv. no. k 1984/8.1. Photo: RMO.

28 Androshchuck 2014.
29 Geibig 1991, 160: Abb. 42.
30 For an example see Gaspari 2017.
31 See Lund 2010; Raffield 2014.

According to Julie Lund,[32] these locations are among the most common find-places for water-finds in general. In addition to this, artefacts tend to accumulate here in larger numbers.

The case of the clumsy warrior?

When commenting on the overall distribution and high proportion of water-finds in his study, Alfred Geibig defined three possible explanations that encapsulate the medievalists' stance towards intentional water deposition of weapons.[33] I will use the same categories here to have a closer look. First, the weapons entered the water because of hostilities on the edge of, or on, navigable waters, and are thus considered to be remnants of battles. Another possibility are accidents in the form of shipwrecks, collapsed bridges or accidents that occurred while crossing fords during floods. The third explanation, certainly the most controversial as stated by Geibig, is that of cultic motifs. He was prone to believe that few of the larger deposits, such as the one from the river Warnow in Schwaan, north-eastern Germany, can be viewed in the light of ritual deposition, but quickly dismissed any ritual motifs in western Carolingian and later high medieval Christian areas. Basing his views on Geisslinger,[34] he assumed that these swords represented "cultural debris". Schulze's proposed ritual interpretation of high medieval Romanesque bronze bowls found along the Rhine does not interfere with this view[35] because, according to Geibig,[36] the different functions of the two groups of materials created non-comparable loss risks. Geibig reasonably argues, that a weapon, a sword in this case, would accompany a man for all dangerous actions, such as river crossings, military conflicts, etc. and as a result, there is a high probability for a sword to be involuntarily dropped in water over the course of its existence. He then concluded that these objections tend to favour the other two, mundane non-religious explanations, with votive/ritual deposition having only a minor significance. In my opinion, the evidence does not withstand this view.

In the context of armed conflicts, Geibig put forward several possible explanations of how weapons could have entered the water.[37] A deliberate disposal of weapons by fleeing troops to prevent them from falling into their opponents' hands seems reasonable. Water would be the perfect choice for such an action since the environment makes it difficult, if not impossible in some cases, to retrieve the sunken objects compared to on land, where they could be easily found and dug out. This, however, does not hold up against the chronological considerations. Armed conflicts were an integral factor that constituted and shaped medieval, as well as prehistoric, societies, and therefore one would expect weapons to be found in or around rivers and lakes all throughout the course of time. This is not the case, however, and there is also a strong difference in the numbers of swords dating to the Merovingian (9) and Carolingian periods (120). The pattern is not unique for the medieval era.[38]

Another possible explanation is that of accidents caused by armed conflicts. Alfred Geibig gives an example from the written sources, a report of a battle between King Ottokar and Duke Ludwig in 1258.[39] Supposedly, the followers of King Ottokar fled the battlefield and crowded the bridge at Mühldorf, Bavaria, which collapsed. In such a case though, one would expect to find other material and other war-gear alongside offensive weapons such as swords. This again, at least with the material at hand, does not seem to fit. As far as swords are concerned, during such an event, it is more than probable that they would enter the water with scabbards, either sheathed or unsheathed, and belts or baldrics. There is hardly any archaeological evidence in the form of scabbards and/or belt fittings from sword finds in water contexts, however. Swords found in watery contexts mostly exist as single finds. Another objection that can be raised against the above-mentioned explanations is the number of swords found at specific sites. If a fleeing group of people disposed of weapons in a river or a lake, or if battles took place on the edges of water courses, one would expect to find a large number of weapons of approximately the same date or design at a single find-spot. Even though we have concentrations of finds, such as in Nijmegen or Mainz, these locations did not produce more than ten examples (one case), but usually less. What is more, these swords, at least from a typological viewpoint, show chronological differences.

The same objections that were raised against the 'armed conflict' explanation are relevant for the 'accidental loss' interpretation. Rivers were being navigated and crossed in the Merovingian period, *i.e.* before the second half of the eighth century AD, arguably just as much as in Carolingian times, yet there are hardly any swords recovered from rivers dated to the former period. Since rivers pose a natural obstacle in the landscape and had to be travelled and traversed consistently, Geibig concluded that accidents must have

32 Lund 2005.
33 Geibig 1991, 177.
34 Geisslinger 1967.
35 Schulze 1984, 226-228.
36 Geibig 1991, 178.
37 Geibig 1991, 178.
38 Bradley 1990.
39 Geibig 1991, 178-179.

occurred in great numbers.[40] Despite this, he considered the number of known discoveries of medieval swords from water contexts to be disproportionately small, when compared to the expected number of accidents. Once again, if we expect that such a large number of accidents had happened, the assumption is that the number of sword-finds should be reflected in the archaeological record in proportion to the quantity of accidents not only in Carolingian times, but across all periods through which this weapon was used. This again, is not the case. As pointed out earlier, the overall geographical distribution seems to exhibit a pattern where these artefacts tend to accumulate. When combined with the above arguments, re-evaluation of these finds as something other than mere casual losses or battle remnants is inevitable.

Conclusion

To discuss in detail the possible avenues of interpretation for these finds is beyond the scope of this article and would demand a more in-depth analysis of the material itself, as well as its context, such as the connection to the cultural and natural landscape. However, it can be concluded that the evidence at hand seems to point towards a conscious disposal of weapons in the Early Middle Ages. Considering the nature of the Frankish empire, it must be recognised that, if indeed intentional, at least some of these depositions must have been undertaken within a Christian context. As already pointed out by Ralph Merrifield, such offerings cannot be understood as though they were gifts for the old pagan river-gods, but should be interpreted in terms of the contemporary religious or magical beliefs.[41] Stocker and Everson have suggested, based on their analysis of the Witham river valley, that the Catholic Church supervised weapon depositions in wetlands up until the fourteenth century AD.[42] Similarly, the continuation and longue-durée of these depositions on the continent well into the high medieval period suggests that it must have been a custom well-established in the Christian mental framework.

About the author

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40 Geibig 1991, 178-179.

41 Merrifield 1987, 115.

42 Stocker and Everson 2003.

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Form follows function

Reconstructing the use of Viking Age swords

Ingo Petri

Introduction

This article attempts to approach the use of Viking Age (eighth to eleventh century) swords from Northern and Eastern Europe. The results presented were created through years of studying sources, experiments and training.[1] However, they are preliminary. From the multitude of relevant aspects, only a few were selected. Further investigations are necessary to take other aspects into account. Many necessary information cannot be found in the literature, as the respective aspects have so far received little or no attention.

Methods, sources and core assumptions

In order to reconstruct Viking Age combat practices, it is necessary to refer to a multitude of methods and sources.[2]

Human body and biomechanics

The human body has not changed significantly since the period relevant to the reconstruction. The people of the present, as well as their ancestors, are equally capable and physically and psychologically equally vulnerable.

A simple but crucial insight relevant to close combat is the correlation between human anatomy and weapon reach. For example: a hand-held weapon can only be operated at maximum reach if it is fully extended and lifted to shoulder level. In contrast, when lowering the weapon hand, the arm turns around the shoulder joint in an arc, which inevitably shortens reach. At the same time, a weapon at shoulder-level threatens extremely vulnerable body regions: the face, the neck and the torso. So, if two fencers try to touch the opponent´s head respectively foot with a weapon, the one who is aiming for the head could make his hit before the other comes within reach. The basic assumption is that even in pre-modern times, the advantages of such aspects were recognised, and combat techniques were optimised in that respect.

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1 The author would like to thank his fencing instructor Roland Warzecha (www.dimicator.com) for years of joint training, experiments, discussions and research trips.

2 See Berthold and Petri 2019, 34-38; Petri 2019, 2-3.

Martial arts principles

Martial arts principles are effective in every form of hand-to-hand combat.[3] Every physical activity is subjected to the laws of physics. Within these parameters, anatomy dictates which movements are effective. The scope for the effective use of a tool, including cutting and thrusting weapons, is very limited. Looking at a single physical action, there are usually not many useful options, but often only one.

Thus, today, given the understanding of these principles, it is possible to reconstruct the use of ancient weapons, for their use must necessarily be based on those same concepts.

The problem with these assumptions is that martial arts most likely never were completely pragmatic but influenced by social and cultural contexts.

Fencing books and other written sources

Fencing books are a heterogeneous group of texts whose common feature is the representation of combat techniques, mostly for duelling situations.[4] Most of the works deliberately distinguish themselves from "common" or uneducated fencers, some of them suggest a quasi-athletic use of fencing, as opposed to serious combat. This implies that the martial arts practised by the majority of fencers, though by no means ineffectual, was less sophisticated than that of the fencing book authors – but perhaps more common.

Non-pragmatic literature such as songs, chronicles, sagas or courtly epics can also be used as sources but are usually much more topoised.

The use of swords from the Bronze Age to the Late Middle Ages cannot be deduced directly from fencing books, which are only preserved from the fourteenth century onwards. But it can be assumed that the martial arts referenced therein represent a tradition already existing earlier, and the principles that are documented in the fencing books can be applied to and tested with Viking Age swords. Other written sources as for example the Icelandic sagas only give indirect indications, like for example about the position of wounds in combat. Also, the sagas were not written until about 200 years after the Viking Age and contain at least partially anachronisms concerning the used weapons.[5] Skaldic poetry dated to the Viking Age may give hints by the kennings used for swords. Kennings are complex linguistic constructions that were used as replacements for simple nouns in skaldic poetry. For instance, swords were referred to as 'wound snake' or 'battle snake'.[6]

3 Warzecha 2014, 155-156.
4 Welle 1993; Anglo 2000.
5 Wetzler 2014, 365, note 57.
6 Brunning 2015, 56-57, Table 2.1; Petri 2019, 3, 9.

Depictions

Illustrations, reliefs and sculptures provide information about weapons in the region and the time of their origin. At best, the depictions also show snapshots of combat techniques.

Problems are artistic conventions, the lack of perspective in representations and antiquisation or exoticisation. The extent to which the illustrators were familiar with equipment and martial arts or wanted to depict these practices in detail is another point of controversy.

Material culture

Well-preserved swords provide the best basis for reconstructions, as they can ideally be used to determine dimensions, material and construction. Swords are first of all designed as specialised tools to kill or maim opponents. And as with every specialized tool, it is to be assumed that their design is not random but follows the requirements for use. Of course, decoration also plays a role in the design of swords, but only to an extent where it does not reduce the usability. So, by carefully analysing their design, it is possible to draw conclusions about for which actions a sword was designed and for which actions it was not designed. In this way it is possible to approach its use in combat.

To better understand the sword and its use, one has to look beyond its design alone, and also consider additional items of military equipment that were used in conjunction. For the period under consideration, this would mainly be shield and body armour.

Human remains and palaeopathology

Human remains sometimes show weapon-related injuries.[7] Analysis of type and distribution may provide indications about the kind of weapons and actions that inflicted the wounds.

Problems are that not all injuries, even fatal ones, leave traces on the skeleton. The detectable spatial distribution of injuries is influenced by the amount and position of bones in the respective body areas while the distribution of injury types is influenced by the size of the wound and thus the probability that it hits a bone or is detected in the analyses of the remains.

Examination of Viking Age swords

Hereinafter, it will be shown which conclusions about the use of Viking Age swords can be drawn from the shapes of the hilt, blade and the sword as a whole.

7 Großkopf 2007; Panhuysen and Dijkstra 2018.

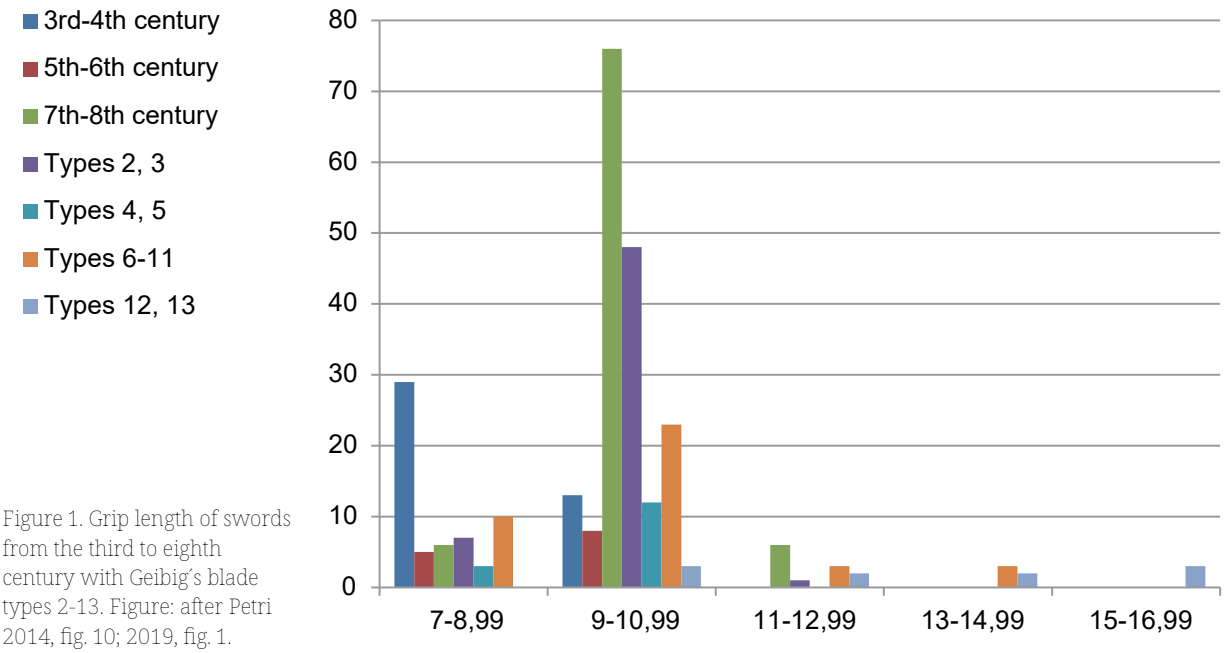

Figure 1. Grip length of swords from the third to eighth century with Geibig´s blade types 2-13. Figure: after Petri 2014, fig. 10; 2019, fig. 1.

The hilt

The hilt is the connection point between the sword and its wielder. So, the hilt should be shaped in a way to allow and facilitate the use of the weapon, but not to hinder it.[8]

Description of hilt forms

Due to different pommel constructions, A. Geibig groups Viking Age sword hilts into three construction types.[9] With type I, the tang passes through both the upper guard and the solid pommel cap, and is peened on top. In hilts of type II, the tang only reaches through the upper guard and is riveted on top of it. The pommel cap is attached to the upper guard by means of two rivets or a U-shaped bracket. The pommel caps were hollow in all the cases studied. In contrast, a pommel consisting of a a single piece is indicative of type III, with the tang passing through and being peened on top.

Construction type I has its main period of use until about 800 AD. Thereafter it is replaced by construction type II, which is in use in the ninth century and parts of the tenth century. In the tenth century, construction type III prevails, which stays the main hilt construction type until the end of the study period and beyond.

Viking Age sword hilts are usually made of iron[10], but some types are made partly or entirely of other materials like bone, copper alloy or silver.[11] These non-iron hilts often deviate from the otherwise typical construction type II and are mounted according to construction types I or III.[12]

Figure 1 shows the development of grip lengths of swords from the younger Roman Iron Age to the thirteenth century.[13] For it swords were analysed, from which the relevant dimensions could be taken from catalogues or measured from plates. The number of swords in the different periods therefore does not reflect the actual amount found, but the data available in accumulative publications. The sword finds from Illerup Ådal serve as an example for the younger Roman Iron Age as this is the largest sword find complex of this time, covering the entire period. In addition, the essential dimensions could either be taken directly from the extensive catalogue or measured from the plates.[14] The swords of the fifth to seventh century were published by W. Menghin.[15] Here only the values mentioned in the catalogue could be included, because the scale of the drawings did not allow to take measurements. The swords of the eighth century were measured using the plates of F. Stein.[16] The most complete dataset is the catalogue of A. Geibig for swords from the end of the eigth to the thirteenth century.[17]

8 See Petri 2019, 4-7.
9 Geibig 1991, 90-97, 141, fig. 24.I-III; Petri 2014, 130, fig. 6-8.
10 Geibig 1991, 91; 1992/93, 222; Petri 2014, 130; 2016, 187.
11 Geibig 1991, 54-56, fig. 12; 1992/93; Müller-Wille 1972, 102 Nr. 1; Müller-Wille 1973, 79 Nr. 1; Müller-Wille 1995, 134, fig. 7.1; Petersen 1919, 156-158, fig. 123; Petri 2016; Schulze-Dörrlamm 2012, 627, fig. 14; Vlasatý 2017; see also Willemsen in this volume.
12 Petri 2016, 187.
13 Petri 2014, 128.
14 Biborski and Ilkjær 2006a; 2006b.
15 Menghin 1983.
16 Stein 1967.
17 Geibig 1991.

Figure 2. Hilt of the sword from Wiskiauten. Photo: after Petri 2017, fig. 3.

Figure 4. Hilt of the sword from Starigard/Oldenburg. Photo: after Gabriel 2000, 07.03.01 a.

Figure 3. Hilt of the sword from Schwedt. Photo: after Petri 2017, fig. 16.

It is visible, that the grip lengths of swords increase continuously from about 7 to 9 cm in the third/fourth century to about 9 to 11 cm in the seventh/eighth century, in some cases to about 11 to 13 cm. Only in the twelfth century do the grips of some individual swords reach about 13 to 15 cm and in the thirteenth century about 15 to 17 cm.[18]

Analysis of hilt forms

A. Geibig explains the hollow pommel caps of the hilts of construction type II by the fact that in the case of some swords, the riveted end of the tang protrudes from the top of the upper guard and has to be covered by the cavity.[19] But for this purpose, these cavities would be unnecessarily large.[20]

The non-iron hilts, which in the case of bone are made of a lightweight material or in the case of cast components could easily be made completely hollow often deviate from the otherwise typical construction type II. Construction type II was thus possibly developed in order to be able to produce hollow hilts from iron.[21]

18 Petri 2014, 132.
19 Geibig 1991, 92-93.
20 Petri 2017, 173-174.
21 Petri 2017, 174.

Figure 5. The sharp-edged lateral upper guard termination of a replica of the sword from Starigard/Oldenburg cutting into the wrist when trying to hold the sword as an elongation of the arm while grasping the grip. Photo: after Petri 2019, fig. 2.

Figure 6. Enclosing the pommel of a replica of the sword from Starigard/Oldenburg in the hand together with the grip, so that little finger and ring finger rest on the pommel, whereby the sword can conveniently be held as an extension of the arm. Photo: after Petri 2019, fig. 3.

It is often believed that the pommels of Viking Age swords served as counterweights for the blade.[22] This function cannot apply to the hollow type II pommel caps.[23] Ph. Roskoschinski claims that the centre of gravity of Viking Age swords, according to experience, is a hand's width (about 8-10 cm) below the crossguard.[24] But in the case of the complete and well-preserved Viking Age swords published by I. Peirce, it varies from 6.5 cm to 28.4 cm below the crossguard.[25] There seems to be no regularity. It is possible that a certain position of the centre of gravity was not intended in Viking Age swords.[26]

Thus, probably a large pommel with low weight was intended. It is unlikely that they only serve an ornamental function[27] as the large pommels together with the usually short grip widths hardly allows the grip

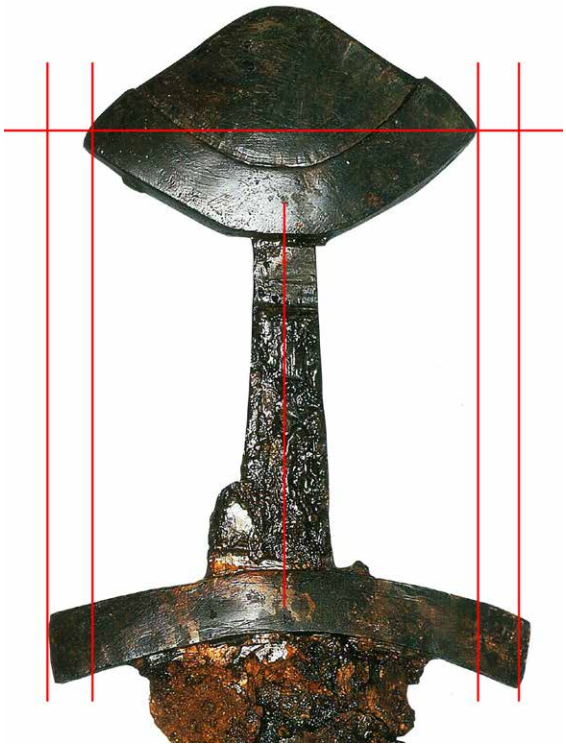

Figure 7. Asymmetries on the hilt of the sword from Starigard/Oldenburg. Photo: after Gabriel 2000, 07.03.01 a, modified.

to be comfortably grasped, and the freedom of movement of the sword hand is additionally greatly reduced by the relatively sharp-edged lateral terminations of the upper guards[28] (Figure 2-4) especially when trying to use maximum reach by holding the sword as an elongation of the arm (Figure 5).

Possible use of hilt forms

Since swords, with the exception of a few definite parade swords,[29] are optimised tools, an enlargement of the pommel for the purpose of decoration can be excluded as soon as it obstructs the manageability.[30] Otherwise hilt shapes would have to occur at the same time and in the same area, which are better suited for handling. But until the turn of the tenth to the eleventh century Northern and Eastern European hilt types are all characterised by their, at first sight, unsuitable shapes.[31] These types must therefore be optimised for a different way of handling. The flat shape of the pommels allows to enclose them in the hand together with the grip, so that little finger and ring finger rest on

22 Jankuhn 1951, 225; Konstam 2002, 120, 124; Morawe 1929, 294; Roskoschinski 2011, 98.
23 Petri 2014, 130.
24 Roskoschinski 2011, 98.
25 Peirce 2002.
26 Petri 2014, 132; 2017, 174.
27 Cf. Petri 2014, 130.
28 Petri 2014, 132; 2017, 174-175.
29 Geibig 1991, 102-103.
30 Warzecha 2014, 156.
31 Petri 2014, 132; Warzecha 2014, 160.

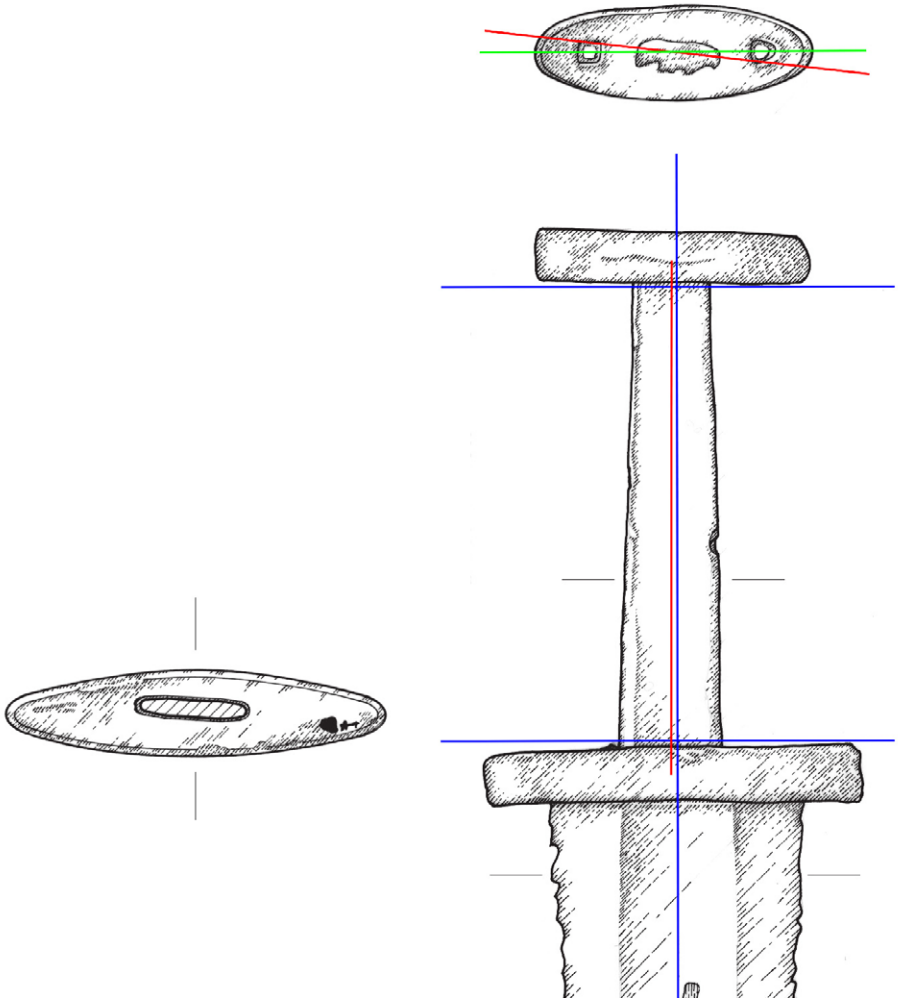

Figure 8. Asymmetries on the hilt of the sword from Awecken. Figure: after Petri 2017, pl. 6, modified.

the pommel. When performing a stroke, the pommel can easily slip into the palm of the hand, whereby the sword can be held as an extension of the arm (Figure 6). The mostly straight lower edge of the pommel provides a secure hold for the little finger and thus prevents the sword from sliding forward out of the hand.[32] So, these pommels are most likely not the end of the handle, but a component of it.[33]

Sword hilts are often not completely symmetrical.[34] For example, with the sword from Starigard/Oldenburg,[35] one side of the pommel is flatter than the other, the curvature of the baseline of the pommel is asymmetrical, as is the curvature of the crossguard and the crossguard is tilted sideways (Figure 7). The distance between the ends of the upper guard and the crossguard differs by 7 mm between both sides. This can of course be coincidental, but asymmetries occur in numerous Viking Age sword hilts. Certain asymmetries appear to be specific to certain types of hilts. For example the swords from Awecken, Wiskiauten and Zohpen[36] all belong to or are close to Geibig's combination type 11 and all show the same combination of asymmetries: the tang is not in the extension of the blade axis, but is shifted to one side and slightly angled. Thereby, crossguard and pommel are not parallel. The larger distance between pommel and crossguard is always on the side to which the tang is shifted (Figure 8-10). On the Awecken sword, pommel and crossguard are also rotated out of the plane of the blade, the pommel by approximately 5°.

These asymmetries appear to be very small. But if swords are held as described above, then they significantly improve the handling of the sword. After all, the human hand also is asymmetrical. For example, pommels rotated out of the plane of the blade. When the pommel slips into the palm of the hand when performing a stroke, it is

32 Warzecha 2014, 160, fig. 3b.
33 Petri 2017, 175.
34 Petri 2019, 7; Warzecha, forthcoming.
35 Gabriel 2000, 166 cat. no. 07.03.01 a; Gabriel and Kempke 2011, 73, plate 117.1, plate 134-137.
36 Petri 2017.

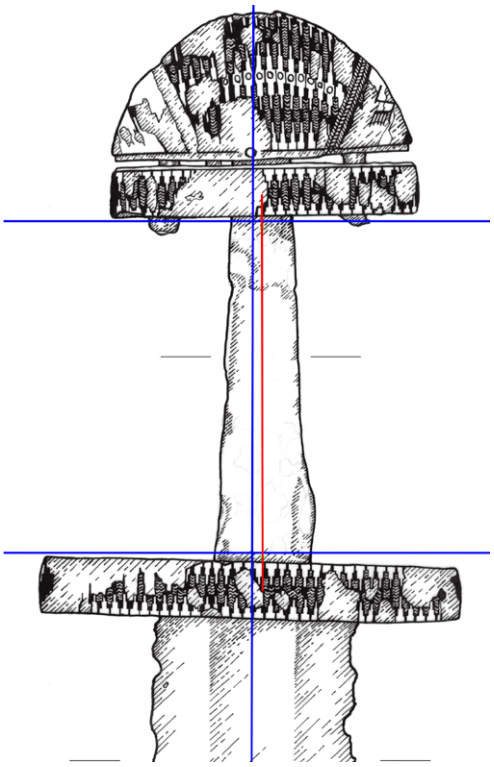

Figure 9. Asymmetries on the hilt of the sword from Wiskiauten. Figure: after Petri 2017, pl. 2, modified.

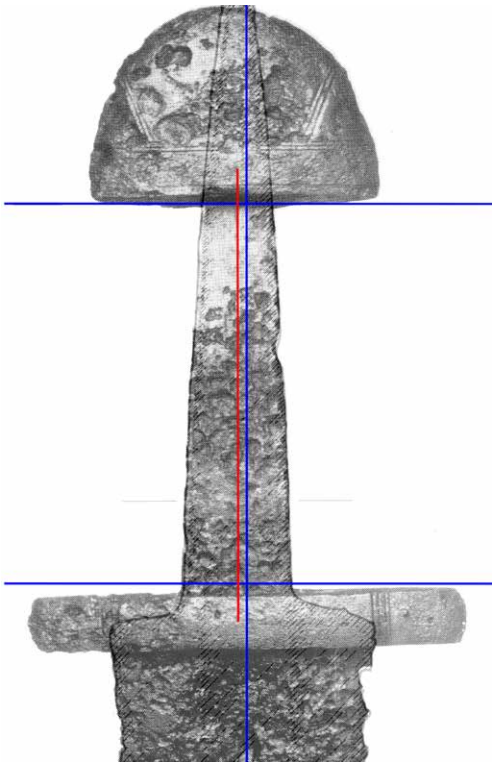

Figure 10. Asymmetries on the hilt of the sword from Zohpen. Figure: after Petri 2017, pl. 4, modified.

pushed to the side by the ball of the thumb and thereby the entire sword rotates around its axis. This makes the stroke imprecise. This is prevented by rotating the pommel. Rotated pommels could be observed on other swords as well, usually the rotation is in the direction fitting for right handers, as with the Awecken sword.

This question requires further study to show how often such asymmetries occur and whether they show regularities.

The blade and the sword as a whole

The blade and the overall shape of Viking Age swords will not be analysed in detail.[37] Only a summary of the results is given here.

The blade is the working part of the sword. Like the hilt, it should be shaped in a way to allow and facilitate the use of the weapon, but not to hinder it. The blades may be used for thrusting and cutting.

At the beginning of the Viking Age, the roughly parallel-sided blades with rounded points were optimised for thrusting against unarmoured opponents. In the course of the Viking Age period the blades got more and more adapted to armoured opponents by getting increasingly tapered towards the point and the point becoming sharper.

Even with parallel-sided blades, the blade´s thickness decreases towards the point. As a result, their effective mass is concentrated in the lower half of the blade, closer to the hilt than to the tip.[38] In contrast, hammers, axes, maces and also machetes have the concentration of their effective mass shifted to the upper half of the tool. The distribution of the effective mass of a sword means that its tip can be moved with little effort and thereby fast, but a blow will have less power than compared to for example an axe or machete. But moving the tip of an axe or machete requires much more effort and therefore is much slower.

Pivot points occur in pairs and are an effect of rotational inertia of the sword. Any given point along the length of the grip has a corresponding point in the blade.[39] When a point on the grip is moved, the sword naturally turns around the corresponding point in the blade. Turning the sword around a point in the blade that does not correspond to the point on the grip that is moved requires more effort and is thereby slower. So, using these points in the blade when moving the sword in combat means to have the greatest effect with the least effort – concerning power as well as speed.

37 For a more detailed analysis see Petri 2019, 7-9.

38 Johnsson 2015, 28-29, 34-40.

39 Johnsson 2015, 30-32, 34-40.

Possible use of swords

Bringing together the analyses of the distribution of the effective mass and of the pivot points of a sword shows that using a sword for delivering powerful chopping or hacking blows is very ineffective and contradicts the design of a sword. But the tip of a sword can be moved with little effort and thereby fast, even more when using the corresponding pivot points. So, swords are most probably optimised for winding actions, be it by winding them around the opponent´s weapon or shield or by using winding motions to close a line of attack. This winding is most effectively done by using maximum reach and pointing the sword´s point towards the opponent, thus threatening him and at the same time being as far as possible from his weapon.

Conclusion and perspective

Viking Age sword hilts are most probably shaped in a way to facilitate holding the sword as an elongation of the arm, the pommel forming a part of the grip. Their blades may be used for thrusting and for cutting. In the course of the Viking Age they become more and more adapted for thrusting against armoured opponents. The swords are not designed to deliver powerful chopping or hacking blows but most likely for winding actions.

These results could only be achieved by a careful study of the sources, especially the preserved swords. Using proper replicas of swords for experiments is crucial, as every change of the original design changes the handling characteristics. For example, in modern re-enactment swords the fact that the grips of Viking Age swords are not comfortably to be grasped is countered by making the grips much longer.[40] On the one hand, this means that the grip can now be comfortably enclosed with the hand. On the other hand, in combination with the mostly solidly executed pommel cap, the centre of gravity of the weapon is shifted in the direction of the hilt. Such swords behave completely different than the originals and are therefore not suitable for the reconstruction of Viking Age combat techniques.

The results presented in this article are only preliminary. Further investigations are necessary to take other aspects into account that could not be considered due to a lack of data. Many information necessary for it cannot be found in the literature, as the respective aspects have so far received little or no attention. So, for example small asymmetries of hilts should receive more attention as well as the physical properties of swords. Hopefully there will be more information for a more exhaustive study on the use of Viking Age swords available in the near future.

40 Roskoschinski 2011, fig. 1.

About the author

Ingo Petri is in charge of the department of museum education at the Varusschlacht im Osnabrücker Land gGmbH – Museum und Park Kalkriese. Besides this he works on early medieval weapons, especially on the development, manufacture and use of swords and shields. He started historical fencing in 2008. While his major discipline is sword and buckler fencing according to MS I.33, he also reconstructs the use of Germanic Iron Age and Viking Age swords and shields.

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DORESTAD AND ITS NETWORKS

Dorestad was the largest town of the Low Countries in the Carolingian era. As a riverine emporium on the northern edge of the Frankish Empire, it functioned as a European junction, connecting the Viking world with the Continent. In 2019, the National Museum of Antiquities in Leiden hosted its quinquennial international congress based around Dorestad, located at present-day Wijk bij Duurstede. This third edition, 'Dorestad and its Networks', coincided with the fiftieth birthday of finding the famous Dorestad brooch in July 1969, and with what would have been the hundredth birthday of prof.dr. Ina Isings, to whom a special session on early-medieval glass was dedicated.

The Third Dorestad Congress brought together scholars from the North Sea area to debate Dorestad and its counterparts in Scandinavia, the British Isles and the Rhineland, as well as the material culture, urbanisation and infrastructure of the Early Middle Ages. The contributions in these proceedings are devoted to new research into the Vikings at Dorestad, assemblages of jewellery, playing pieces and weaponry from the town, recent excavations at other Carolingian sites in the Low Countries, and the use and trade of glassware and broadswords in this era. They show the political, economic and cultural networks of Dorestad, the only town to be called 'vicus famosus' in contemporary sources.

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