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Where Worlds Collide

A Typological and Compositional Analysis of the Copper-Alloy Mounts from Viking-Age Walcheren

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Abstract

This article presents a combined compositional and typological analysis for a group of ninety Viking-Age mounts found in Walcheren, the Netherlands. This new analysis is supported by data gathered using Handheld X-Ray Fluorescence Spectrometry (HHpXRF). The new data sheds light not only on the character of the technology available at the time, but also allows us to formulate a new hypothesis of their purpose and cultural associations within a Viking-Age, North Sea world. Similar mounts have been found in other coastal areas of the southern North Sea, but not in great numbers, suggesting that production was more likely to have been local. Their compositional and typological characteristics matched those of certain forms of Viking-Age equestrian gear, but the relatively small size of these mounts allowed for the possibility that these items were more likely used on personal equipment. Although a question over the exact dating remains, the styles suggest that close ties existed between the Frisian, Viking, and Anglo-Scandinavian worlds between the ninth and eleventh centuries. This expression of identity should be considered in a context of continued intensive relations between Frisians, Vikings, and Anglo-Saxons.

1. Introduction

In this article we present a typological analysis for a group of ninety Viking-Age mounts, found in and around the North Sea coastal town of Domburg (Walcheren, the Netherlands). This new analysis is supported by compositional data gathered using Handheld X-Ray Fluorescence Spectrometry (HHXRF).¹ The new data sheds light not only on the character of the technology available at the time, but also allows a reconsideration of their functional use together with their role in expressing social identity within a Viking-Age, North Sea world.

¹ Also known as portable XRF (pXRF) and Handheld portable XRF (HHXRF).

Typological interest in ancient copper-alloy objects can be traced back well over two hundred years, but it has only been since the 1950s, with the invention of X-ray techniques such as Optical Emission Spectrometry (OEM), Neutron Activation Analysis (NAA), and X-Ray Fluorescence Spectrometry (XRF), that much compositional research has been undertaken. Studies using these techniques have revealed a lot about the technical choices presented to ancient craftsmen. The technical choice of alloying agents added to copper, namely, tin to make bronze, or zinc to make brass – with or without a quantity of lead – has revealed much about the complex relationship between composition and typology.² The technological limitations imposed on certain artefact types by the use of different alloy mixtures have been given particular attention, especially differentiating between items cast in a liquid form into a mould or wrought by beating into a desired shape with a hammer.³ But a combined typological and compositional approach to studying copper-alloy items – especially those from the early medieval period – has, up until now, been limited,⁴ particularly in the Netherlands where research has mainly centred

² David Dungworth, 'Roman Copper-Alloys: Analysis of Artefacts from Northern Britain', *Journal of Archaeological Science*, 24 (1997), 901-10 (p. 902).

³ For example, see Joseph Smythe, 'Roman Objects of Copper and Iron from the North of England', *Proceedings of the University of Durham Philosophical Society*, 9 (1938), 382-405; Henry Unglick, 'Structure, Composition and Technology of late Roman Copper Alloy Artifacts from the Canadian Excavations at Carthage', *Archaeomaterials*, 5 (1991), 91-110; Josephine Bayley and Sarnia Butcher, 'The Composition of Roman Brooches found in Britain', *Acta of the 12th Congress on Ancient Bronzes, Nijmegen 1992* (Amersfoort: Rijksdienst voor het Oudheidkundig Bodemonderzoek, 1995), pp. 113-19; Josephine Bayley and Sarnia Butcher, *Roman Brooches in Britain: A Technological and Typological Study based on the Richborough collection* (London: The Society of Antiquaries of London, 2004); Paul Craddock, 'Copper Alloys of the Hellenistic and Roman World: New Analyses and Old Authors', in *Aspects of Ancient Mining and Metallurgy*, ed. by John Jones, *Acta of the British School at Athens Centenary Conference, 1986* (Bangor: University College of Wales, 1988) pp. 55-65.

⁴ For example, see Bayley and Butcher, *Roman Brooches in Britain*; Marcos Martínón-Torres and others, 'Forty Thousand Arms for a Single Emperor: From Chemical Data to the Labor Organization Behind the Bronze Arrows of the Terracotta Army', *Journal of Archaeological Method and Theory*, 21 (2012), 534-62; Marcus Roxburgh, Hans Huisman and Bertil van Os, 'All change? The End of a Metalworking Tradition in Early Medieval Frisia', *De Vrije Fries*, 94 (2014), 19-30.

upon typological concerns.⁵ Therefore, we present this combined analysis of this interesting group of mounts and formulate a new hypothesis about their purpose and cultural associations.

1.1 The Selection of Material

A great many of the copper-alloy mounts selected for this article were recovered from the beach adjacent to the modern seaside town of Domburg, and subsequently published in a catalogue by Capelle in 1976.⁶ These mounts, along with a great many more beach finds, found their way into the collections of the Zeeuws Museum and the Cultural Heritage Agency of Zeeland's archaeological depot (SCEZ), partly as the collection of the Koninklijk Zeeuwsch Genootschap der Wetenschappen (KZGW; the Royal Zeelandic Society of Sciences)⁷, in Middelburg. Access to the material was initially granted for a compositional study by Pim van Tendeloo from the Vrije University, Amsterdam, with additional scientific support from the Dutch Cultural Heritage Agency.⁸ In 2014, the data from this study was kindly donated to a much larger compositional survey undertaken by the first author, as part of his ongoing PhD research project.⁹ A follow up visit was subsequently undertaken in late 2014 to gather more compositional data from finds from a wider geographic area (Walcheren and the province of Zeeland), and it was observed at this point that the large number of Viking-Age mounts being presented for analysis warranted more detailed investigation. This same conclusion had also been reached by the second author, after conducting an examination

⁵ See Torsten Capelle, *Die frühgeschichtlichen Metallfunde von Domburg auf Walcheren* ('s-Gravenhage: ROB, 1976), Hans-Jörg Frick, 'Karolingisch-ottonische Scheibenfibeln des nordlichen Formenkreises', *Offa* 49/50 (1992), 243-409, Stefan Thörle, *Gleicharmige Bügelfibeln des Frühen Mittelalters*, Universitätsforschungen zur prähistorischen Archäologie 81 (Bonn: Habelt, 2001), Jurjen Bos, 'Medieval Brooches from the Dutch Province of Friesland (Frisia): A Regional Perspective on the Wijndaldum Brooches. General Introduction', *Palaeohistoria*, 47/48 (2006), 447-54.

⁶ Capelle, *Die frühgeschichtlichen Metallfunde*, p. 28, Taf. 20-22.

⁷ Many thanks to Aagje Feldbrugge for providing photographs of the collection.

⁸ Pim Van Tendeloo, 'A Compositional Analysis of Copper-Alloys from Early Medieval Domburg', (Unpublished master's thesis, Vrije Universiteit Amsterdam, 2017).

⁹ 'Charlemagne's Workshops' – based at the department of Roman Provinces, Middle ages and modern period, Faculty of Archaeology, Leiden University – is an investigation into the composition of early medieval copper-alloys.

of a number of the mounts, within a wider selection of Zeeland objects, undertaken as part of her ongoing PhD project.¹⁰ Therefore, the decision was made to select a coherent group of items from the Domburg collections and to study them from a combined, compositional, typological, and contextual point of view.

The mounts and associated items selected for this study were classified as follows (Fig. 1).

The first group consists of five items that have been assigned the name pendants (Fig. 1, a1, a2). They appear to be designed to hang from another object, which could possibly have been an object similar to the pendant mounts (Fig. 1, b1, b2) discussed below. If these objects were intended to swing freely, then the term pendant is valid. However, they may equally have been used as a clasp or closing mechanism, perhaps for a bag or box. The holes running through the centres of the pendants could have been functional rather than decorative, allowing them to be pushed onto a peg or similar mechanism, thus acting as a closing device.

The second group of six items has been assigned the name pendant mounts (Fig. 1, b1, b2). This is because we have already made an association with the pendant group mentioned above. These objects appear to have been designed for mounting to another object, perhaps a leather strap or a box lid. Another object, perhaps similar to Fig. 1, a1, a2, would have completed the assembly by being attached to the lower end via a retaining pin.¹¹

The third group, the largest with fifty-three items, has been assigned the name strap-end mounts. They typically have two holes to allow them to be riveted onto another item (a number of these survive with rivets still in place). This other item again could have been a leather strap or possibly wood, either of which would have corroded very quickly after deposition. A common theme throughout this group is that they all bear decorative animal heads at one end, either singularly (Fig. 1, c1, c2) or in some cases two, perhaps representing a double-headed creature (Fig. 1, c3). Many of these animal heads appear to curve inwards slightly as if conforming to the shape of the object to which they were once attached (e.g., Fig. 1, c1).

The last group of twenty-two items is distinguished by two lozenge-form holes alongside two smaller rivet holes (Fig. 1, d1). These have been

¹⁰ Interdisciplinary PhD project at the University of Groningen on Frisia in a Viking-Age North Sea World. Material from Zeeland was examined in October 2013 during the *Workshop on the Early Medieval Metalwork from Domburg* (Middelburg, 15 Oct 2013) and during a visit to the SCEZ. With thanks to Henk Hendrikse, Aagje Feldbrugge and Pieterjan Deckers.

¹¹ Discussed later in Section 4.3 with reference to drawings in Fig. 7, d, f.

Fig. 1. Pendant mounts (a), Strap-end mounts (b), Strap-links (c), Strap-links (d). Drawn by first author.

assigned the name strap-links and initial observations suggest that they may link two thin leather straps together. However, this is less clear when the rivet holes are analysed. As per the other groups just described, these strap-links seem to have been riveted to another item such as a leather strap or piece of wood. Therefore, they may have functioned as a closing device or as a device from which another object could hang.

1.2 Find Locations and Historical Context

Most of the mounts presented in this study came from locations near to modern day Domburg. These were mainly beach finds from an early medieval settlement and grave fields now lost under the sea. Many of the beach finds made their way into the KZGW-collection, which was collected between Oostkapelle and Domburg in the nineteenth and early twentieth centuries.¹² An additional five mounts came from excavations in the *Ringwalburg* or circular fort (built in the ninth century) in the present-day town, found by ARC in 2010.¹³ An additional two mounts were presented from the area around Middelburg and a further mount is known from Oost-Souburg but was not available for the compositional study.

The present seaside town of Domburg lies on the Northwest coast of Walcheren. Walcheren, as well as other parts of the Dutch coastal area, belonged to the historical region of Frisia, which stretched from the border of Belgium in the south-west to the river Weser in Germany in the north-east. Even after incorporation in the Frankish realm in the eight century, the area remained known as Frisian. From time-to-time, the North Sea reveals Domburg's earlier origins along the beach, at very low tides, in the form of settlement structures, grave fields, and thousands of metal finds, which were frequently washed ashore after heavy storms.¹⁴ It is thought that activities may have continued into the tenth and eleventh centuries, during which time the area was gradually covered in drifting sand and eventually lost under large dunes, primarily due to the effects of coastal erosion and the prevailing westerly winds.¹⁵ The first record of beach

¹² With thanks to Aagje Feldbrugge for providing the information.

¹³ Adrie Ufkes, *Een archeologische opgraving in de vroegmiddeleeuwse ringwalburg van Domburg*, ARC-Publicaties 223 (Groningen: ARC, 2011).

¹⁴ Wybrand Op Den Velde and Cornelis Klaassen, *Sceattas and Merovingian Deniers from Domburg and Westenschouwen* (Middelburg: Koninklijk Zeeuwsch Genootschap der Wetenschappen, 2004), p. 3.

¹⁵ Saskia Jelgersma and Jean-François Van Regteren Altena, 'An Outline of the Geological History of the Coastal Dunes in the Western Netherlands', *Geologie*

finds is from January 1647,¹⁶ when sandstone altars from a roman temple were revealed along with numerous coins, which were subsequently collected from the beach by the local inhabitants. From this point onwards a combination of storms and low tides have at intervals revealed more settlement structures, graves, and much metalwork, including the largest number of sceattas and Merovingian deniers ever found at one location in all the North Sea countries.¹⁷ It has been proposed that this lost settlement was called *Walichrum*, from which the island takes its name, and, as the archaeology suggests, that it must have been quite an important settlement and trading site in early medieval times.¹⁸

It has also been suggested by the number of finds, especially coins, that this was the site of an emporium, a trading post originating in the late sixth century – facilitating interregional trade around the North sea and Britain especially – with trade that lasted well into ninth century.¹⁹ Its importance in the Carolingian period could have almost matched that of Dorestad;²⁰ however, during the ninth century, this role appears to have been taken over by other trading sites.²¹ The situation was possibly made worse by subsequent Viking raids resulting in Walcheren being given to Danish warlords as a fiefdom by the Frankish emperor Lothar I. It is thought that the trading post declined rapidly during the last quarter of the ninth century, the time in which a large defensive ring fort or ‘burg’ was built nearby, possibly as a refuge from ongoing Viking raids.²² This

en Mijnbouw, 48 (1969), 335-42; Leendert Louwe Kooijmans, ‘Archaeology and Coastal change in the Netherlands’, in *Archaeology and Coastal Change*, ed. by Frederick Thompson, The Society and Antiquarians of London, Occasional paper (New Series) 1 (London: 1980), pp. 106-33.

¹⁶ Cornelis Rethaan Macaré, *Verhandeling over de bij Domburg gevondene munten* (Middelburg: Zeeuws Genootschap, 1838, Repr. 1992).

¹⁷ Op Den Velde and Klaassen, *Sceattas*, V.

¹⁸ Capelle, *Die frühgeschichtlichen Metallfunde; Vroeg-Middeleeuwse ringwalburgen in Zeeland*, ed. by Robert van Heeringen and others (Goes: De Koperen Tuin. 1995), pp. 34-44.

¹⁹ *Vroeg-Middeleeuwse ringwalburgen*, p. 2.

²⁰ Capelle, *Die frühgeschichtlichen Metallfunde*, p. 5

²¹ Capelle, *Die frühgeschichtlichen Metallfunde*, p. 5; *Vroeg-Middeleeuwse ringwalburgen*, p. 230.

²² *Vroeg-Middeleeuwse ringwalburgen*, p. 230. This identification has been questioned and the idea was proposed that it could have indeed been a Viking construction. See Letty Ten Harkel, ‘A Viking Age Landscape of Defence in the Low Countries’, in *Landscapes of Defence in Early Medieval Europe*, ed. by John Baker and others (Turnhout: Brepols, 2013), pp. 223-59.

'burg' subsequently formed the nucleus around which the later town of Domburg grew. Danish rule is thought to have come to an end by at least 884, when the last Danish benefice-holder died; from this time onwards, power transferred to local counts.²³ It also appears the region, at this time, was used for the production and export of Frisian cloth – *pallia fresonica*.²⁴ From the late ninth until the early eleventh century, the ring fortress at Domburg remained inhabited and, during this Viking Age, connections between the Frisian coast, Scandinavia, and the British Isles seem to have continued.²⁵ This history is indicated by a handful of Viking finds (in particular of the Borre style) that were recovered from excavations in the fortress in 2010 and are dated to the late ninth or early tenth century.²⁶ The material selected for our current analysis, therefore, is all generally thought to date from the ninth century to the end of the eleventh century and thus falls within this Viking Period (Fig. 2).

1.3 Research Orientation and Questions

A literature search of early medieval copper-alloys revealed that much had already been published on fibulae, strap-ends, stirrup-strap mounts, and horse harnesses. Useful typologies now exist for the fibulae found around Domburg.²⁷ Strap-ends are also a frequent find and can be compared, to some extent, to the typologies created by Thomas for Viking-Age Britain.²⁸ However the mounts presented here bear little similarity to either fibulae or strap-ends, so other associations need to be considered. The lozengi-form shape of the strap-links in Fig. 1, d. provides a worthwhile lead and

²³ Simon Coupland, 'From Poachers to Gamekeepers. Scandinavian Warlords and Carolingian Kings', *Early Medieval Europe*, 7 (1998), 85-114.

²⁴ *Vroeg-Middeleeuwse ringwalburgen*, pp. 233-35.

²⁵ Nelleke IJssennagger, 'A Viking Find from the Isle of Texel (Netherlands) and its Implications', *Viking and Medieval Scandinavia*, 11 (2015), 127-42.

²⁶ Ufkes, *Een archeologische opgraving*.

²⁷ Stefan Thörle, 'Gleicharmige Bügelfibeln des Frühen Mittelalters', *Universitätsforschungen zur prähistorischen Archäologie* 81 (Bonn: Habelt, 2001); Jurjen Bos, 'Medieval Brooches from the Dutch Province of Friesland (Frisia): A Regional Perspective on the Wijnsdum Brooches. Part I: Small Equal-Armed Brooches', *Palaeohistoria* 47/48 (2006), pp. 455-77; Jurjen Bos, 'Medieval Brooches from the Dutch province of Friesland (Frisia): A Regional Perspective on the Wijnsdum Brooches. Part II: Disc Brooches', *Palaeohistoria*, 47/48 (2006), 709-93.

²⁸ Gabor Thomas, 'A Survey of Late Anglo-Saxon and Viking-Age Strap-Ends from Britain' (Unpublished doctoral thesis, University of London, 2000).

Fig. 2. Find locations for the mounts in this study.

similarities to the Anglo-Scandinavian horse harness become apparent when reviewing the literature.²⁹ But the size of the individual items makes this interpretation problematic because if the width of modern horse harnesses is considered, the Walcheren mounts are very small,³⁰ and the holes especially seem too small to take a leather strap strong enough to withstand equestrian activities. Viking-Age stirrup-strap mounts³¹ are the other class of item that need to be considered as there are a number of stylistic similarities, which will be discussed further below. But, as already stated, the mounts we are concerned with appear to be too small for an equestrian application.

So, the questions we address here are straightforward. First, can we gain a clearer understanding of their function through a combined compositional/typological approach? In doing so, can we say something from the composition, for example, about the likely organisation of production and their subsequent distribution? Second, can we infer anything new about the cultural associations the decoration of these objects may hold? By comparison to finds from other areas, both within the Netherlands and beyond, can we provide a wider (historical) context for the phenomenon? For example, can we support an Anglo-Saxon or Anglo-Scandinavian context to these objects, or do we need to consider a more local continental origin?

2. Theory and Methodology

2.1 Theory

The main assumption is that through a combined compositional/typological approach, something useful can be gained about the social organisation behind the production and use of these objects. To do this we must draw on what is already known about the organisation of craft production at this time.

In an attempt to model early medieval craft production, the Flemish historian Verhulst suggested that artisan activities were mainly located around abbeys, royal courts, large estates, and urban centres, with the

²⁹ See David Williams, *Anglo-Scandinavian Horse Harness Fittings*, FRG Datasheet 39 (The Finds Research Group AD 700-1700, 2007).

³⁰ See Capelle, *Die frühgeschichtlichen Metallfunde*, Drawings 334, 335, 336 as examples. The overall lengths are between 4-5 cm.

³¹ See David Williams, *Late Saxon Stirrup-Strap Mounts: A Classification and Catalogue* (York: Council for British Archaeology, 1997).

addition of a small proportion of travelling artisans, perhaps less regulated than those living within more static environments.³²

The exact nature of these craft activities and the social position of the artisans who produced them is still attracting some debate. However, different organisational structures for artisan activities must have existed. Söderberg, a Swedish archaeologist and craftsman, adopted the classification proposed by Hedegaard in his attempt to study Viking-Age workshop organisation.³³ Models for copper-alloy craft activities could therefore be differentiated between casting at or by:

- a) Royal centres, with professional craftsmen possibly engaged as bondsmen.
- b) Supra-regional, professional, permanent workshops, with the products destined for periodic markets.
- c) Permanent administered urban production sites, such as Emporia, e.g., Dorestad and Hamwic.
- d) Infrequently used primitive workshops, making socially determined goods and exhibiting little experimentation.
- e) Merchants, whilst travelling, producing simple ingots and weights.
- f) Domestic households, non-professional, including simple jewellery and repairs.

The technology and artisanal skill required to produce copper-alloy mounts can be compared to these theoretical workshop models. Artisans are frequently able to choose the raw materials involved and the quantities required to repeatedly produce the artefacts that they are skilled at making. For copper alloy, this can take the form of melting fresh or recycled metal supplies or even the smelting of ores if, perhaps, production is close to the area of extraction. Typological evidence in terms of morphological consistency can also be combined with a comparison of alloy choice. Consistency (or otherwise), when studied over wide geographic areas, can suggest how standardised production was in terms of intentional choice (Martín-Torres and others, 'Forty Thousand Arms for a Single

³² Adriaan Verhulst, *The Carolingian Economy* (Cambridge: Cambridge University Press 2002), p. 72.

³³ Ken Hedegaard, 'Bronzestøberhåndværket i yngre ger- manertid og tidlig vikingetid i Skandinavien teknologi og organisation', *Lag* (1992), 75-92; Anders Söderberg, 'Metallurgic Ceramics as a Key to Viking Age Workshop Organisation', *Journal of Nordic Archaeological Sciences*, 14 (2004), 115-24.

Emperor,' p. 536). The level of standardisation present, therefore, can then be modelled conceptually against Söderberg's organisational structures and, subsequently, something can be suggested about how their production interacted within the wider North Sea economy.

How does Hand-Held XRF work?

The technique employed for the compositional research is Handheld XRF, which has the same principles as more conventional laboratory based XRF, but is typically hand-held, working in the field, at a lower wattage.³⁴ An X-Ray tube with a silver anode fires a primary X-Ray beam at the object of interest. As a result, this beam causes the atoms in this object to become excited resulting in the release of electrons, freed from their place within their normal atomic structure. The energy given off by the release of electrons is measured by a detector; mounted within the equipment, and as this energy level is unique for each element, it can be characterised, and an assessment of the ratio of each elements present can be made.

A single Niton XL3t GOLDD XRF analyser was used for the compositional study. These machines automatically adjust anode current settings to ensure optimal counts and are factory calibrated, using a fundamental parameters method with standards for metals and alloys. The analyser was fitted with a silicone drift detector with optimised geometry; furthermore, the analysis did not use filters or vacuum or helium purges. The electronic metals mode was selected and used throughout the data-gathering phase. The advantage of this mode is that the same metals are used (Cu, Sn, Ag, Zn, Au) in modern electronic equipment, or are marked as potential hazardous materials (Pb, Hg, As, Se) as can be found in medieval alloys. In the field, the analyser was mounted on a lead-covered portable test bench to provide a consistent operating environment and protect the user from radiation. After testing with longer measuring times, the signal was found to be stable after a reading time of 35 seconds, so this was deemed sufficient to determine an elemental count of 10ppm for most elements. The lower limit of detection was determined for each measurement separately, as it was affected by the matrix (i.e., alloy composition). If the matrix is

³⁴ For more technical details and applications in archaeology, see *X-Ray Fluorescence. Spectrometry (XRF) in Geoarchaeology*, ed. by Michael Shackley (New York: Springer-Verlag, 2011); *Handheld XRF for Art and Archaeology*, ed. by Aaron Shugar and Jennifer Mass, Studies in Archaeological Sciences, 3 (Leuven: Leuven University Press, 2012); *Portable X-ray Fluorescence Spectrometry: Capabilities for In Situ Analysis*, ed. by Phillip Potts and Margaret West (Cambridge: Cambridge University Press, 2008).

favourable, the 10ppm detection limit is obtainable. Analyses where the element concentration was below the matrix-influenced detection limit were equalled to 0. Two spectrum readings per 35-second interval were taken, the first for the main range of elements at 50kV (Cu-K to Ba-K, and Au-L to Pb-L) and the second for the low range at 10kV (Al-K to Cu-K). The spectra processing was done using dedicated Niton software; after the analyses, the spectra were checked for unexpected peak overlaps.

One measurement per mount was taken and an external normalisation of the completed dataset in Microsoft Excel™ was undertaken, which corrected for the contribution of the light elements that would be present due to contamination from soil residues (such as sand, clay, and iron hydroxides). The elemental concentrations of the alloying elements were normalised on a light elements (Si-Fe) free basis. In the present paper, only the deliberate alloying elements (Sn, Zn, Pb) are considered. The factory calibration of the device was checked against the CHARM-bronze reference set³⁵ (see Fig. 3, left), and bias due to corrosion was also evaluated by comparison to studies on corroded Roman finds, which revealed that a depletion in copper and zinc takes place, altering measurements recorded on the outer surface of an item.³⁶ Quantitative analysis using HHXRF is well accepted now on obsidian, for example, but there has been some debate on the suitability of use on heterogeneous materials such as corroded non-ferrous metals.³⁷ The results presented in this paper are interpreted in a qualitative or semi-quantitative way.

The ternary diagram (Fig. 3, right) demonstrates the difference in graph location for corroded and non-corroded results.³⁸ In this case, values containing zinc move towards the brass corner of the graph as the ratio of zinc to the other elements increases. Therefore, if it had been possible to

³⁵ Arien Heginbotham and others, 'The Copper CHARM Set: A New Set of Certified Reference Materials for the Standardization of Quantitative X-Ray Fluorescence Analysis of Heritage Copper Alloys', *Archaeometry*, 57 (2014), 856-68.

³⁶ See Vince van Thienen and Sylvia Lycke, 'From Commodity to Singularity: The Production of Crossbow Brooches and the Rise of the Late Roman Military Elite', *Journal of Archaeological Science*, 82 (2017) 50-61; Ricardo Fernandes and others, 'The use of Hand-Held XRF for Investigating the Composition and Corrosion of Roman Copper-Alloyed Artefacts', *Heritage Science*, 1-30 (2013), 1-7 for similar methodologies.

³⁷ Heginbotham and others; Michael Shackley, 'Is There Reliability and Validity in Portable X-ray Fluorescence Spectrometry (PXRF)?' *The SAA Archaeological Record*, 10 (2010), 17-20.

³⁸ Using Grapher™ 10, software.

clean the mounts studied in this paper (by destructively removing outer layers), it would be expected that the results in Section 3.1 (below) would behave in the same way.³⁹

2.2 The Interpretation of Compositional Data

The classification scheme developed by Bayley and Butcher for their compositional study of Roman brooches was adopted here.⁴⁰ They used ternary graphs to visualise three variable groupings, in this case, the three main alloying elements in copper-alloy: tin, zinc, and lead (see Fig. 3). The names given to the areas of the graph are, of course, associated with terminology employed in modern metallurgy; however, it is important to understand that ancient names and their corresponding alloy ratios are less understood.⁴¹ Attempts to apply modern classifications could less likely represent working limits set out by ancient craftsmen. But, by visualising large numbers of measurements, as presented in this article, the data may reveal patterning that better reflects ancient technical choice. The graphs presented in Fig. 4 are of other types of items measured in the larger PhD research program of the first author.⁴² They have been included to demonstrate how different artefact types produce classifiable groups when measured in large numbers. Stirrup-strap mounts can be interpreted as a leaded brass, disc fibulae as a higher leaded brass or leaded copper, and a large number of ring pins are of a leaded bronze. The results in Section 3.1 are presented with these classifications in mind.

³⁹ For further reading on corrosion, see Luigi Campanella and others, 'The Effect of Tin on Dezincification of Archaeological Copper Alloys', *Corrosion Science*, 51 (2009), 2183-191; Matthew Nicholas and Panagiota Manti, 'Testing the Applicability of Handheld Portable XRF to the Characterisation of Archaeological Copper Alloys', in *ICOM-CC 17th Triennial Conference, Melbourne, 15-19 September 2014*, art. 0904, ed. by Jane Bridgland, (Paris: International council of museums, 2014), pp. 1-13; Vana Orfanou and Thilo Rehren, 'A (not so) Dangerous Method: pXRF vs. EPMA-WDS Analyses of Copper-based Artefacts', *Archaeological and Anthropological Sciences*, 7 (2014), 387-97.

⁴⁰ Bayley and Butcher, *Roman Brooches in Britain*, p. 24, for their definitions of brass and bronze.

⁴¹ Bayley and Butcher, *Roman Brooches in Britain*, p. 14.

⁴² Marcus Roxburgh and others, 'A Workshop at the Edge of the World? A Compositional Analysis of Copper-Alloy finds from Viking Age Walcheren', in *A Central Place on the World's Edge: Studies on the Early Medieval History and Archaeology of the Island of Walcheren, the Netherlands*, ed. by Pieterjan Deckers and Letty Ten Harkel (Turnhout: Brepols, in press).

Fig. 3. Ternary graphs showing: compositional classifications (after Bayley and Butcher, 'The Composition of Roman Brooches', Fig. 7), measurement bias compared to CHARM standard (left) and deviation in measurement due to corrosion (right). Drawn by first author.

Fig. 4. Comparative ternary graphs showing corroded, compositional results for three groups of Walcheren finds, Stirrup-strap mounts (a) Disc fibulae (b) and Ring pins (c).

Fig. 5. Ternary graph showing corroded, compositional ratios of the 90 mounts in this study (inset: mounts plotted as crosses overlaid with Stirrup-strap mounts (Fig. 4a) plotted as dots).

3. Results

3.1 Compositional Analysis

The results of the compositional analysis (Fig. 5) shows a clear grouping, well within the brass making copper-alloy tradition. It has been shown in Fig. 3 that the effects of corrosion on this data produces lower zinc levels than if we were able to analyse fresh uncorroded alloys. This suggests, therefore, that if it were possible to measure uncorroded metal, the zinc levels would have been higher, resulting in an even tighter grouping towards the brass corner of the graph, perhaps also resulting in fewer outliers.

3.2 Typological Analysis

The mounts are unevenly divided over four groups (a-d) according to their possible function. Within the groups – in particular, the largest groups c and d – subdivisions can again be made on the basis of the typological features. All ninety mounts fall into these groups and a typological analysis will be presented in this Section. Most mounts in this analysis have already been catalogued and described by Capelle, and his descriptions are taken as a starting point for further discussion. As noted by Capelle, most mounts are characterised by decorative animal heads, or the probable remains of what would originally have been animal heads, and he dates them mainly to the ninth century.

Animal heads and other zoomorphic decoration are a general part of Germanic art styles, from early Migration Period styles into the Viking Age. They are often thought to be related to the mythological world, and in pagan Norse mythology, many types of animal were used as personal guardians⁴³ or as symbols referring to mythological tales. For example, Odin had an eight-legged horse called Sleipnir who features in many northern shamanic traditions,⁴⁴ as well as two ravens, Huginn and Muninn, representations of which can frequently be found on objects such as fibulae. The Midgard-serpent is also a well-known animal, and

⁴³ Peter Jordan, 'The Materiality of Shamanism as a 'World-View': Praxis, Artefacts and Landscape', in *The Archaeology of Shamanism*, ed. by Neil Price (London: Routledge, 2001), pp. 87-104 (p. 101).

⁴⁴ Neil Price Shamanism and the Viking? in *Vikings: The North Atlantic Saga*, ed. by William Fitzhugh and Elizabeth Ward (Washington: Smithsonian, 2000), pp. 70-71.

serpents figure in pagan symbolism as well. Freyja had a chariot pulled by Bygul and Trjegul, two male cats. The cat features frequently in Viking-age Borre style art, a style popular between 850-975.⁴⁵ Many pre-Christian copper-alloy items from Anglo-Saxon England also feature animal forms, which in some cases have been considered to imbue protective qualities on their wearer.⁴⁶ Whether or not they were imbued with a particular mythological meaning, animal-like creatures are also found on objects from Frisia as well, such as fibulae and bracteates. By the Viking Age though, this zoomorphic decoration is popular in the Christian sphere of influence as well as the Norse and, therefore, need not be identified as a purely pagan style.

As already mentioned in Section 1.3, there are many similarities between the Walcheren material and what is classified as the Anglo-Scandinavian horse harness, decorated in a Ringerike or a related style – a style which may have developed from earlier pagan zoomorphic imagery, but is dated to the eleventh century.

Pendants (a)

The first group comprises five pendants, classified as such because they appear to be designed to hang from another object. These include three animal head pendants with a single rivet hole (Fig. 1, a1) and two openwork zoomorphic pendants (Fig. 1, a2). Of these, only one of the openwork pendants was described as such by Capelle; the rest are classified as mounts. Indeed, for the three animal head pendants that also have a single rivet hole, their function is not as clear, since they closely resemble other mounts (with one or more rivet holes) with similar animal heads. Animal head decoration frequently appear in different decorative styles. The animal heads on these 3 mounts, however, cannot be assigned to a certain style or exact period at present, but, most likely, they date between the tenth and eleventh centuries. Two of the open-work pendants – GA0095 and 0032-68 – consist of two animals facing each other (Fig. 6). GA0095 is most clear in style and mostly resembles a late Viking style, possibly the

⁴⁵ Charlotte Hedenstierna-Jonson, 'Borre Style Metalwork in the Material Culture of the Birka Warriors: An Apotropaic Symbol', *Fornvännen*, 101 (2006), 312-22 (p. 312).

⁴⁶ Tania Dickinson, 'Symbols of Protection: The Significance of Animal-Ornamented Shields in Early Anglo-Saxon England', *Medieval Archaeology*, 49 (2005), 109-63 (p. 161).

Fig. 6. Double animal head pendant Nr. 0032-68 Photo: Koninklijk Zeeuws Genootschap der Wetenschappen.

Ringerike style popular in the eleventh century.⁴⁷ Two animals facing each other is also a standard feature on Anglo-Scandinavian horse harness pendants.⁴⁸ It should be noted that the two animals on GA0095 differ slightly in size, so the pendant is not entirely symmetrical. The other zoomorphic pendant represents two animals facing each other, albeit highly stylized.

Pendant Mounts (b)

Six pendant mounts have been identified with either one or two rivet holes (Fig. 1b). Only 0039-17 (old id. 2125K to distinguish it from other items numbered 0039-17, and Capelle nr. 361) can be considered as complete, two more may possibly be complete, but the remaining three are certainly fragmented. On three of the pieces we find animal head decoration. On

⁴⁷ Jane Kershaw, *Viking-Age Scandinavian Art Styles and their Appearance in the British Isles Part 2: Late Viking-Age Art Styles, Datasheet 43* (The Finds Research Group AD 700-1700, 2010), p. 3.

⁴⁸ Williams, *Anglo-Scandinavian Horse Harness Fittings*, 6. See also PUBLIC-1FCD40 in the PAS database (Lincolnshire). Our example is 3.3 cm high, while the PAS example is 4.8 cm high.

Fig. 7. Single animal-head mount Nr. 0032-55. Photo Koninklijk Zeeuws Genootschap der Wetenschappen, www.zeeuwsgenootschap.nl.

0039-17, the animal head can be seen in full detail and may possibly relate to the Borre style or a later Viking style, particularly with reference to its pointed ears.

Strap-end Mounts (c)

This is by far the largest category of mounts and they can be divided into those with one animal head (Fig. 7) with either one (Fig. 1, c2) or two (Fig. 1, c1) rivet holes, and those with two animal heads (Fig. 1, c3, and Fig. 8). A number of the animal heads seem comparable with Borre style and there are similar items in the PAS database, mostly dated to the eleventh century, and some dated earlier between 900 and 1100.

Strap-links (d)

The strap-links with lozengiform holes again have close parallels in horse harness links and other related pieces (Fig. 9). Williams classified this style as Anglo-Scandinavian.⁴⁹ These strap-links also bear some stylistic

⁴⁹ Williams, *Anglo-Scandinavian Horse Harness Fittings*.

Fig. 8. Double animal-head mount Nr. 0032-80. Photo Koninklijk Zeeuws Genootschap der Wetenschappen, www.zeeuwsgenootschap.nl.

Fig. 9. Lozengiform strap-link Nr. 0032-68. Photo Koninklijk Zeeuws Genootschap der Wetenschappen, www.zeeuwsgenootschap.nl.

similarity to Viking keys (cf. LVPL-3Co7ED) dated around the mid-ninth to the end of the eleventh century, a number of which have recently been found in the northern Netherlands.

It is possible, therefore, that some of the mounts date to the ninth or early tenth centuries, particularly if they can indeed be related to a Borre style.

For other pieces, a later tenth or eleventh century date is most likely, for instance, when related to a Ringerike style. In general, though, the pieces can be considered to date between the ninth to eleventh centuries, the late Viking Age. It must be stressed that while seeming related, they are not clear examples of a pure Viking style, as is the case for a number of other items found in the ring fortress excavations of 2010.⁵⁰ However, a resemblance of Viking and Anglo-Scandinavian decoration styles is clear.

3.3 Parallels

Similar mounts to those recovered at Walcheren have been found elsewhere. As mentioned in Section 1.3, the mounts from Walcheren were subjected to a literature search. Metal detector finds from the Flanders coast have revealed a small number of mount-like objects decorated in a similar manner, in addition to two Stirrup-strap mounts and other possible horse harness material in a Borre or related art style.⁵¹ Further close parallels may be present in other collections, both in the Netherlands and abroad. So far, we have identified a number of them. It must be noted that these do not represent a full corpus, or the result of an extensive search program. These are items that have been located at the Noordelijk Archeologische Depot in Nuis⁵² and online in the Portable Antiquities Scheme (PAS) database.⁵³ A handful of mounts as well as stirrup-strap mounts and other horse harnesses – similar to those found in Flanders – have been recovered from various locations in the modern-day provinces of Friesland and Groningen, both of which were part of Frisia in early medieval times. There are also a small number of mounts from locations scattered across the county of Norfolk (England), with a further three related mounts from the adjacent county of Suffolk. The PAS-descriptions for the English examples classify them as Middle to Late Saxon, ninth-century strap

⁵⁰ Ufkes, *Een archeologische opgraving*.

⁵¹ Pieterjan Deckers, 'Productive Sites in the Polders? Griffin Brooches and Other Early Medieval Metalwork from the Belgian Coastal Plain', *Medieval and Modern Matters: Archaeology and Material Culture in the Low Countries (MMM)*, 3 (2012), 21-43 (p. 23-26 and p. 31-35).

⁵² The Northern Archaeology Depot, Nuis, Groningen.

⁵³ The Portable Antiquities Scheme encourages the voluntary recording of archaeological finds by members of the UK Public. The online database (www.finds.org.uk) was accessed on 13 October 2015 and searches conducted for Early Medieval, Strap fittings and mounts in the counties of Lincolnshire, Norfolk, Suffolk, Essex and Kent.

fittings⁵⁴ with a small number of entries describing them as box fittings. The Frisian examples are classified as strap-end mounts (or fragments thereof), only of the single-headed type, and have not been classified in terms of cultural affiliation or style. See Fig. 10 for a map of these find areas in relation to Walcheren.

These are all individual pieces found by metal detectorists of course and, as such, they are not easily recognized as mounts of a distinguished group and, therefore, could often be overlooked in the field and in collections. In addition, a handful of other pieces were identified as being from horse harnesses, mainly due to their size as well as their style, but this material was not included in this analysis. However, they need to be kept in mind as they, too, can provide useful context in terms of dating, style, function, and location. Hopefully, further research will identify many more similar pieces in the future, providing us with more information on precise dating, occurrence, and cultural affiliations. For now, we can say that these mounts are not exclusive to Walcheren but have parallels – albeit in small numbers for now – in various North Sea regions, from central Frisia, Flanders, to England. Nonetheless, the Walcheren corpus is for now by far the largest cluster of these small characteristic mounts.

4. Discussion

4.1 Composition

The mounts selected in this paper form a compositional group that associates with the stirrup-strap mounts found around Domburg (see Fig. 5, inset) but not with items from other copper-alloy types. Disc fibulae, ring pins (Fig. 4, b, c) produced different results demonstrating that craftsmen were working with different compositions for different types of items.⁵⁵ Production in brass may have been chosen for improved technical characteristics. Research into Roman alloys, for example, suggested that wrought items were made in a higher zinc/lower lead ratio than objects that were cast.⁵⁶ This observation, if applied to the difference we see between the composition of the mounts (Fig. 5) and the disc fibulae (Fig. 4, b), becomes interesting.

⁵⁴ For example, PAS references. NMS3712D, NMS28DA87, NMSA92457, SF5718, SFEBDD47

⁵⁵ Marcus Roxburgh and others, 'A Workshop'.

⁵⁶ Dungworth, 'Roman Copper-Alloys', p. 902.

Fig. 10. Find Locations of mounts outside of the study (in grey).

The mounts could have been cut, hammered, and shaped from bars or ingots rather than cast, as is the case for disc fibulae.⁵⁷ Archaeological evidence for brass bars in Viking-Age Europe has been found, not in the areas that were once Frisia, but in hoards and trading centres in the Baltic.⁵⁸ The bars found in the Baltic areas were produced in the 'spill-form' tradition and were typically long and thin, the proportions of which could possibly form a useful starting point in the making of a mount similar to the ones discussed here. Also, the brass used in these bars tentatively suggests that it originated in the Rhineland, probably with the reopening of the Roman zinc mines near Aachen, as no other source of zinc is known in Western Europe at this time.⁵⁹ However, a closer comparison of the composition of the mounts to that of the brass bars suggests that a further casting event has taken place. A significant amount of lead is present in the Walcheren mounts, whereas an analysis of three bars from Gotland revealed an alloy ratio of up to twenty five percent zinc but no lead.⁶⁰ A possibility therefore exists that brass bars could have been used as a raw material in a secondary casting process, one where lead is deliberately added.

⁵⁷ Frick, 'Karolingisch-ottonische Scheibenfibeln', p. 255.

⁵⁸ See Søren Sindbæk, 'An Object of Exchange: Brass-bars and the Routinization of Viking Age Long-distance Exchange in the Baltic Area', *Offa*, 58 (2003), 49-60.

⁵⁹ Sindbæk, 'An Object', p. 59.

⁶⁰ Sindbæk, 'An Object', p. 55.

4.2 Workshop Organisation and Access to Materials

The most important observation from the compositional study is that the craftsmen producing these mounts were working within a set of alloy mixing limits, namely, a leaded brass. Production in brass is a technologically different process than that of bronze, so the craftsman would have been aware of this when producing these objects.⁶¹ Furthermore, a visual inspection of the items reveals that although stylistic groupings are present, they do not appear to have been produced in an exact same way. If copying or mass production took place, for example, then they are still reasonably different. This suggests that they were made by a number of different craftsmen working under a common theme, perhaps over a protracted length of time, but with no need for exact duplication. This observation is contrary to disc brooch production, for example, where a closer duplication of size and decoration seemed to be present.⁶²

The large number found around Domburg compared to other areas could suggest that they were produced locally. This would be associated with production at the emporium if it was still active, or at a later administered workshop where both the required skills and a continued availability of zinc, either as a raw material or in brass ingot form, which would have allowed for the mixing ratios seen in the results above. This hypothesis matches Söderberg's model C., a permanent administered workshop site manufacturing objects for trade.

Production seems less likely to have taken place within models A or B, i.e., casting within Frankish-controlled royal or supra-regional centres, as the professional craftsmen engaged at these places may have been more concerned with higher quality items in the first instance.⁶³ Then secondly, super-regional production would presumably have produced higher volumes distributed over a wider geographic area. Thirdly, in considering the Christian nature of the Frankish world, many copper-alloy items found

⁶¹ The ore calamine was needed for brass production along with a technical process called cementation, Bayley and Butcher, *Roman Brooches in Britain*, p. 12-13.

⁶² See Marcus Roxburgh, Hans Huisman and Bertil van Os, 'The Cross & the Crucible: The Production of Carolingian Disc Brooches as Objects of Religious Exchange?' *Medieval and Modern Matters. Archaeology and Material Culture in the Low Countries (MMM)*, 5 (2016), 117-32.

⁶³ Such as the craft production at the Royal Palace at Aachen, see Herbert Schutz, *The Carolingians in Central Europe, Their History, Arts and Architecture: A Cultural History of Central Europe, 750-900*, Cultures, Beliefs & Traditions: Medieval and Early Modern Peoples, 18 (Leiden: Brill 2004), p. 386.

within the hinterlands bear Christian motifs, which is not the case for the mounts in this analysis; indeed, the decorations appear to be influenced by animals from earlier Germanic or Norse art styles. Carolingian/Ottonian period disc fibulae are also found around Domburg, but these fibulae are also found in large numbers across the hinterland and it has been shown that they have the same alloy composition across a wide geographic area. The exception to this is a small number of disc fibulae found only around Domburg produced in a bronze tradition not a brass one, which could potentially be explained by local copying perhaps within model C. Also, items bearing non-Christian motifs would seem at odds with production at monastic workshops or at Frankish royal estates. Production here could have presented an ideal opportunity to replace the zoomorphic style with Christian ones, or at least to add Christian elements to the mounts. This however, does not appear to have taken place.

Production at primitive workshops seems equally unlikely (model D), because the skills and knowledge required to apply the zoomorphic decoration would have to have been maintained over long periods of inactivity while simultaneously maintaining the technological knowledge required for casting in brass. Bronze casting would seem the easier option in a more primitive setting. It would also seem likely in this scenario that scrap items would be poorly sorted, allowing bronze or gunmetal to enter the 'metal flow', which is not the case for our leaded brass mounts.

The merchants involved in model E may well have had something to do with the production of the brass ingots found in the Baltic, but it is more likely they would have been interested in trading the finished goods that the mounts were destined for rather than overseeing their production. Finally, production in a domestic setting (model F) would have been the least likely due to the advanced craft levels needed to work in brass and to decorate in a zoomorphic style.

The most likely option, therefore, is that of an urban production site (model C) under a non-Christian or at least a Church neutral administration – possibly Scandinavian or Frisian in nature rather than Frankish.

4.3 Morphological Similarities to the Horse Harness

With a compositional similarity to stirrup-strap mounts established, it is tempting to classify all of this material as horse harnesses, especially since there are historical references from the late ninth century onwards of Vikings from the Scheldt area being mounted on horses and travelling over land.⁶⁴ However, this becomes problematical when you assess the

⁶⁴ *Vroeg-Middeleeuwse ringwalburgen*, pp. 89-91.

differences in size. The strap-link 0032-79-422 appears to link 3 straps together and GA0082-419 looks like it may have linked 4. Both look almost identical to Anglo-Scandinavian horse harness links,⁶⁵ but are significantly smaller. The Walcheren strap-links are under 3cm across, whereas the one published by Williams is around 7cm across. Size is also a problem for the lozengiform strap-links. Although very similar to the harness equivalents published by Williams, they are again small, 4-5 cm in length compared to 6-8 cm in Williams.⁶⁶ But, as Williams suggests, they could have taken an iron ring – now long corroded away – that allowed a suitable leather strap to be attached. A further difference is the rivet holes drilled into the Walcheren strap-links, suggesting a different purpose than for horse harness links.⁶⁷

For comparisons with the strap-end mounts, we turn to Williams' publication on late Saxon stirrup-strap mounts.⁶⁸ These stirrup-strap mounts again date mainly to the eleventh century and were originally interpreted as book clasps or as fittings for boxes or chests. But, as identified by Margeson, they appeared to be too large and cumbersome to have been used as book clasps.⁶⁹ Equally, the idea of box fittings was challenged.⁷⁰ In light of archaeological evidence showing an association with equestrian stirrups, they were finally classified as a decorative mount that is riveted to the leather strap at the point at which it passes through the stirrup.⁷¹ The strap-end mounts in this study, as well as being compositionally similar, were also riveted to another object. Also, a number of the heads turn in slightly as if they follow the line of the material they were originally attached to (see Fig. 1 c1). This inward turn is also a feature on many stirrup-strap mounts, suggesting a close functional similarity between these groups.⁷² Finally, the pendants and pendant mounts also appear to function in a similar way to horse harness pendants. But, again,

⁶⁵ Williams, *Anglo-Scandinavian Horse Harness Fittings*, p. 5, Fig. 6 f.

⁶⁶ Williams, *Anglo-Scandinavian Horse Harness Fittings*, p. 5, Fig. 6a, b.

⁶⁷ For example, Fig. 1 d1.

⁶⁸ Williams, *Late Saxon Stirrup-Strap Mounts*.

⁶⁹ Sue Margeson, 'A Group of Late Saxon Mounts from Norfolk', *Norfolk Archaeology*, 39 (1986), 323-27 (p. 327).

⁷⁰ Steven Ashley and others, 'A Further Group of Late Saxon Mounts from Norfolk', *Norfolk Archaeology*, 41 (1991), 225-29 (p. 228); Paul Robinson, 'Some Late Saxon Mounts from Wiltshire', *Wiltshire Archaeology and Natural History Magazine*, 85 (1992), 63-9.

⁷¹ Williams, *Late Saxon Stirrup-Strap Mounts*, p. 2.

⁷² Williams, *Late Saxon Stirrup-Strap Mounts*, p. 2, see angled flange on class B mount in Fig. 1.

they appear small. The pendants published by Williams appear to be 3-4 cm wide, whereas pendants in this study are only between 1-2 cm. That said, as decorative rather than functional items, this could have been less important.

Combining the observations just mentioned together with the reconstruction drawings put forward by Williams, it was possible to attempt a reconstruction of the relationship between the Walcheren mounts and the leather straps they may have been attached to (see Fig. 11). It must be remembered that the observations regarding the size (and presumably functional strength) allow for the possibility that these items were personal equipment rather than reserved for an equestrian harness. Furthermore, there is no evidence to suggest that the decorative style on personal equipment would differ significantly from the decoration placed on a horse harness. Both horse and rider could have worn the same style.

5. Debate

5.1 Identity: Frankish, Frisian, Scandinavian, or Anglo-Saxon?

Our first impression was that the Walcheren mounts stylistically resemble fragments of eleventh-century equestrian equipment, classified as Anglo-Scandinavian, and found in many areas of England and southern Scandinavia. But our study suggests that we need to reconsider both the use of the Walcheren mounts as horse harnesses and also as Anglo-Scandinavian. The question that also needs addressing is what cultural affiliation can we assign to these mounts, if any? Additionally however, we must re-look at the dating of the objects, from the presumed ninth-century origin to a tenth- or eleventh-century context.

The lozengiform style horse harness is suggested by Williams to derive from the late Viking Ringerike style, with the harness links themselves being typical of the eleventh century.

The lozengiform strap-links found at Walcheren exhibit strong style connection to these links, as they do to Williams' Class A, type 12 stirrup-strap mounts, which are found in a wide distribution across South East of England.⁷³

The decoration found on the Walcheren strap-end mounts, especially in terms of the animal heads, bear similarities to Williams' stirrup-strap mount classifications: Class A, type 2, type 8, and to Class B, types 1 and 2. He associates these stirrup-strap mounts with the late Viking Ringerike

⁷³ Williams, *Late Saxon Stirrup-Strap Mounts*, p. 21, Fig. 16 distribution map.

Fig. 11. Suggested relationships to leather straps, after Williams, *Late Saxon Stirrup-strap mounts* Fig. 4. Drawn by the first author.

or Urnes styles of the eleventh century. However, the context of the strap-end mounts from Walcheren suggest they date from the ninth century, which matches the date given to a number of close parallels from Norfolk (see the PAS references above).

As we have demonstrated, the Walcheren mounts are most likely a separate typological group, stylistically and compositionally related to the tenth- and eleventh-century horse harness, but smaller and, therefore, most likely for personal rather than equestrian use. Although these mounts are typologically related to this material, especially to many eleventh-century pieces, the Walcheren strap-end mounts, in particular, may have a ninth-century context. The possibility also exists that there may be different chronological groups with the strap-end mounts, some dating from the ninth century while some of the others, more closely related to Borre and Ringerike styles, date to the tenth or possibly early eleventh century.

Even though uncertainties as to the precise dating remain, the styles suggest that close ties existed between the southern North Sea, Frisian, Viking, and Anglo-Scandinavian worlds between the ninth and eleventh centuries. The fact that we find similar pieces in Flanders, central Frisia, and in the east of England illustrate this. If we assume that the mounts were produced locally in these areas, then we could, perhaps, expect some local variation composition and type, which could be tested in the future. If these particular mounts were produced locally in Walcheren (i.e., Frisia), then it would be better to describe them as a Friso-Anglo-Scandinavian group of mounts. Thus, we may tentatively consider the possibility that these mounts relate to a local group of people who were closely connected to Scandinavian and Frisian inhabitants (as would be the case in the other areas). Perhaps they were connected to Danish warlords and their followers (or indeed their descendants), a multi-ethnic group who temporarily settled in Frisia and who travelled back and forth between the Frisian coastal area and England. It has been suggested elsewhere that the Vikings on Walcheren should perhaps be thought of as the *Scaldingi* – the Scheldt Vikings – a group that could have been multi-ethnic in character.⁷⁴ In any case, we argue that the term Anglo-Scandinavian, or indeed Frankish, does not suffice.

This suggestion fits very well with the general view that Frisia had close connections to southern Scandinavia and eastern England. We usually see this in a passive way, but here we might have an active example of these

⁷⁴ Shane Mcleod, *The Beginning of Scandinavian Settlement in England. The Viking 'Great Army' and Early Settlers c. 865-900* (Turnhout: Brepols, 2014), pp. 134-35.

Viking-Age connections.⁷⁵ In any case, there is evidence of a cultural group in Walcheren in the (late) Viking Age expressing their visual identity in terms of these non-Christian, animal-style decorations, and this identity should be considered in a context of continued intensive relations between Franks, Frisians, Vikings, and Anglo-Saxons.

Amongst the many seafaring travellers in the ninth to eleventh centuries, Vikings, Frisians, and Anglo-Saxons were constantly travelling back and forth across the North Sea. The Great Danish Army that invaded Anglo-Saxon England in 865 is believed to have also included contingents from the Frisian coastal areas, which also coincides with the time of the Danish benefices at Walcheren.

It has been argued elsewhere that this has led to a group of Friso-Danes, perhaps existing for several generations.⁷⁶ Part of such a group, if it manifested itself in Walcheren with connections in the northern Dutch coastal area as well as in East Anglia, may have generated their own form of harness decoration, which we can see here. The island of Walcheren in the Viking Age, as a Frisian area within the Frankish realm, with continuous contact with eastern England and under pagan Viking administration, is a place where worlds collide: a place and a context – perhaps continuing over several decades – in which the Walcheren mounts could exist.

6. Conclusion

In this article we presented a combined analysis of a large group of early medieval mounts, found in and around the North Sea coastal town of Domburg on Walcheren. This analysis sheds new light on their functional use and their role in expressing social identity within a Viking-Age, North Sea world.

The questions we addressed were straightforward and, through them, we were able to gain a clearer understanding of the mounts' function through this approach given that the composition of the mounts, as well as their typological characteristics, matched those of certain forms of Viking-Age equestrian gear. While the equestrian gear mainly dated towards the eleventh century, the mounts from Walcheren – bearing

⁷⁵ Nelleke IJssennagger, 'Between Frankish and Viking: Frisia and Frisians in the Viking Age', *Viking and Medieval Scandinavia*, 9 (2013), 69-98.

⁷⁶ IJssennagger, 'Between Frankish and Viking'; McLeod, *The Beginning of Scandinavian Settlement in England*, pp. 134-35; IJssennagger, 'A Viking Find', and references therein.

strong typological similarities – appear to date between the ninth and early eleventh centuries.

Having found that the choice of alloy for making the mounts was controlled to some extent, and that the symbolism was likely to be of pagan rather than Christian origin, we were able to suggest that these items were produced at an urban production site under at least a Church-neutral administration – possibly Scandinavian or Frisian in nature rather than Frankish. The relative density of finds in Walcheren compared to other areas also suggested that this production was likely to have been local.

The observations regarding the size of these mounts allowed for the possibility that these items were used on personal equipment rather than reserved for equestrian harnesses. The equipment for both horse and rider could have been decorated in the same style. An analysis of the function of stirrup-strap mounts did, however, offer a tentative reconstruction of their use as functional attachments to leather straps but, as just mentioned, for personal equipment rather than equestrian.

Although a question over the exact dating remains, the styles suggest close ties existed between the Frisian, Viking, and Anglo-Scandinavian worlds between the ninth and eleventh centuries. If we assume that the mounts were produced locally, then it would be more beneficial to describe their cultural associations as being Friso-Anglo-Scandinavian in character, rather than Anglo-Scandinavian.

Therefore, our hypothesis proposes the existence of a cultural group in Walcheren in the Viking Age expressing their visual identity in terms of these non-Christian, animal-style decorations. This identity should be considered in a context of continued intensive relations between Frisians, Vikings, and Anglo-Saxons. This is supported by arguments elsewhere of the existence of a group of Friso-Danes, perhaps manifesting itself in Walcheren, and generating their own form of harness decoration.