

PATTERNS OF SCANDINAVIAN BEAD USE BETWEEN THE IRON AGE AND VIKING AGE, CA. 600-1000 C.E.

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This paper places Johan Callmer's seminal chronology of Viking-Age beads in the broader contexts of subsequent research. It begins with an examination of how Callmer's chronology of grave goods can be linked into preceding chronologies from the cemeteries of late Iron-Age Bornholm and mainland Sweden (ca. 540-860). It then considers how these chronologies compare with those available from the early Scandinavian emporium at Ribe, a site of bead production and trade (ca. 700-850). Finally, it provides a detailed analysis of Callmer's classification system and the implications of his chronological framework (ca. 800-1000). Comparing these diverse chronologies reveals divergent patterns of bead use, enriching our understanding of how individuals, communities, and networks connected with each other through beads in the late Iron Age and the early Viking Age.

INTRODUCTION

It is forty years since Johan Callmer (1977) published his dissertation, *Trade Beads and Bead Trade in Scandinavia ca. 800-1000 A.D.* This work has endured as a standard reference through four decades of paradigmatic change and evidence accumulation. Intervening scholarship has reoriented the ways by which we investigate the past and revised our frameworks for understanding the early middle ages (Effros 2017; Hodges and Whitehouse 1983; McCormick 2001; Wickham 2005). Beads have interested scholars throughout these developments in part due to two of Callmer's central claims: Viking-Age bead assemblages show considerable change over time, and the distribution patterns for beads preserve traces of the routes by which they traveled.

Viking-Age beads retain significant potential for contributing to our understanding of the early Middle Ages. Here, I advance that agenda by placing Callmer's classification system and assemblage chronologies within broader and more varied social and temporal frameworks. Three sections contribute toward this goal: 1) pre-Viking burials, identifying changing patterns of bead use, 2) early

Scandinavian emporia, where beads were made, traded, and supplied to others, and 3) reassessing Callmer's Viking-Age classification system and chronology in light of this work and subsequent Scandinavian research. Each section begins with a brief critique of evidence and methods, presents a chronological framework, and discusses the implications arising from these chronologies. I base my discussion on published reports of the assemblages, and I have also examined representative samples of the beads described in these works. This comparative analysis of extant chronologies for Scandinavian beads reveals that patterns of bead use varied by context. Different types of beads circulated among different communities at different times, and these differing communities implicitly shared their beads through differing means of exchange.

PRE-VIKING BURIALS

Any investigation of Scandinavian beads in the centuries preceding the Viking Age must reckon with the legacy of Emil Vedel who, along with Johan Andreas Jørgensen, excavated a large number of rich inhumation burials on Bornholm between 1866 and 1902. The elites of Iron-Age Bornholm accumulated remarkable wealth, as witnessed by the cult center at Sorte Muld (Adamsen et al. 2009), and their tendency to inhume rather than cremate their dead preserved a substantial record of their material lives. Vedel and Jørgensen ensured that remains recovered from these burials were saved from the vicissitudes of modern erosion and agriculture. They delivered their artifacts to the National Museum in Copenhagen for conservation, and Vedel (1878, 1886, 1890, 1897) published articles and monographs extensively documenting his work.

Vedel and Jørgensen excavated about 20 sites, accounting for a significant portion of the burials recovered from late Iron-Age Denmark. Two sites proved particularly productive: Bækkegård, excavated between 1876 and 1880, uncovering 168 graves (Jørgensen 1990), and Lousgård,

excavated between 1886 and 1887, uncovering 50 graves (Lyngstrøm 1989). These sites yielded thousands of beads, but both pose problems for researchers. In the case of Bækkegård, Vedel or an intermediary delivered most of the beads to Copenhagen in a single package, which museum staff subsequently restrung as spurious assemblages for exhibition, approximating the descriptions recorded in Vedel's reports. In the case of Lousgård, Jørgensen conducted most of the excavations, and Vedel (1886:413-417) hurried an interpretation of the site into his first monograph, which was already in the process of being published. Staff at the National Museum sorted the artifacts according to this initial interpretation, but Vedel (1890:87-101) soon revised his understanding of the site. These revisions led to a number of discrepancies between Vedel's descriptions and the artifacts as preserved by the National Museum. As a result, although a large number of beads survive from Iron-Age Bornholm, many lack identifiable contexts.

Beads have proven especially difficult to ascribe to particular contexts due in part to Vedel's methods of recording. Vedel mistakenly identified opaque glass beads as being made of either stone or paste (*lermasse*), which suggests that occasional beads of other materials such as fossils, limestone, or shell might have accidentally been subsumed into these categories as well. Conversely, he attempted to distinguish mosaic beads from beads of painted glass (*malet glas*) without clarifying the criteria he used to differentiate these categories. Vedel also made broad use of a category that he described as "other glass" (*andet glas*). In some cases, his notes indicate that this category included segmented beads, but in many cases no further details survive. This means that bead researchers working with the rich assemblages of Bækkegård and Lousgård must either study the preserved artifacts while accepting uncertainties about their provenance, or they must rely on Vedel's records while accepting uncertainties over their accuracy.

For bead researchers, the significance of Bækkegård and Lousgård hinges on Karen Høilund Nielsen's (1987) analysis of these sites and their artifacts. She approached these difficult sites by adopting Vedel's system of classification, relying on his catalog for Bækkegård, and then conducting her own inspection of artifacts from other sites. She identified 90 assemblages from Bornholm with 10 or more beads, comprising approximately 3,800 beads. Of these, 47 assemblages (52%) with about 1,500 beads (40%) derive from Bækkegård, and 15 assemblages (17%) with about 700 beads (18%) derive from Lousgård. The remaining 28 assemblages (30%) account for approximately 1,600 beads (42%). Høilund Nielsen demonstrated that Vedel's terms of analysis and his records for Bækkegård preserved sufficient detail for a correspondence analysis and

seriation of bead assemblages and associated grave goods. She identified four basic types of bead assemblages, defined according to the dominant materials and colors of the beads. This work has largely superseded previous studies by C.J. Becker (1953) and Mogens Ørsnes (1966).

Before outlining Høilund Nielsen's system of classification, however, three subsequent publications must be taken into account. First, Lars Jørgensen (1990) published a major review of previous research on Bækkegård, including modern investigations that assessed Vedel's methods and yielded a previously undiscovered grave. Jørgensen (1990:23-27) also examined Høilund Nielsen's sources and methods. He suggested that some of her assemblages should not have been treated as closed contexts and argued that some of the early artifact types had been too loosely defined, introducing a potential source of imprecision in divisions between the early phases.

Lars Jørgensen and Anne Nørgård Jørgensen (1997) subsequently applied Jørgensen's earlier suggestions to the evidence of a rich set of new excavations at Nørre Sandegård Vest. Vedel had visited this site but left it largely unexcavated, and major campaigns in 1986 and 1987 contributed to an eventual total of 59 graves from the late Iron Age. In analyzing these finds, the authors revised Høilund Nielsen's seriation to accommodate Jørgensen's comments (Jørgensen and Nørgård Jørgensen 1997:24-35). This produced a more reliable seriation and allowed the authors to refine the absolute chronology that Høilund Nielsen had proposed.

Finally, Høilund Nielsen (1997) undertook revisions of her own work, testing whether the Bornholm classification and chronology applied to other areas as well. She had few opportunities for comparison, however, since most late Iron-Age communities in Scandinavia cremated their dead at temperatures that rendered glass beads unrecognizable. In central Sweden, however, lower temperatures were used for cremation burials, and Høilund Nielsen focused on these assemblages as a basis for comparison with Bornholm. She adjusted her analysis to accommodate the recommendations proposed by Jørgensen, and she included graves from the mid-Iron-Age cemetery at Lovö where independent work provided a chronology to verify the early phase divisions that Jørgensen had questioned. Høilund Nielsen concluded that the bead assemblages of central Sweden divided into the same four groups that she had found on Bornholm, as well as a fifth group found only in Sweden.

Taken together, these studies provide an established sequence of bead assemblage types for late Iron-Age Bornholm and mainland Sweden. It bears repeating that these assemblage types, and thus their connections to

particular periods of time, are only suggestive and not strictly defined. Moreover, the assemblage types do not occur in a rigid sequence but overlap, such that burials with different assemblage types may nevertheless be ascribed to a common phase. Additionally, the use of correspondence analysis makes persons buried with heirloom artifacts seem more closely linked to previous generations than to theirs. Individual graves must always be examined for artifact types which could provide a *terminus post quem*.

The discussion below refers primarily to the assemblages from Sweden and Bornholm for which Høilund Nielsen (1997: Abb. 5) published complete inventories. I have expanded this catalog to include all late Iron-Age graves from Bækkegård (Table 1) as inventoried by Vedel (1878) with reference to Jørgensen (1990). Discussion of phases takes into account both Høilund Nielsen's chronology and the chronology developed by Jørgensen and Nørgård Jørgensen (1997). Where discrepancies occur in the published seriations, Høilund Nielsen tends to seriate assemblages one phase earlier than Jørgensen and Nørgård Jørgensen. I have preferred to follow Jørgensen and Nørgård Jørgensen's later dates to diminish the potential effect of heirloom items skewing grave assemblages earlier than their actual date.

Høilund Nielsen (HN) Group R3A (540-660)

Bornholm phases 1A1-1D1. Cf. Lövo bead horizons 3-4

R3A assemblages are characterized by a large number of undecorated orange and red opaque beads (Figure 1). Barrel shapes, cylinders, and cones are common. The ends of these beads are typically flat with distinct edges where the ends meet the body or face. Translucent blue, opaque white, and decorated beads of diverse colors are rare but stand out strongly where they occur. Similar assemblage groups at Lovö in the Mälars region are classified as p3 or p4.

There are 43 assemblages with published inventories ascribed to group R3A: 14 from Bækkegård, 14 from

other sites on Bornholm, and 15 from mainland Sweden. Assemblages range from 2 to 159 beads with a median of 57 and an average of 69. R3A assemblages seriate into Bornholm phases 1A through 1D1, or between 540 and 660. The consistent appearance of numerous high-quality red and orange beads throughout the early 600s suggests that the major glass production centers of the Near East managed to continue manufacturing and exporting glass despite prolonged conflicts between the Byzantine and Sassanid empires.



Figure 1. Bead assemblage from burial K45 at Nørre Sandegård, Bornholm, typical of HN Group R3A (540-660). Similar orange and red beads are also common during the Viking Age (Bornholms Museum 1409x1307 (all images by the author).

HN Group R3B (630-800)

Bornholm phases 1D1-2C. Cf. Lovö bead horizon 5

R3B assemblages are characterized by a large number of decorated beads, most frequently with a base color of translucent blue or opaque white (Figure 2). These polychrome beads are often combined with undecorated beads in opaque green, opaque white, and translucent blue. Many assemblages include rock-crystal beads, and some

Table 1. Høilund Nielsen (1991) Bead Groups.

Group	Dating	Burials in Study	Average Beads	Total Beads	Characteristic Beads
R3A	540-660	43	69	2,951	Red, orange
R3B	630-800	75	50	3,033	White, green, blue, decorated
R3C	750-775	12	31	371	R3B with gold-foil, colorless < 12%
R3D	775-800+	7	46	319	Gold-foil, silver-foil, colorless >12%
R3E	750-800+	Not inventoried			Drawn beads



Figure 2. Bead assemblage from grave 6 at Lousgård, Bornholm, classified by Høiland Nielsen as belonging to Group R3B (630-800). Associated grave goods link this assemblage to Bornholm phase 2A (700-750). Note especially the three large mosaic beads at the bottom of the image, which become scarce after the early Viking Age (National Museum of Denmark C5594).

beads of bronze and wood also occur. Similar assemblage groups at Lovö in the Mälars region are referred to as p5. This is the final phase at Lovö.

There are 74 inventoried assemblages ascribed to group R3B: 35 from Bækkegård, 12 from other sites on Bornholm, and 27 from mainland Sweden. Assemblages range from 6 to 164 beads with a median of 35 and an average of 40. As such, although some assemblages were larger than during the preceding period, most assemblages are about half the size. R3B assemblages seriate into Bornholm phases 1D1 through 2C, or between 630 and 800. The smaller size of assemblages may reflect the broad economic downturn of the 600s, while the presence of a few extravagant displays may reflect intensified competition among local elites against this backdrop of impoverishment. This economic collapse also set the stage for the early Islamic conquests, and the changing types of glass found in Scandinavian bead assemblages beginning in the mid-600s may reflect the economic restructuring that occurred after the rise of the Umayyad caliphate.

HN Group R3C (700-800)

Bornholm phase 2B

R3C assemblages are similar to R3B assemblages, incorporating decorated blue and white beads together with undecorated beads of green, white, and blue. R3C assemblages, however, may be distinguished by the

presence of colorless beads and segmented gold-foil beads (see Figure 5). Høiland Nielsen (1987:53-54) judged that an assemblage may be classified as R3C if the colorless or gold-foil beads are present but comprise no more than 12% of it. Metal-foil beads are considered especially important as indicators of long-distance exchange since the techniques used to make these beads are thought to have been limited only to the Near East (Sode et al. 2010:320-323).

There are twelve inventoried assemblages ascribed to group R3C: three from Bækkegård, four from other sites on Bornholm, and eight from mainland Sweden. Assemblages range from 14 to 77 beads with a median of 30 and an average of 31. Most assemblages are about the same size as R3B assemblages, which continued into the period when R3C assemblages were deposited. After R3C assemblages enter the cemetery sequences, however, exceptionally large assemblages become rare.

Relatively few assemblages are ascribed to the R3C assemblage type. R3C assemblages seriate into Bornholm phases 2A through 2C, or between 700 and 800 (Høiland Nielsen 1997), although a more precise focus of 750-775 is tenable (Jørgensen and Nørgård Jørgensen 1997). The scarcity of extravagant displays during this period may indicate diminished elite competition and relative social stability. Furthermore, if the R3C assemblages were all deposited during the short period of 25 years, as Jørgensen and Nørgård Jørgensen suggest, this rapid rate of deposit suggests broad access to exotic imports and a resurgence of long-distance exchange.

Høiland Nielsen strained her definitions to include assemblages from the Swedish mainland in this group. Two assemblages (RAÄ:27:3A; SHM 31039:6) in particular are comprised of more than 40% gold-foil beads. Additionally, two of the Swedish assemblages (RAÄ:27:3A and RAÄ:27:137) lack polychrome beads which make up an average of 20% of the other assemblages. Finally, although green beads make up 20% of the Bornholm assemblages, including the assemblages from Bækkegård, green beads are typically absent from the Swedish mainland and make up only 5% of the Swedish assemblages assigned to this group.

These divergences represent a clear occurrence of geographic variation; communities in different places had access to different kinds of beads. The prominence of green beads on Bornholm and their relative scarcity on mainland Sweden indicates that, although beads played a privileged role in elite displays both in central Sweden and on Bornholm, the selection of beads which reached the elites of central Sweden had already been culled. Among the elites of the south Baltic, green wound beads were highly valued and assiduously collected, whereas segmented gold-foil beads

were less likely to be retained and more frequently passed on to communities that lay further north.

HN Group R3D (775-800+)

Bornholm phases 2C-VIK

R3D assemblages are characterized by colorless, gold-foil, and silver-foil beads. These beads comprise at least 15% and often more than 40% of the assemblages (see Figure 5). Undecorated blue and green beads occur, as do white beads. Decorated beads also occur, most often with a base of white, but occasionally with blue and green. When Høilund Nielsen expanded her study to include central Sweden, she noted that rock-crystal and carnelian beads could appear as well.

There are five assemblages ascribed to group R3D: two from Bækkegård, three from other sites on Bornholm, and none from mainland Sweden. Assemblages range from 8 to 120 beads with a median of 43 and an average of 50. R3D assemblages seriate into Bornholm phases 2C through the Viking period, or between 775 and an unspecified date after 800. Most R3D assemblages, however, were likely deposited no later than about 860, when rock-crystal and carnelian beads became dominant, as discussed below.

HN Group R3E (750-800+)

Not found on Bornholm; Seriated alongside Bornholm phases 2B and 2D

R3E assemblages are characterized by the appearance of a large number of drawn beads in various colors. Høilund Nielsen (1997) classified two assemblages as type R3E, and both of these derive from mainland Sweden. She characterized these assemblages as consisting of drawn cut beads of diverse colors, often smaller than the other beads of the late Scandinavian Iron Age. Although these assemblages had few associated finds, Callmer (1977:89) noted the occurrence of similar drawn cut beads throughout the Viking Age, but with especially high representation between 845 and 860.

Discussion

In the graves of Bornholm and central Sweden, high rates of inhumation or low cremation temperatures preserved unusually large numbers of beads from the late Iron Age. These survivals reveal how the composition of assemblages changed over time, providing a key for

interpreting associated grave goods. These assemblages also offer important insights into the changing political, economic, and social circumstances of the communities in which the beads were collected and eventually deposited. Additionally, the uneven distribution of specific bead types, such as the wound green beads present on Bornholm but rare in mainland Sweden, suggest traces of the routes by which these artifacts moved. In short, the beads of Iron-Age Scandinavia preserve information about the individuals, communities, and networks that all played a role in the collection and deposition of beads.

The vast majority of these beads are made of glass which was not produced locally. Most of this glass derived from major production centers in the Near East: Egypt, the Levant, Syria, and Iran (Henderson 2013:282-290; Whitehouse 2003). Some glass presumably reached Scandinavia via exchange through Western Europe which mediated travel between Scandinavia and the Near East via Mediterranean routes and which was also home to several small production centers.

Nevertheless, the chronologies for the beads of Western Europe collapse at the cusp of the Viking Age. Merovingian sequences come to an end with the period of Carolingian expansion (Friedrich 2016:92-95; Koch 2001:160-164, 2007:118-125; Sasse and Theune 1996:219-221; Stauch 2004:77-98). Beads were simultaneously falling out of circulation in Anglo-Saxon England (Brugmann 2004:42-70; Hamerow 2016), and most of the early medieval beads from Ireland were entering their final period of use (Mannion 2015:89). By the year 700, Scandinavians had few opportunities to obtain beads from the West.

The Scandinavian demand for beads, however, did not dissipate. Scandinavians found access to beads through two different means. First, they continued to import finished beads, but as western interest in beads disappeared, they sought new routes, both south and east. Second, they began to import glass as a raw material. This could be obtained from minor production and recycling sites in the West or from major production centers in the Near East. Both options demanded the creation of new centers for craft production and redistribution which needed to operate on a larger scale than Iron-Age centers like Uppåkra or Sorte Muld had previously supported.

The Viking Age is, in large part, the story of these two changes – the pioneering of new routes that could satisfy Scandinavian demands and the creation of new communities to support these routes (Barrett 2015). Beads played an essential part in both of these changes. The burials of Bornholm and Sweden provide one important line of

evidence, revealing how demand and access to beads changed across the late Iron Age, foreshadowing the transformations of the Viking Age. Early Scandinavian emporia – the sites of production and exchange that flourished across northern Europe – provide a second line of inquiry.

PRE-VIKING EMPORIA

New communities began to develop in Western Europe during the long 8th century with the emergence of craft and trade centers known as emporia. These sites include Quentovic and Dorestad in Francia and Frisia, respectively, as well as sites like Hamwic and Ipswich in England. Three sites in Scandinavia stand out as counterparts in this development: Ribe on mainland Denmark, Åhus near the south Baltic coast of Sweden, and Paviken on the west coast of Gotland. Additionally, the site of Groß Strömkendorf, located on the north German coast near Wismar and associated with the early medieval trading place of Reric, should be considered alongside these sites (Pöche 2005). These locations were particularly well suited to facilitate maritime traffic moving from the Frisian homewaters of the present-day Netherlands into the Baltic and toward central Sweden (Näsman 2000; Sindbæk 2009). In general, these Scandinavian sites functioned as seasonal camps throughout much of the 700s, rather than as sites of permanent settlement. Permanent occupation of Scandinavian emporia sites began only during the late 700s or early 800s, whereas Reric was destroyed in 808, preceding the foundation of nearby Hedeby.

The craftworkers who gathered at these sites initially procured glass from the West where it was scavenged from old Roman mosaics, recovered from broken glassware, produced in small amounts as a raw material, or carried in bulk from the Near East. But only on arrival in Scandinavia did glass become valued as a raw material for producing beads. The emporia that were developing in Western Europe supported new institutions of church and state which discouraged bead use – the concentration of authority around increasingly powerful monarchs reduced the incentive for elites to compete via costume displays among the living, while lavish funeral rites were giving way to unfurnished churchyard burials for the dead. As such, beads are scarce or absent from the emporia sites that developed in Western Europe, whereas in Scandinavia, bead production proved to be a central activity at these sites and a catalyst for their growth.

Ribe stands out as the best excavated of these early Scandinavian emporia as the result of two extended series of campaigns: 1970-1976 and 1984-2000 (Feveile 2006). For the purposes of bead research, with regard to

the chronology of proto-urban bead production, the most important excavations occurred in 1990-1991, in advance of the construction of a new post office. These excavations are commonly referred to as the *Posthuset* (post office) excavations. The trenches cut through about 80 m² of what had been an active marketplace between 705 and 850, and their distinct stratigraphy established the phasing for the rest of the site.

The Ribe Chronology

Claus Feveile and Stig Jensen (2006) published a detailed analysis of the *Posthuset* excavations including a thorough discussion of the glass and beads. The chronology of the beads excavated there spans from 705 during the site's initial period of use to 850 when later disturbances cut into the Viking-Age stratigraphy. Phase A was assigned to the pre-emporia layers and is not further discussed here. The subsequent emporia period was broken into eight phases (B-I), although the last two phases overlap (H/I). These phases were dated using dendrochronology, coins, and artifact types, with the phases ranging from 10 to 35 years in length. Over 2,400 beads were collected from the *Posthuset* excavations, and 1,788 could be associated with particular phases from the emporia period (Table 2).¹

Ribe Posthuset Phase B (705-725)

During Phase B (705-725), the first phase of Ribe's period as an emporium site, beads were already circulating in large numbers. There are 486 beads ascribed to this period, deposited at a rate of 24.3 beads per year. Blue melon beads (n=32; 7%) and so-called Ribe beads (n=29; 6%) appear among the earliest layers. The blue melon beads are made from translucent glass similar in appearance to the blue glass beads found in the graves at Bornholm. Ribe beads are made of similar blue glass but are ring-shaped and decorated with lines. The most common colors for decorations are red, white, and yellow, often applied as alternating straight and wavy rings around the bead. These two types of beads, however, make up only 13% of the period beads. Although diagnostic types appear, variety was the rule.

Ribe Posthuset Phase C (725-760)

During Phase C (725-760), 463 beads were deposited at a rate of 13.2 beads per year. Blue melon beads become scarce, constituting only 3% of the period beads (n=17), while Ribe beads become prevalent (n=142), constituting

Table 2. Ribe Posthuset Diagnostic Beads.

Phase	Dating	Glass Beads	Loss per Year	Blue Melon	Ribe Beads	Wasp Beads	Metal-Foil	Blue Segmented	Green Tubes	Eye Mosaic	Drawn Cut	Tesserae	Tesserae Loss / Year
A/AA	<705	1										3	
B	705-725	486	24.3	32	29		1					592	29.6
C	725-760	463	13.2	17	142	12			1		1	988	28.2
D	760-780	37	1.9	3	9	2						174	8.7
E	780-790	288	28.8		1	91	5	1	4		1	185	18.5
F	790-800	227	22.7		1	11	46	9	36		2	53	5.3
G	800-820	108	5.4			1	38	10	15	5	15	17	0.9
H/I	820-850	179	6.0	1	7		5	3	6		53	35	1.2
J	1100s	6	0.1						1		1		
None		635		9	4	97	79	13	39		85	157	
Total		2,430		62	193	214	174	36	102	5	158	2,204	

31% of the period beads. Beadmaking was presumably becoming a more specialized craft with emphasis on fewer but more complex beads than in the preceding period. The increasing presence of polychrome blue beads indicates that the craftworkers at Ribe were making beads to meet the demands of rural elites, such as those of Bornholm, who were being buried with beads of this style and who may, in fact, have patronized the same craftworkers who frequented Ribe.

This period of proliferating beadmaking also witnessed experimentation in bead types. This includes the first known wasp beads, of which 12 have been attributed to this period. Although they account for less than 3% of the period beads, they stand in sharp contrast to the more frequently encountered Ribe beads. Wasp beads typically consist of a thin black cylindrical body decorated with yellow rings, sometimes also appearing in other colors such as red. Although the appearance of these beads contrasts superficially with Ribe beads, both styles include highly visible decorations that advertise the extra time and expertise that the beadmakers invested in each bead. As the elites of Bornholm consumed similar polychrome beads during this phase, they demonstrated a similar interest in eye-catching decorations.

Ribe Posthuset Phase D (760-780)

During Phase D (760-780), beads became extremely scarce – although this impression is sharpened by the

stratigraphic mixing of Phase D layers with layers from other phases, so that some beads lost during this period cannot be definitively assigned to it. As a result, only 37 beads were recovered from contexts dating to this phase, at a rate of loss of only 1.9 beads per year. The bead varieties present during Phase D are distributed similarly to the preceding period, including three blue melon beads (8%), nine Ribe beads (24%), and two wasp beads (5%). The similarities between these beads and the beads of the preceding period, as well as their scarcity, suggest that they are mostly old beads kept in lengthy circulation, rather than newly made. This decline in bead production likely stems from restricted access to glass. The loss rate of tesserae – the most readily quantifiable raw material for making beads – drops from over 28 tesserae per year during preceding periods to only 8.7 tesserae per year.

Conversely, there is no evidence for a general decline in the demand for beads among Scandinavian elites. Ribe Phase D phase overlaps with Bornholm Phases 2B (750-775) and 2C (775-800). All three late necklace types (R3B, R3C, and R3D) have been seriated into Phase 2B. This helps qualify the earlier observation that Bornholm elites had greater access to green beads than their counterparts in Sweden. During this period, the elites of Bornholm were probably not acquiring these beads from Ribe, as might be expected, nor were they acquiring beads from Sweden where the selection of beads was small. Instead, Bornholm was likely the hub for routes that connected south to the Danube and the glass- and bead-production centers beyond.

Despite this suggestion of expanding access to beads via southern routes, the size of bead assemblages was decreasing and large assemblages became rare. During Phases 2B and 2C in the cemeteries of Bornholm and mainland Sweden (750-800), 18 inventoried assemblages ranged from 12 to 54 beads with a median and average of 31 beads. These elite sought to bury their dead with beads that could not be found at Ribe, even though this choice limited their ability to collect large assemblages. As a result, beadmaking in Ribe languished, and in the 20 years that this phase endured, a new generation may have almost entirely displaced the older craftsmen familiar with beadmaking. Much of the technical knowledge for high-quality bead production may thus have been lost.

Ribe Posthuset Phase E (780-790)

During Phase E (780-790), 288 beads were deposited at a rate of 29 beads per year (Figure 3). This increased rate of loss parallels a similarly increased loss of tesserae, with 185 deposited at a rate of 19 per year. Local bead production renews with particular emphasis on wasp beads ($n=91$) which comprise 32% of the period beads while the old Ribe style appears with only one example and blue melon beads are completely absent. This suggests that few of the old workshops or families retained the technical expertise for beadmaking through the preceding period of diminished production. Conversely, the 12 wasp beads deposited during Phase C may have been the early experiments of a young beadworker who, during Phase E, found a renewed source of prosperity after 20 years of dormant demand.

Phase E also witnessed Ribe's first period of oriental bead imports.² These include metal-foil and blue segmented beads, cold-cut green tube beads, and drawn cut beads. Eleven oriental beads of these various types appear at Ribe during Phase E. While they constitute only 4% of the period beads, they are significant as indicators of newly found access to finished bead imports. These styles are further discussed below in the context of Callmer's classification system.

Ribe Posthuset Phase F (790-800)

During Phase F (790-800), 227 beads were deposited at a rate of 22.7 beads per year. This is nearly a return to the rate of loss when beadmakers were active at Ribe during its earliest phases. Wasp beads decline, with 11 examples constituting 5% of the period beads. This rapid decline may indicate the death of a beadmaker or the dissolution of a workshop. Meanwhile, imported oriental beads become



Figure 3. Beads from a phase E (780-790) context at the Ribe Posthuset excavations. Most are wound and may have been made on site. Oriental imports include a fragmentary gold-foil bead (left side of second row) and a fragmentary cold-cut green tube bead (bottom right) (Sydvestjyske Museer ASR 9x261).

common. Segmented beads are the most prevalent, with 46 metal-foil beads (20%) and nine blue beads (4%). Green tube beads are represented by 36 examples (16%). Drawn beads again occur but only rarely, with just two examples (1%).

The influx of oriental beads at Ribe occurs after their arrival in the cemeteries of Bornholm and mainland Sweden, as indicated by the seriations of Højlund Nielsen. This indicates that, at least with regard to beads, Ribe functioned first as a center for local craftwork and only later as a hub for finished imports. It also indicates that the emporium's inhabitants lay further down the bead supply chain than the elites of Bornholm, and the merchants of the emporia must have been competing with other exchange networks capable of drawing material goods from distant sources. If this is the case, then the emporia ultimately depended on the elites for their survival, and not vice versa.

Ribe Posthuset Phase G (800-820)

During Phase G (800-820), 108 beads were deposited at a rate of 0.9 beads per year. The appearance of new bead varieties reveals that although the overall bead trade was declining, it nevertheless remained active. Oriental beads

dominate the period's small assemblage. This includes 38 metal-foil beads (35%), 10 blue segmented beads (9%), 15 green tube beads (14%), and 15 drawn cut beads (14%). The increase of drawn cut beads corresponds with the appearance of a new oriental import: eye mosaic beads. Five such beads (5%) may be ascribed to this period. These beads typically come in variants that are blue or green, and both are present at Ribe. The blue variants likely traveled north via the Danube, whereas the green variants likely traveled north via the Volga (Callmer 1991). Their joint appearance at Ribe indicates that traffic to this emporium arrived from the south via both routes.

Ribe Posthuset Phase H/I (820-850)

Phases H and I (820-850) are treated as a single chronological period in the literature. During these phases, 170 beads were deposited at a rate of 6.0 beads per year. Local bead production seems to have renewed, with five melon beads (3%) and seven Ribe beads (4%) appearing. There were 35 tesserae lost at a rate of 1.2 tesserae per year, slightly higher than the preceding period but still much lower than during the early phases at Ribe. Nevertheless, oriental imports still dominate the period assemblage, with 67 oriental beads (39%). Metal-foil, blue segmented, and green tube beads diminish to a combined total of 14 beads (8%), while eye mosaic beads disappear altogether. Drawn cut beads, however, became increasingly prolific. There are 53 drawn cut beads (31%) from these phases. They correspond to Høilund Nielsen assemblage type R3E, found in Sweden but not on Bornholm. This indicates that the old networks centered on Bornholm had already fallen apart, although the newly forming networks unfortunately fall outside the scope of this limited survey.

Discussion

The chronology of beads at Ribe adds greatly to the picture Høilund Nielsen and her interlocutors drew from Bornholm. Nevertheless, the discussion above depends on only a small part of the available evidence from Ribe. Jan Holme Andersen and Torben Sode (2010) classified 501 beads from the 1970-1976 excavations and analyzed them by phase. This work followed on Sode's (2004) earlier study of beadmaking technologies at Ribe and retains a similar focus on materials and technique. This evidence generally confirms the outline presented above, although the stratigraphy of the 1970-1976 excavations was preserved only in general layers and lacks the chronological precision of the Posthuset excavations.

Moreover, although Ribe has attracted significant attention among early Scandinavian emporia due to its excellent stratigraphic preservation, other Scandinavian sites are available for comparison, particularly Åhus in southern Sweden and Paviken near the western shore of Gotland. Both sites have yielded extensive evidence for bead production, with Åhus showing strong similarities to early Ribe. Åhus has also been subject to two major campaigns, although published information remains largely limited to a small set of articles (Callmer 2002; Callmer and Henderson 1991). Paviken has likewise been subject to two major excavation efforts. The first took place between 1967 and 1973, resulting in a single publication (Lundström 1981). Additional excavations have been conducted more recently and although the annual reports have been made available, a comprehensive study of the site is eagerly anticipated (Karn 2014a, b, 2015).

Thus there remains significant research potential for bead studies of the period immediately preceding the Viking Age and substantial groundwork has already been laid. The available evidence suggests contrasting chronologies between elite graves and emporia deposits, with emporia developing in the early 700s, partly in response to elite demands, but with elite demands shifting away from emporia later in the century. It remains to be seen how these chronologies fit with other sites of the period, particularly those like Uppåkra, Sorte Muld, Gudme, and Lofoten, which have attracted much attention on their own merits as central places. These sites, however, typically lack a close chronology for beads, further complicated by the destruction of most Viking-Age layers by modern agriculture at sites in southern Scandinavia.

At present, Høilund Nielsen's typology of assemblages remains the most useful chronological key for interpreting Scandinavian beads at the cusp of the Viking Age. Norwegian beads are sorely in need of renewed attention, with Synnøve Vinsrygg's (1979) dissertation enduring as the most recent sustained study. Meanwhile, discussion of beads from the Vendel period in Sweden generally remains largely limited to local contexts, such as the classification system for Lovö which Høilund Nielsen found useful for comparisons with her own typology.

Looking further afield, Birte Bruggmann (2004) has thoroughly reworked previous Anglo-Saxon bead chronologies. Mags Mannion (2015) has surveyed early medieval Irish assemblages, and Joanna O'Sullivan (2013) has treated the Viking-Age beads from Ireland to a more focused study. Continental beads from the Merovingian period are typically discussed in terms of individual cemeteries, in part because the rich number of finds at many of these sites parallels the abundance of finds excavated from

Bornholm. Nevertheless, Ursula Koch (2001, 2007) has progressively developed her systemization of Merovingian beads which has been further expanded by Eva Stauch (2004). Matthias Friedrich (2016:92-95) has reviewed these and other German-language efforts in a useful commentary. Barbara Sasse and Claudia Theune (1996, 1997) have discussed Merovingian beads more generally.

VIKING-AGE SCANDINAVIA

Against this background of pre-Viking-Age contexts, Callmer's study offers enriching insights. It hinges on a survey of 299 assemblages including 10 or more Viking-Age beads, for an aggregate total of 14,936 beads.³ Only beads of glass, faience, rock crystal, carnelian, agate, amethyst, and jade were counted for this study. Beads of other common materials – such as amber, silver, shell, limestone, and wood – were either omitted or not encountered among the selected assemblages. Accompanying pendants – often of silver, copper alloys, or amber – were noted but left as a separate category and not included in the analysis of beads.

The majority of assemblages (n=164; 55%) and beads (n=9,750; 65%) derive from inhumation burials, while the remaining assemblages (n=134; 45%) and beads (n=5,186; 35%) derive from cremation burials.⁴ Not all assemblages, however, were recovered or documented under ideal conditions. Callmer considered 225 of the assemblages (75%) comprising 11,406 beads (76%) to have been excavated under expert conditions. This, however, includes the work of some early excavators such as Vedel whose methods of recording and handling artifacts are described above, as well as that of Hjalmar Stolpe who occasionally used dynamite and other explosives to speed the excavation of burial mounds at Birka (Gunnar Andersson 2017: pers. comm.; Erikson 2015). Conversely, Callmer considered 50 of the assemblages (17%) comprising 1,518 of the total beads (10%) to have been non-expertly excavated, and he described an additional 12 of the assemblages (4%) comprising 1,066 of the total beads (7%) as non-expertly discovered but recovered with some degree of expert oversight.

Callmer's data suggest that professional archaeologists have tended to encounter cremations with greater frequency than non-expert investigators. Moreover, professional archaeologists have tended to recover more beads, averaging 55 beads per inhumation and 37 beads per cremation as compared to the non-experts' 48 beads per inhumation and 28 beads per cremation.⁵ Refined excavation techniques have almost certainly been a factor in this increased rate of recovery. It is also likely that early non-expert investigators

culled damaged or deformed beads from their assemblages before depositing them for preservation since assemblages deposited by professional archaeologists tend to include twice as many unclassifiable beads as assemblages delivered by non-experts.

Since these numbers represent only assemblages where more than 10 beads were retained, they give only a partial picture of Viking-Age bead use. Graves with fewer than 10 beads have been frequently encountered, especially in contexts interpreted as male burials (Lagerholm 2009; O'Sullivan 2015). Furthermore, among female burials, a focused study of 78 graves from Gotland (Thedéen 2008:85) indicates that age could be a determining factor, with girls who survived the perilous years of early youth but who died before reaching a marriageable age receiving the largest number of beads. Similar large assemblages dominate Callmer's study, with the 74 assemblages (25%) that contain 50 or more beads comprising a total of 8,873 beads or 59% of the primary material.

Burial practices were not uniform across Viking-Age Scandinavia (Svanberg 2003), and Callmer (1977:7) explicitly omitted Gotland from his study due to the special character of its assemblages. Nevertheless, the evidence from Gotland suggests that the majority of beads studied by Callmer may have been buried with girls aged 5 to 15. By extension, most of these beads had been acquired less than 15 years before their final deposition. This suggests that Callmer's dataset may be particularly well suited for identifying precise windows of time when bead styles changed. Conversely, a dataset dominated by the beads buried with young girls may be a weak basis for discussing how beads circulated among women who survived into adulthood or among other segments of the population.

Callmer's own study supports this conclusion, since larger assemblages more easily fit into his chronological framework, with an apparently short period between collection and deposition. The 252 assemblages that could be sorted according to his rules ranged from 10 to 1,216 beads, with a median of 33 and an average of 53. The 44 assemblages which did not conform to Callmer's rules but needed to be sorted as arbitrary addenda ranged from 10 to 184 beads, with a median of 24 beads and an average of 34. This means that large assemblages tended to follow period norms more closely, whereas smaller assemblages tended to deviate from period norms and appear idiosyncratic. It seems likely that these smaller assemblages belonged to older women throughout Scandinavia, just as they did on Gotland. Further study is required to show, however, whether this association is correct and whether the processes by which aging women refined their assemblages may be detected.

Despite the problems of representativity that these observations suggest, Callmer's data proved sufficient to develop an elaborate classification system for Viking-Age beads. He based his classification system on bead material and technique, shape, proportions, size, diaphaneity (translucency), color, and decorations – specifically lines and eyes applied to wound glass. Altogether, Callmer posited 595 bead types. From the 14,936 beads comprising his primary material, Callmer assigned beads to 391 of these 595 different types (66%), accounting for 12,272 of his total beads (82%). More narrowly, 95% of all classified beads fall within the 146 types for which Callmer found seven or more examples. He noted the material and technique for an additional 1,291 beads (9%), leaving the remaining 1,373 beads (9%) entirely unclassified.

Callmer then posited a classification system for assemblages using the presence or prevalence of various bead types to sort 252 of his assemblages (84%) into 19 groups, adding a further 44 assemblages (15%) to these various groups as addenda and omitting the remaining three (1%) from further analysis. He consolidated these 19 groups into nine more manageable clusters, using accompanying artifacts to place these clustered groups into a series and propose an absolute chronology. The close correspondence between bead groups and datable artifacts confirmed the utility of this classification system to use single beads and especially bead assemblages to establish the likely dates of archaeological contexts. Callmer's study suggests that almost all Viking-Age assemblages of 10 or more beads can be located within a span of not more than 35 years and, in some cases, may be pinpointed to a single decade.

Callmer's Classification System

Callmer's system is rigorous but complex, and it makes use of terms rarely found in more recent studies. Consequently, before discussing the chronology that Callmer presented, it is necessary to reexamine his system in the terms of contemporary scholarship. A summary of his basic classes of beads is sufficient for present purposes.⁶

Callmer classified beads using straightforward descriptions of color, shape, and size. Color is the most important of these criteria since he uses color and translucency to organize both his classification tables and his discussion. Højilund Nielsen's work on Bornholm indicates that even this basic level of information can provide valuable datasets for analysis.

Difficulty arises, however, from a lack of an index for color and diaphaneity (Brugmann 2004:22-25). Callmer's terms focus on hue (red, orange, yellow, etc.), and

these are occasionally expanded to indicate purity (e.g., greyish yellow) or depth (e.g., dark brown). Additionally, suggestions of translucency are embedded in these colors, particularly along the spectrum between green and blue: bluish-green beads tend to be translucent, turquoise beads are semi-translucent, and bluish-gray beads are opaque. Reference to a standard such as the *Munsell Bead Color Book* (Munsell Color 2012) would clarify this critical dimension of Callmer's classification system and elevate Viking-Age research to the standards of international bead studies (Table 3). It is also possible to convert Munsell values into the Natural Color System which is more commonly known in Scandinavia (Scandinavian Colour Institute 2008). Additionally, a more precise standard for measuring diaphaneity would aid classification and interpretation.

Callmer Class A comprises undecorated wound glass beads. These are subdivided into specific types according to color, diaphaneity, shape, proportions, and size. Class A undecorated wound beads are the most common Viking-Age beads with 4,047 examples comprising 27.1% of Callmer's overall inventory (N=14,944).

Callmer Class B comprises decorated wound glass beads. These are similarly organized according to the color of the base glass, but the color of decorative elements does not figure in the classification system. Callmer describes decorations according to the patterns of eyes and lines, generating a complex list of 332 distinct types. In practice, he lists no examples of 144 types and only one or two examples of an additional 103 types. These rare types could be removed, dramatically simplifying the classification system while rendering only a small number of beads unidentifiable. In particular, Callmer regularly treats B088 and B090 beads as a single type, which is significant in his discussion of later bead periods. Callmer identifies 1,274 Class B decorated wound beads in his assemblages (8.5%).

Callmer Class C comprises folded glass beads. These are probably best considered a subtype of Class A beads in which a single piece of glass is wrapped around a mandrel and the ends are fused together. These can be distinguished from Class A wound beads if the beadmaker left traces of the seam where the ends met but, in practice, it is difficult to distinguish a folded bead from a wound one. Callmer classifies only two beads (0.01%) as folded. Other researchers examining Viking-Age beads should exercise similar discretion.

Callmer Class D comprises blown segmented beads with thin walls and one or more segments. These tend to be large and hollow, often surviving only as small translucent shards. Callmer lists only seven Class D blown segmented beads (0.04%) without identifying specific types. One

Table 3. Colors of Viking-Age Beads.

Color	Number of Beads	Percent of all Beads	Translucent	Semi-Translucent	Opaque	Munsell Equivalent	Nearest NCS Sample Equivalent
Colorless	457	3.1%	82%	18%	0%		
White / Grayish White	1,113	7.6%	0%	10%	90%	N 9	1000-N
Black	248	1.7%	0%	0%	100%	N 1	9000-N
Yellow	745	5.1%	3%	16%	80%		
– Yellow	734	5.0%	4%	16%	80%	5.0Y 8/8	1050-Y
– Grayish Yellow	11	0.1%	0%	0%	100%	10.0YR 7/8	2050-Y20R
Orange	53	0.4%	0%	0%	100%	5.0YR 6/12	1080-Y40R
Red / Brown	347	2.4%	5%	1%	97%		
– Red	20	0.1%	0%	15%	80%	8.75R 4/14	1580-Y80R
– Brownish Red	315	2.1%	100%	0%	100%	7.5R 4/6	4040-Y90R
– Yellow Brown	7	0.0%	0%	0%	0%	2.5YR 2/2	8005-Y80R
– Dark Brown	5	0.0%	100%	0%	100%	10.0R 3/2	7010-Y90R
Purple (Malva)	157	1.1%	100%	0%	0%	10.0P 2/4	7020-R50B
Blue	2,862	19.5%	95%	3%	2%		
– Dark Blue	2,778	18.9%	98%	2%	0%	5.0PB 3/4	6020-R80B
– Forget-Me-Not	15	0.1%	0%	93%	7%	7.5B 6/6	2040-B10G
– Bluish Gray	69	0.5%	1%	0%	99%	7.5PB 5/6	4030-R70B
Teal	1,519	10.4%	63%	14%	24%		
– Bluish Green	421	2.9%	55%	44%	1%	5.0G 5/4	4030-B90G
– Bluish Green / Grayish Green	216	1.5%	100%	0%	0%	7.5GY 6/6	3040-G40Y
– Grayish Green	882	6.0%	57%	3%	40%	7.5GY 8/4	1030-G30Y
(Pale) Turquoise	279	1.9%	0%	100%	0%	5.0BG 8/2	1020-B70G
Green	1,137	7.7%	5%	91%	4%		
– Medium Green	1,132	7.7%	5%	91%	4%	10.0GY 5/10	2070-G20Y
– Dark Green	5	0.0%	0%	0%	100%	7.5GY 4/3	6030-G30Y
Silver	1,537	10.5%	57%	43%	0%		
+ Bluish Green	27	0.2%	100%	0%	0%		
+ Colorless	659	4.5%	0%	100%	0%		
+ Yellow Brown	851	5.8%	100%	0%	0%		
Specified	10,454	71.2%	35%	18%	19%		
Unspecified	4,220	28.8%					
Overall	14,674	100%					

occurs in Birka Grave 800 which Callmer dates to 885-915, and the remaining six occur in Birka Grave 1084 which Callmer dates to 960-980. Similar beads, however, are also encountered in settlement contexts such as at Kaupang (Wiker 2007).

Callmer Class E comprises drawn segmented beads. This class does not include wound segmented beads which were common during the late Iron Age, most often in translucent blue glass. The wound varieties may be identified by their irregular segment sizes as well as their large perforations which are typically at least 3-4 mm in diameter. In contrast, drawn segmented beads often have extremely small perforations less than 2 mm in diameter that are occasionally completely sealed. Scandinavian examples generally consist of between one and three segments although longer variants also occur. These beads likely originated in Muslim or Byzantine workshops, probably routed north via the Middle Danube (Jönsson and Hunner 1995; Sode et al. 2010; Staššiková-Štukovská and Plško 2015).

During the Viking Age, segmented beads were often made from two layers of glass, sometimes with a metallic dust or foil between them. Callmer cataloged all these metal-foil beads as silver-foil although many appear golden in color. He reserved the category yellow for true yellow segmented beads, never using it for gold-foil beads made from layers of translucent brown glass. This choice to conflate silver- and gold-foil beads seems appropriate, especially since it can often be difficult to distinguish silver- from gold-foil in deteriorated specimens. Many survive without their outer layer, making it impossible to identify the original surface appearance. Furthermore, in certain circumstances, the difference between silver and gold coloring may be caused merely by incidental heat applied during manufacture rather than divergent manufacturing processes. A hotter, oxidizing flame is needed to preserve the clear outer layer that allows the silver to shine through, while a cooler, reductive flame will cause the glass to turn amber and result in a golden sheen (Moa Råhlander 2017: pers. comm.). Because of the difficulties involved in classifying these beads precisely, most researchers would benefit most from comparing segmented beads only to Callmer's most common variants, although more precise descriptions are preferred when possible (Sode et al. 2010). Callmer identifies 2,290 Class E beads in his assemblages (15.3%), including five types with more than 100 specimens each (E020, 030, 060, 110, 140).

Callmer Class F comprises drawn cut beads. They tend to be smaller than most Viking-Age beads and are sometimes little more than extremely thin and small tubes, similar to many drawn beads from more modern contexts. All variants except one rare type (F080) are monochrome. Most are blue, green, or yellow. Drawn cut beads rarely show up singly

but are frequently accompanied by large assemblages of similar beads. They may be easily distinguished by their longitudinal structure, with impurities in the glass stretching from end to end rather than wrapping around the body. One end is often flat while the other is slightly rounded. This unique shape shows that the beads were either slowly cooled or reheated to soften the edges. Among other reasons, this may have been done to prevent sharp edges that could cut necklace strings (Råhlander 2017: pers. comm.). These beads were imported from production centers in the Near East and were especially common at trading sites such as Kaupang (Wiker 2007). Callmer identifies 3,936 Class F beads in his assemblages (26%) including seven types with more than 100 specimens each (F011, 030, 031, 050, 051, 060, 070).

Callmer Class G and H comprise mosaic beads. Callmer called these beads composite beads which is currently not a commonly used term. Other researchers occasionally refer to these beads as millefiori (thousand flowers), but this term should instead be reserved only for instances where a bead incorporates an indisputably floral design.

Callmer subdivided Class G beads based on the inclusion of special elements such as single-color rings on each end (G001-2), blurred features (G020), blue/yellow checker patterns (G030-2), square-tiled diamond patterns (G040-1), multi-color parallel rings on each end typically paired with blue or green eye mosaics (G050), or the absence of these particular elements (G010-4). Class H beads are a subset of G050, typically composed of blue or green eye mosaic pieces but generally lacking bands or rings. Callmer identifies 220 Class G mosaic beads (1.5%) and four Class H mosaic beads (0.03%).

In practice, these divisions have yielded few meaningful results, with almost all variants being most common in Callmer's first period (790-820). The only common exceptions are G050 beads, which fall primarily into Callmer's second period (820-845). The criteria used to distinguish G050 beads from Class H beads are difficult to apply and the few examples of Class H beads should probably be classed together with the G050 beads.

A more useful classification could be derived from Alexander Pöche's (2005:146-147) classification system for the beads of Groß Strömkendorf which distinguishes most of the motifs commonly found in Iron-Age and Viking-Age Scandinavia. In addition, Reinhart Andrae (1973) has developed a detailed classification system for eye mosaic beads, including the variants which belong to Callmer's Class H, as well as pierced variants which belong to Callmer Class J, discussed below. The main distinction among these

eye beads seems to be that individual eye mosaic pieces have borders that are predominantly either green or blue. Callmer (1991) traces the arrival of blue eye mosaic beads via the Danube and green eye mosaic beads via the Volga. Additionally, a third rare type of eye mosaic bead may be identified by its bright orange borders (Callmer 1977: Color Plate III B696O). These beads should be treated as a distinct group since they occur only during the late Viking Age whereas the other eye mosaic variants tend toward the early Viking Age.

These three eye bead styles – blue, green, and orange – should be distinguished in classifications or discussions with reference to Andrae's precise classification system where possible. For other variants, Armin Volkmann and Claudia Theune (2001) have identified numerous examples in continental cemeteries from the Merovingian period, and several examples have had their chemical composition identified (Hložek and Trojek 2015).

Callmer Class J comprises pierced beads. Callmer only notes variants made from mosaic elements, where one piece or several fused pieces of mosaic glass have been heated and pierced with a pointed rod. These mosaic pieces are typically either green or blue eyes (J001-2) or square-tiled diamond patterns (J003-4). The classification of these beads could be meaningfully expanded to indicate whether they were built from eyes framed in either green or blue, and whether they consist of one or more pieces.

Additionally, pierced beads made from non-mosaic glass should be gathered into this group. A subtype of Class J beads should be created for round pierced beads of purple glass which are at present classified among wound variants as A154 or A155 beads (Ericsson-Borggren 1993, which was prepared with the collaboration of Callmer). Close inspection of these beads, however, reveals that they contain air bubbles that are nearly spherical and not stretched from winding or drawing. In later publications, Callmer (1991) treats these beads as indicators of oriental trade, and these beads often occur in the same contexts as pierced mosaic beads, as at Åhus. Callmer identifies 25 Class J pierced mosaic beads (1.7%) and to these should be added five pierced purple beads (0.03%) currently classified as types A154 and A155.

Callmer Class K comprises reticella beads. Reticella consists of various colors of glass formed into spirals, sometimes referred to as twisted stringers. Reticella beads typically consist of a single twisted stringer folded around a mandrel. This leaves the impression of stripes that circle through the perforation. Occasionally, multiple reticella pieces are joined side-by-side, typically with the glass wrapped in alternating directions, producing a herringbone

effect much like S- and Z-twisted threads combined in fabric twill. These beads often give the loose impression of irregular eyes where the ends of the reticella pieces have been seamed together. Reticella beads occur in late Iron-Age assemblages across northern Europe, often in red and yellow. Early Viking-Age variants are more frequently blue wrapped with white or green wrapped with yellow. Callmer identifies nine Class K reticella beads (0.06%).

Callmer Class Q comprises cold-cut beads that form two common groups. The first group (n=23) consists of glass that has been cut into a faceted cube, similar to the many beads of rock crystal or carnelian discussed below. These beads tend to appear in blue or green glass. The second group (n=22) consists of green tubes, often with five or six sides. Large numbers of these beads have been found at Ribe, as well as at Åhus where they are classified as types Q052, Q060, and Q061 (Ericson-Borggren 1993). These beads have a high lead content tentatively associated with raw materials taken from the Taurus Mountains along the frontier between the Byzantine empire and the Abbasid caliphate (Sode et al. 2010). In some Scandinavian soils, these high-lead beads deteriorate considerably and may appear cylindrical or heavily decayed, sometimes giving the impression of splintering yellow wood as the structure begins to deteriorate. Callmer identifies 70 Class Q cold-cut beads (0.5%).

Callmer Class R comprises faience beads. Faience is composed of fused powdered quartz and is technically not a glass. It typically appears in opaque turquoise blue but can be distinguished from glass due to the distinctive shape of the beads, primarily large melons, as well as by how the material decays. Often the projecting ribs or gadroons will deteriorate and fade to white, while the recessed areas between the ribs retain a rich turquoise color. Callmer identifies 50 Class R faience beads (0.3%).

Callmer Class S comprises rock-crystal beads. There is some evidence for the production of a small number of rough rock-crystal beads in Norway (Myhre 2005), but most were likely imported from the East, where they are thought to have ultimately derived from either Iran or India. Spherical and barrel variants tend to belong to either the early or late Viking Age, with smaller examples more likely dating to the late period. Tubes and faceted cubes may more frequently be ascribed to the mid-Viking Age. Daniel Hepp (2007) has published a thorough study of the rock-crystal and carnelian beads from Haithabu, which may be used as a reference to distinguish more precise types. Callmer identifies 691 Class S rock-crystal beads (4.6%).

Callmer Class T comprises carnelian beads. Carnelian, like rock crystal, is a variant of quartz, and these beads

likewise arrived via eastern routes tied to Iran or India. These beads appear in similar shapes as the rock-crystal beads and have a similar chronology. It seems likely that the same workshops produced both rock-crystal and carnelian beads, and it is possible that they produced faceted cold-cut glass beads as well. In describing carnelian beads, Hepp's (2007) classifications should also be referenced, if possible. Callmer identifies 879 Class T carnelian beads (5.9%).

Callmer Class U comprises amethyst beads. These occur occasionally before the Viking Age, often in tear-drop shapes, but they became rare after 700 (Ljungkvist 1991:42). Callmer identifies only three Class U amethyst beads (0.02%).

Callmer Class V comprises jade beads. Callmer identifies a single jade bead from a burial at Överlandet in Haram, western Norway.

Callmer was unable to classify 1,373 beads (9.2%). Many of these were probably fragmented or decayed beyond recognition, but his classification system also excludes a number of beads of other materials which occur in Viking-Age burials. Most notably, amber beads were excluded from Callmer's classification system and a thorough study of amber beads and pendants remains wanting. Silver, bronze, wood, shell, jet, and garnet also occur and may be meaningfully classified (Resi 2011a, b). Callmer also chose to exclude pendants which would be a welcome addition to bead classification systems, along with spacer beads. Spacer beads and certain bronze pendants shaped like fish heads are common on Gotland, for which Lena Thunmark-Nylén (2006:180-182, 198-201) has produced a basic typology. It remains to be seen whether these Gotlandic types are similar to those found elsewhere.

Callmer's Chronology

Callmer grouped his assemblages according to the various proportions of different bead types, often relying only on the general class, such as the presence or absence of rock crystal and carnelian. In some cases, Callmer relied on the presence or absence of specific types, such as his hybrid type B088/90 which he identified as occurring in graves no earlier than 960. Callmer then used associated grave goods to place these assemblage groups in a series and suggest absolute dates, which he confirmed against a larger dataset in the later chapters of his text. In doing so, he needed to conflate several of his assemblage groups into larger bead period groups which he identified using the largest group name. This produced a confusing situation in which Callmer's bead periods occur in the order I, II, III, IV, VII,

VIII, VI, IX, and XII (Table 4). To add clarity, I will instead refer to these bead periods as phases, listing Callmer's bead period and the assemblage variants it includes below.

Callmer Phase 1 (Bead Period I: 790-820)

Callmer Bead Period (BP) I. Assemblage Variants I.A, I.B, I.C, I.D

Callmer assigns 49 assemblages to this period, of which 24 (49%) derive from cremation contexts.⁶ Assemblages range from 10 to 175 beads with a median of 33 and an average of 43. This period is defined by a prevalence of wound and mosaic beads (Figure 4).

Wound beads comprise at least 50% of most assemblages, totaling 85% of all period beads. Dark blue beads are most common, followed by beads of green and white. Slightly less than 20% of all wound beads are decorated, with eyes appearing somewhat more frequently than rings, which may be applied singly, side by side, or interwoven. Assemblages with undecorated turquoise beads (A291, 340, 341, 345) or including various white, black, or turquoise beads with rings (B021, 066, 531, 536, 538, 545, 610) are typically excluded from this period and should instead be regarded as belonging to the later period 885-915.

Mosaic beads are most common during this period, comprising about 5% of the assemblages. Callmer attributes to this phase three exceptional assemblages in which mosaic beads comprise more than 30%. These derive from northern Norway. In all assemblages from this phase, drawn beads are extremely rare, comprising about 1% of period beads and appearing only exceptionally in groups of more than one within a single assemblage. Rock-crystal and carnelian beads are generally absent.

This phase corresponds to Bornholm phases 2C and 2D (775-800+). R3C assemblages consisting of green, white, blue, and polychrome beads mixed with colorless and gold-foil beads were being deposited alongside R3D assemblages consisting of colorless, gold-foil, and silver-foil beads. These descriptions conflict slightly with Callmer's study, for which colorless and silver-foil beads each make up less than 2% of the period assemblages. The Bornholm phases are open-ended, however, and these beads become more prevalent in Callmer's later phases. This suggests that, although furnished burials were sparse on Bornholm during the Viking Age, they continued past Callmer's first phase, at least into his second (820-845).

This phase corresponds to Ribe Posthuset Phases F and G (790-820). Wasp beads, which were declining but still common in Ribe, are completely absent from Callmer's

Table 4. Callmer Assemblage Classification.

Bead Period	Bead Group	AB Wound	A Undecorated	B Decorated	EF Seg./ Drawn	E Segmented	F Drawn	G Mosaic	ST Rock/ Carn.	Note
I 790-820	I.a	>50%				0%		<30%	0%	1
	I.b	>50%	>50%			<10%	<15%	<30%	0%	1
	I.c	>50%		>50%		<10%	<15%	<30%	0%	1
	I.d					<10%		>30%	0%	
II 820-845	I/II.a	>50%				10-25%	<15%	<30%	0%	1
	I/II.b	>50%				25-50%	<15%	<30%	0%	1
	II.a		>30%			>50%	<10%	<30%	0%	2
	II.b		<30%			>50%	<10%	<30%	0%	2
III 845-860	II/III.a					>50%	10-50%	<30%	0%	2
	II/III.b		30-50%			25-50%	10-50%	<30%	0%	
	III.a		<10%			10-25%	>50%	<30%	0%	
	III.b		<10%			<10%	>50%	<30%	0%	
	III.c		10-50%			<10%	>50%	<30%	0%	
IV 860-885	III/IV.a	<60%					>10%		<30%	
	IV.a	<60%					<10%		<37.5%	
	V.a							>75%	3	
VII 885-915	VII.a	>50%	<B		<10%			<30%	0%	4
	VII.b	>50%	>B		<10%			<30%	0%	4
	VII.c	>50%				>10%	<10%	<30%	0%	4
	VII.d	>50%				<10%	>10%	<30%	0%	4
VIII 915-950	VIII.a	>50%							<50%	5
	XI.a	<60%					<10%		>37.5%	6
	X.a							50-75%		
VI 950-960	V/VI.a						20-50%		≥0%	7
	VI.a						>50%		≥0%	7
	VIII/IX.a	10-50%				20-50%			<50%	8
IX 960-980	IX/X.a	10-50%				20-50%			<50%	9
	IX.a					>75%			<50%	10
	IX.b					50-75%			<50%	
	X.b							50-75%		
	V.b							>75%		
XII 980-1000	XII.a	>50%							<50%	12
1. A291, 340, 341, 345 < other A and/or A291, B021, 066, 531, 536, 538, 545, 610 absent. 2. Only E060, 110, 120, 140. 3. Early context. 4. A291, 340, 341, 345 > other A and/or A291, B021, 066, 531, 536, 538, 545, 610 present. 5. A001, 291, 341, 345 dominate (but A001<50%) and/or B011, 066, 545, 691 present.					6. Absence of B088, 090, E030, 03-1, 050. A171, 172, 177 not dominant. 7. Small F. 8. Lack of B088, 234. A171 not dominant. 9. B088, 090, 235 present or A171 dominant. 10. Presence of B088, 090 and/or dominance of A171, 172, 177 and/or presence of E030, 03-1,050. 11. Late context. 12. Dominance of A001(>40%), 020, 171.					



Figure 4. Beads from grave 35 at Tuna i Badelunda, classified by Callmer as BP I (790–820), assemblage variant I.c. This assemblage variant is dominated by wound beads (Västmanlands läns museum 27651.)

inventory for this phase. The oriental beads also present an interesting contrast between Ribe and Callmer's burial inventories. In Ribe, 18% of the segmented beads are blue, the rest are metal-foil. Callmer, however, inventoried a single blue segmented bead, while the remaining 97% of segmented beads were silver-foil. Moreover, segmented beads comprise over 30% of the period beads at Ribe but are only found in 1.6% of the period burials. This leaves the impression that some styles of beads – in this case wasp beads and segmented beads – circulated in emporia but were not displayed by surrounding elites. Elites were still primarily displaying wound beads which may have been made locally or acquired through networks of patronage or trade. But the people living in Scandinavian emporia were instead surrounding themselves with beads newly arrived from the orient, appearing in drawn and segmented styles that could not be replicated by Scandinavian craftworkers but were instead visibly identifiable as products made in the Near East.

Callmer Phase 2 (BP II: 820-845)

BP II (+ II/III). Assemblage Variants I/II.A, I/II.B, II.A, II.B

Callmer assigns 42 assemblages to this period, 17 of which (41%) derive from cremation contexts. Assemblages range from 13 to 91 beads with a median of 32 and an average of 37. These assemblages are somewhat smaller than in the preceding period. This period is defined by an increasing number of segmented beads, but drawn cut beads remain rare (Figure 5).

Wound beads decline to only 35% of assemblages, with green and white beads striking a more even balance with the still dominant blue. Decorated beads are slightly more common at just over 20%, with ring patterns occurring more frequently than eyes. Mosaic beads occur at a rate of about 4%. Pierced mosaic beads are most common during this period, although they represent less than 1% of the period beads.



Figure 5. Beads from grave 47 at Lousgård, Bornholm. Callmer classifies this assemblage as BP II (820-845), assemblage variant II.b, dominated by segmented beads of metal-foil or blue glass, while Høilund Nielsen classifies it as Group R3D (775-850) and links it to Bornholm phase 2C (775-800) (National Museum of Denmark C5710).

Segmented beads dominate this period, comprising over 40% of the period beads. About 80% of these are silver-foil; the remaining segmented beads are dark blue. Drawn cut beads also occur but only in small numbers, comprising only about 1% of the period beads. Blue is the most common color with a single occurrence of green. Cold-cut beads also appear during this period, typically as narrow cylinders or 5- or 6-sided tubes. Many of these have deteriorated and exhibit an opaque white or brown coating, although strong lighting will often reveal the bright green color of the underlying glass. Rock-crystal and carnelian beads are rare, at less than 2% of the period's assemblages.

This phase corresponds to Ribe Posthuset Phases H/I (820-850). Earlier oriental imports have gone into final decline, including segmented beads which are finally becoming common in elite graves. These beads drop from 31% to 4% of the period beads at Ribe, while rising from

2% to 44% in period graves. Instead, Ribe's assemblage is dominated by a new oriental import: drawn cut beads which rise from 5% to almost 30% of period assemblages. These beads, which characterize Høilund Nielsen's assemblage type R3E, also begin to appear in Callmer's grave inventories, but only at a rate of 1.2%.

Callmer Phase 3 (BP III: 845-860)

BP III (+ II/III, + III/IV). Assemblage Variants II/III.A, II/III.B, III.A, III.B., III.C, III/IV.A

Callmer assigns 29 assemblages to this period, of which 12 (41%) derive from cremation contexts. Assemblages range from 10 to 243 beads with a median of 54 and an average of 62. These assemblages include substantially more beads than preceding periods. This period is defined



Figure 6. Beads from grave 810 at Hedeby, Germany. Almost all are oriental imports. Due to the large proportions of segmented (61%) and drawn cut beads (29%), this assemblage may be classified with variants II/III.b and grouped with BP III (845-860) (Schleswig-Holsteine Landesmuseen Hedeby Grave 487/1960.)

by the frequent occurrence of drawn cut beads, often in combination with drawn segmented beads (Figure 6).

Wound beads decline to just 10% of assemblages. Green beads become prominent at about 30% of the wound beads, with blue and blue-green each making up an additional 20%. White also continues to occur. Decorated beads make up a larger percentage of wound beads than before, now comprising 25%. Rings remain the more common pattern for decoration, now more frequently occurring singly or side by side rather than interwoven. Mosaic beads and pierced mosaic beads fall to less than 1% of assemblages, while segmented beads decline to only about 10% of assemblages. About 67% of segmented beads are silver-foil, the remaining segmented beads are mostly blue.

Drawn cut beads make up more than 70% of all assemblages, and their dramatic increase accounts for the large assemblages of this period. More than half of them are blue, and most of the rest are yellow, although white and sometimes green specimens also occur. Cold-cut beads continue to occur at about the same rate as the previous phase, again comprising about 1% of assemblages. Rock-crystal and carnelian beads are rare, also constituting less than 1% of the period beads.

The chronology for Ribe falters around 850, as any later Viking-Age layers have been disturbed by subsequent activities. Nevertheless, more drawn cut beads were found in these disturbed layers than in all preceding phases combined, suggesting that they continued to circulate

at Ribe at least through Callmer's third phase. Kaupang also offers a useful point of reference. Although no close chronological study of the Kaupang beads has yet been published, drawn cut beads occur throughout the stratified layers of Site Phase II, which lasted until about 850 (Pilø and Pedersen 2007; Wiker 2007). Callmer Phase 3 may therefore represent a point of convergence, as both rural elites and emporia residents encountered and engaged with similar beads. This is a strong indicator that long-distance exchange – although always a small fraction of medieval economics – had nevertheless taken on social significance as the source of a shared material culture throughout the diverse communities of Viking-Age Scandinavia.

Callmer Phase 4 (BP IV: 860-885)

BP IV (+ V.A). Assemblage Variants IV.A, V.A

Callmer assigns 38 assemblages to this period. Seventeen of these assemblages belong to Callmer's group V, which he recommended splitting, based solely on context, into an early group belonging to this period and a later group belonging to the period 960 to 980, further discussed below. Three assemblages (154, 182, and 191) should be reassigned to the later period due to accompanying artifacts dating to the late Viking Age. Another assemblage (221) should be similarly reassigned due to the presence of a particular type of bead (S006) which is otherwise almost exclusively associated with the late Viking Age (Figure 7).



Figure 7. Beads from grave 81 at Hedeby, Germany. Newly imported rock-crystal and carnelian beads dominate this assemblage, with a single blue drawn cut bead. This assemblage is typical of variant V.A, grouped into BP V (885-915) (SHLM, Hedeby Grave 64/1908.)

Of the remaining ten group V assemblages combined with the 21 group IV.A assemblages, 20 (59%) derive from cremation contexts, a dramatic increase from previous periods. Assemblages range from 10 to 402 beads with a median of 38 and an average of 54. This indicates that although some exceptional assemblages were much larger than in the previous period, assemblages in fact tended to be decreasing in size. This period is defined by the sudden appearance of rock-crystal and carnelian beads, as well as the rapid disappearance of drawn segmented and cut beads.

Wound beads again become common and constitute 40% of assemblages. Green is the most common color at about 33% of all wound beads and turquoise specimens comprises an additional 25%. These green or greenish beads are more frequently translucent than during earlier periods. White beads also remain common. More than 20% of wound beads are decorated, with rings occurring almost twice as often as eyes. Mosaic beads remain rare.

Segmented beads drop to only 2% of assemblages and drawn cut beads fall to 7%. Blue remains the most common color, followed by yellow, white, and green. Rock-crystal and carnelian beads jump to 40% of the period beads. In 12 burials (35%), these beads comprise over 75% of their assemblages and in four of these cases, the assemblages consist solely of rock-crystal and carnelian beads. Eleven of these burials were at Birka or in the surrounding areas

of central Sweden, and the remaining one was located at Hedeby. Overall, carnelian beads occur about twice as frequently as rock crystal. A small number of faience beads are also present, although they still number well below 1% of the period beads.

The dramatic abandonment of glass beads for beads of rock crystal and carnelian marks an important turn in the Viking Age. The Ribe chronology has ceased by this point, and although Kaupang shows some evidence of occupation until about 930, the scarcity of rock crystal and carnelian suggests that it no longer functioned as a hub for long-distance exchange. Conversely, at Hedeby and Kaupang, the arrival of carnelian and rock crystal corresponds to the first major expansions of the excavated harbor areas (Ambrosiani et al. 1973:32, 236; Kalmring 2010:351-359, 664). Kalmring associates the expansion of the Hedeby harbor with an effort to accommodate larger vessels, which would have included an increased capacity for trade. The sudden presence of rock-crystal and carnelian beads in the harbor layers as well as in elite graves across Scandinavia demonstrates the expanding importance of maritime traffic and long-distance exchange during this period. This reinforces Christoph Kilger's (2008:228-235) arguments that the silver trade thrived throughout this period as well.

Callmer Phase 5 (BP VII: 885-915)

BP VII. Assemblage Variants VII.A, VII.B, VII.C, VII.D

Callmer assigns 36 assemblages to this period, of which 13 (36%) derive from cremation contexts. Assemblages range from 11 to 146 beads with a median of 22 and an average of 33. Despite the presence of a few large assemblages, most are the smallest of the Viking Age. This period is defined by the sudden end of rock crystal and carnelian and the return of wound beads (Figure 8).

Wound beads comprise 70% of period assemblages with green and turquoise specimens each exceeding 20%. White beads follow at about 15%. Beads in other colors occur occasionally. Over 25% of the beads are decorated, which is the highest frequency of decoration during the Viking Age. In particular, white, black, or turquoise beads with rings (B021, 066, 531, 536, 538, 545, 610) are characteristic of this period. Their presence, or in certain cases the prominence of undecorated turquoise beads (A291, 340, 341, 345), helps distinguish assemblages of this period from earlier assemblages dominated by wound beads.

Drawn segmented beads occur at a rate of 5%, and drawn cut beads reduce to less than 4%, occurring almost exclusively in blue and yellow. Mosaic beads are somewhat more frequent than in the preceding two periods, although



Figure 8. Beads from grave 497 at Hedeby, Germany. This assemblage may be associated with variant VII.a, BP VII (885-915). The green translucent beads with wavy rings, often alternating with straight rings, are especially characteristic of this period (SHLM, Hedeby Grave 188/1960.)

rebounding to only 2% of assemblages. Very few rock-crystal beads occur and carnelian beads are entirely absent.

The abandonment of oriental bead imports corresponds to the influx of Samanid silver that began during this period (Kilger 2008:235-240). Beads no longer served as a dominant long-distance exchange commodity and may even have been displaced as a means of exchange. Instead, there seems to have been a revival of local bead production. At present, few chemical studies are available to indicate the source of the glass used to make these beads, but there is evidence that glass production occurred at Hedeby, at least from recycled materials (Kronz et al. 2015).

Callmer Phase 6 (BP VIII: 915-950)

BP VIII (+ IX, + X.A). Assemblage Variants VIII.A, XI.A, X.A

Callmer assigns 27 assemblages to this period, of which 18 (67%) derive from cremation contexts. Assemblages range from 11 to 184 beads with a median of 29 and an average of 41. This is an overall increase in assemblage size from the preceding period and large assemblages are again more common. This period is defined by the return of rock-crystal and carnelian beads, mixed with a larger number of wound beads, including several diagnostic types decorated with rings (Figure 9).

Wound beads comprise over 50% of the period assemblages. Green remains the most common color, albeit



Figure 9. Beads from grave 77 at Hedeby, Germany. Callmer classifies this assemblage as variant X.A, BP VIII (915-950), based on the large number of rock-crystal and carnelian beads. This falls between variants IV.A and V.A, both of which are grouped into BP IV (860-885) (SHLM, Hedeby Grave 60/1908).

at only about 25% of the wound beads. Colorless, white, red, and turquoise specimens are also common. The presence of certain turquoise and grayish-green beads (A001, 291, 341, 345) helps distinguish the assemblages of this period. About 15% of the wound beads are decorated. The presence of certain white, black, and green beads with rings (B011, 066, 545) or green beads with eyes (B691) also helps distinguish the assemblages of this period.

Drawn segmented, drawn cut, and mosaic beads occur rarely. Cold-cut and faience beads occur only exceptionally. Rock-crystal and carnelian beads each occur at a rate of about 13%, comprising 25% of the period beads. Most of these appear in styles that were already common between 860 and 885, predominantly tubes, faceted cubes, and spheres. The appearance, disappearance, and reappearance of rock-crystal and carnelian beads may reflect major changes in the structure of the Central Asian trade contingent on the rise of the Samanid emirate, which is similarly reflected in changing sources of silver imports (Kilger 2008).

Callmer Phase 7 (BP VI: 950-960)

BP VI (+ V/VI, + VIII.IX). Assemblage Variants V/VI.A, VI.A, VIII/IX.A

Callmer assigns 16 assemblages to this period of which 4 (25%) derive from cremation contexts. Assemblages range

from 27 to an exceptional 1,216 beads with a median of 57 and an average of 195. Large assemblages seem to be common during this period with over half of the assemblages comprising more than 50 beads, four of which include over 300 beads. This period is defined by the dominance of small drawn cut beads (Figure 10).



Figure 10. Beads from grave 644 at Hedeby, Germany. This assemblage consists solely of small drawn cut beads, typical of variant VI.A, grouped with BP VI (950-960) (SHLM, Hedeby Grave 340/1960.)

Wound beads are extremely rare during this period, comprising less than 5% of the assemblages. Green remains the most common color, followed by white, blue, and turquoise. About 25% of wound beads are decorated, with rings being a somewhat more common design feature than eyes. A single mosaic bead was found in a grave in southwestern Sweden and a small group of cold-cut beads was found in a Birka grave.

Drawn cut beads comprise almost 80% of assemblages from this period. Almost 50% of these beads are green while blue comprises only about 15%. This is the opposite of earlier periods when most drawn cut beads were blue and green was only rarely encountered. Drawn segmented beads also occur during this period at a rate of about 10%.

Callmer Phase 8 (BP IX: 960-980)

BP IX (+ IX/X, + X.B, + V.B). Assemblage Variants IX/X.A, IX.A, IX.B, X.B, V.B

Callmer assigns 49 assemblages to this period. Additionally, at least four assemblages dominated by rock crystal and carnelian and likely stemming from late contexts should probably be included in this period. Of these 53 assemblages, 19 (36%) derive from cremation contexts. Assemblages range from 10 to 136 beads with a median of 28 and an average of 35. These numbers represent a significant reduction from the massive displays of the previous period. This period is defined by a large number of segmented beads mixed with rock crystal and carnelian (Figure 11).

Wound beads comprise just over 10% of assemblages. Blue beads are again more prominent than green, although no single color dominates this period. Almost 30% of wound beads are decorated. Black beads decorated with both eyes and lines (B088/90) are diagnostic types for this period.



Figure 11. Beads from grave BØ at Stengade, Denmark. The large black bead with eyes and interwoven rings belongs to type B088/90, which is characteristic of variant IX/X.a, grouped with BP IX (960-980) (Langlands Museum 8277).

Drawn cut beads almost disappear during this period, dropping to only 1% of assemblages. Drawn segmented beads become much more common, comprising over 50% of period beads. Silver-foil beads dominate at 67%, but yellow and blue both make up more than 10% of the period's segmented beads. Rock crystal and carnelian make up 20% of period beads with both occurring at about the same rate.

Callmer Phase 9 (BP XII: 980-1000)

BP XII. Assemblage Variant XII.A

Callmer assigns 10 assemblages to this period of which six (60%) derive from cremation contexts. Assemblages range from 10 to 90 beads with a median of 29 and an average of 32. The relatively small number of assemblages that Callmer was able to assign to this period suggests that burials with grave goods were already becoming rare. This is the last phase of Callmer's sequence. It is defined by the return of wound beads with some continuation of drawn segmented beads and beads of rock crystal and carnelian (Figure 12).

Wound beads comprise over 60% of period assemblages. Translucent colorless beads (A001), opaque white beads (A020), and translucent blue beads (A171) are diagnostic of the period. Red beads are also present in substantial numbers, but green beads disappear almost entirely. Only about 15% of wound beads are decorated, which is the lowest rate of decoration during the Viking Age. White and



Figure 12. Beads from grave 79 at Tuna i Badelunda, classified by Callmer as BP XII (980-1000), assemblage variant XII.a. In addition to the two B088/90 black decorated specimens, there are also two large drawn melon beads which are characteristic of the late Viking Age (Västmanlands läns museum 27651).

blue beads are the most likely to be decorated, with a slight preference for eyes over rings.

Drawn segmented beads occur at a rate of just over 5% of assemblages. Half of these are colorless while most of the remainder are silver foil. A single yellow drawn cut bead can be assigned to this period. Rock-crystal and carnelian beads occur in about equal numbers, comprising a combined total of 10% of the period assemblages.

Discussion

Further study of other chronological contexts would complement this study, giving researchers insights into how women selected beads from the varieties that were available. Urban sites provide the most immediate comparative context, although chronologies are often lacking for the later Viking Age. The Ribe stratigraphy offers a tight chronology of beads through the early decades of the Viking Age. A stratigraphic study of the beads from Kaupang could further this urban bead chronology into the late 800s (Gaut 2011; Wiker 2007). Ongoing work on the stratigraphy has unraveled the early layers from Birka (Ambrosiani 2013), and a forthcoming volume focused on the later stratigraphy is eagerly anticipated. Hedeby has also been the subject of rigorous studies, although chronologies tend to be based on typologies rather than on stratigraphic sequences (Steppuhn 1998). Several south Baltic sites should also be included with these studies, including especially Groß Strömkendorf/Reric (Pöche 2001, 2005), Janów Pomorski/Truso (Dekówna and Purowski 2012), and Szczecin/Wolin (Olczak and Jasiewiczowa 1963; Stanisławski 2003). Russian sites such

as Staraya Ladoga would also be welcome additions but are beyond my linguistic abilities.

Callmer's chronology is now also in a position to be reassessed in terms of bead circulation outside Scandinavia. Viking-Age beads in Britain have received an initial treatment by Megan Hickey (2014), and both Ireland (O'Sullivan 2013) and Iceland (Hreiðarsdóttir 2005) have unpublished catalogs of beads classified according to Callmer's typologies. The beads from Ireland hold rich potential for advancing our understanding of the chronology of Norse activity there, whereas the beads from Iceland provide a firm chronological key, revealing which bead types were still in circulation after settlement began in 871±2.

Callmer omitted Gotland from his study, although he later provided comments in a short contribution to the *Wikingertid Gotlands* volumes (Callmer 2006). The bead finds from Gotland have proven especially rich, although no chronological analysis has yet been published (Carlsson 2003). I am, however, prepared to offer some initial comments after my own examination of almost 3,000 beads at the Gotland Museum in the spring of 2017, with reference to several key publications (Rundkvist 2003a, 2003b; Thunmark-Nylén 2006).

Through much of the late Iron Age, Gotland bead assemblages look similar to those from mainland Sweden and Bornholm, with the additional inclusion of local limestone beads. The growth of an early emporium at Paviken parallels developments at Åhus and Ribe and suggests that the material culture of Gotland maintained links to Scandinavia into the early Viking Age.

Gotlanders, however, soon forged their own connections eastward, bringing in varieties of oriental beads differing from those seen in other parts of Scandinavia (*see cover*). Few segmented or drawn cut beads appear, and rock crystal and carnelian are similarly scarce. Instead, Gotlanders began using large numbers of cowrie shell beads which ultimately came from the Indian Ocean (Trotzig 1988). Cowrie beads continue into the late Viking Age, when B088/090 beads also begin to appear, showing reintegration with the long-distance networks that served the rest of Scandinavia. At some point during the later Viking Age, a new port developed at Fröjel near the defunct site of Paviken and this was in turn overshadowed by the medieval development of Visby. The late Viking Age and early medieval assemblages from Gotland have few parallels in the rest of Scandinavia, but this is mainly due to the abandonment of beads in other areas of Scandinavia as Gotlanders sought to maintain links to the bead-wearing cultures of the East.

CONCLUSION

Callmer's study has demonstrated that bead assemblages changed significantly over the course of the Viking Age and this has been broadly upheld by subsequent research. Højlund Nielsen's late Iron-Age chronologies complement Callmer's study and add temporal depth to the chronologies of elite assemblages, while the rich stratigraphy of Ribe also offers a perspective on bead use in a different kind of community. Together, these studies show that beads performed a central role in the Viking-Age creation of communities and networks to facilitate craft production and material exchange. They also reveal that not all Scandinavians participated in these transformations in the same ways. The parallel chronologies of pre-Viking burials and emporia show how elite demand shaped bead production and imports, sometimes benefitting beadmakers and importers, and sometimes demanding that they adapt to the circumstances around them. Meanwhile, the development of emporia and new networks of exchange opened opportunities for communication and mobility, and the widespread occurrence of beads throughout Scandinavia indicates how deeply these effects permeated the societies of the Viking Age.

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ENDNOTES

1. Feveile and Jensen (2006) published two sets of data derived from two different methods of counting

artifacts. Although the counting methodologies are never fully elaborated, it seems that one key difference lay in how contexts that could not be assigned to specific phases were tallied into the site totals. Additionally, the high number of fragmentary beads could be counted in many ways. These figures are therefore only suggestive and not absolute. In my discussion, I rely especially on the tables presented in the focused discussion of glass artifacts (Feveile and Jensen 2006:147-149).

2. One green tube bead and one drawn cut bead may be attributed to Phase C, but Phase E is unique for the variety and increasing number of imported beads.
3. There are minor discrepancies between the totals given for each assemblage and the number of beads in the inventories that Callmer provides. When discussing assemblages, I use the numbers that Callmer indicates as the assemblage totals, but when discussing specific classes or types of beads, I derive my numbers from his inventory lists.
4. Callmer also included a grave from Sandviken in this period (assemblage 130; GLM 15667), without identifying the burial rite. This grave should be counted as an inhumation burial (Sandviken 54:1). I am grateful for the help of Maria Björck, Avdelningschef Kulturmiljö, Läns museet Gävleborg, in establishing the context of this find.
5. Two outliers have been omitted from these averages: Callmer no. 67 (University Museum of Bergen, no. B 11769), a non-expertly excavated cremation from Fjørtoft in western Norway yielding 365 beads, and Callmer no. 93 (Tromsø University Museum, no. Ts 5281), an expertly excavated inhumation from Steigen in northern Norway yielding 1,216 beads.
6. Since Callmer's classification system has long been out of print and is not widely available, I have created an online appendix (Delvaux 2017) to this article which presents the system with updated terminology, reorganized for digital use, and incorporating chronological information. Hosted by Harvard Dataverse, the appendix may be downloaded as a spreadsheet file at doi:10.7910/DVN/RODUZG. I thank Johan Callmer for granting permission to reproduce these data, and likewise thank Barbara Mento, Chelcie Juliet Rowell, and Carli Spina of the Boston College Libraries for their support.

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