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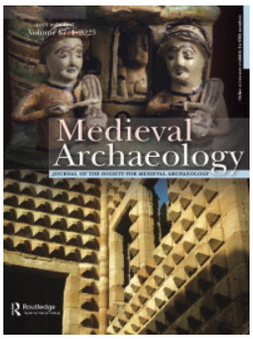

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The Human Remains from Early Medieval Domburg (Netherlands) and Other Coastal Communities in International Perspective: Towards an International Research Agenda for the Cemeteries of the North Sea *Emporia*

By LETTY TEN HARKEL[1], ROBERT VAN DIERENDONCK[2], ELEANOR FARBER[3], MICHAEL DEE[4], PETRA DOEVE[5], HELENA HAMEROW[6], ESTHER JANSMA[7], PETRUS LE ROUX[8], RAPHAËL PANHUYSEN[9] *and* PIETERJAN DECKERS[10]

THIS PAPER ADDRESSES THE QUESTION, who were the people who were buried at the early medieval North Sea emporia? Conclusions about the mercantile character of the North Sea emporia are often based on portable material culture. In recognition of the fact that it is difficult to draw conclusions about the identities of people based on finds assemblages, two pilot projects have been completed that involved bioarchaeological analyses of cemetery populations associated with these sites. The first of these, the Investigating the Dead in Early Medieval Domburg project, undertook multi-disciplinary analyses of the (very small) surviving burial population from the mostly destroyed sites in the Domburg area (Netherlands), combining isotope analysis, radiocarbon dating, biological anthropology, dendrochronology, and provenancing and study of previous use of coffin wood. The second, the Medieval Migrants of the North Sea World project, inventoried available isotopic evidence for human remains from emporia sites in England, the Netherlands and Scandinavia, alongside contextual archaeological information. This paper presents both projects, providing the detailed information from Domburg in its wider, international context, and highlighting the need for a comprehensive research agenda to fill current gaps in our understanding of early medieval emporia populations.

[1] School of Archaeology, University of Oxford, Oxford, UK; Faculty of Archaeology, University of Leiden, Leiden, Netherlands. *a.t.ten.harkel@arch.leidenuniv.nl*
[2] Zeeland Heritage (*Erfgoed Zeeland*) (Netherlands).
[3] Department for Continuing Education, University of Oxford, Oxford, UK. *eleanor.farber@arch.ox.ac.uk*
[4] Centre for Isotope Research (CIO), University of Groningen, Groningen, Netherlands. *m.w.dee@rug.nl*
[5] Laboratory for Dendrochronology at BAAC Archaeology and Building History (Netherlands). *p.doeve@baac.nl*
[6] School of Archaeology, University of Oxford, Oxford, UK. *helena.hamerow@arch.ox.ac.uk*
[7] Cultural Heritage Agency (*Rijksdienst voor het Cultureel Erfgoed*) (Netherlands). *e.jansma@cultureelerfgoed.nl*
[8] Department of Geological Sciences, University of Cape Town, Cape Town, South Africa. *petrus.leroux@uct.ac.za*
[9] anthro.nl (Netherlands). *raphael.panhuysen@gmail.com*
[10] Maritime Cultures Research Institute, Vrije Universiteit Brussel, Brussels, Belgium. *pdeckers@vub.ac.be*

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During the period c AD 670–840, a new type of settlement emerged in the North Sea region—the *emporium* or 'wic'—whose archaeological imprint emphasises economic and commercial functionality (Blair 2018, 43). A strong research tradition into the function of these settlements originated in England during the boom in large-scale urban excavations in the 1960s and 1970s, focusing mainly on the large *emporia* of *Lundenwic* (London), *Hamwic* (Southampton), *Gipeswic* (Ipswich) (although fewer excavations have taken place here), and *Eoforwic* (York) (Wickham 2005, 681–2; Blair 2018, 165–6).[11] Following the seminal 1982 work by Richard Hodges, certain contemporary settlements across the Channel and North Sea were recognised as being part of the same 'network' of long-distance trading sites, including *Quentovic* (Pas-de-Calais, France), Hedeby/Haithabu (Schleswig-Flensburg district, northern Germany), Ribe (Esbjerg, Denmark), Kaupang (Vestfold, Norway), *Dorestad* (Wijk bij Duurstede) (Utrecht, the Netherlands), and Domburg (Zeeland, the Netherlands) (also referred to as *Walichrum*), while Birka (Ekerö, Sweden) on the Baltic coast was often also included in this group (Fig 1) (Hodges 1982; also see 2012; Wickham 2005, 681–2; Blair 2018). More recent archaeological research and international collaboration has also substantially expanded our understanding of this network in the Baltic region (eg Jöns 2015; Jöns and Kowalska 2020). These all share certain characteristics, including a coastal or riverine location with easy access to the North Sea and a finds assemblage that indicates long-distance connections (usually interpreted as trade). There is some historical evidence for the presence of multi-ethnic populations in *emporia* settlements, as in the case of London, which Bede (*Historia Ecclesiastica* II, 3) famously described as 'an emporium for many nations who come to it by land and sea' ('multorum emporium populorum terra marique uenientium').

The 'one-sided economic profile' of the *emporia* as mercantile enclaves has previously been criticised based on copious excavated evidence for craft activities, such as the production of ceramics, metalwork, bone and antler objects, including copper-alloy fibula production at Domburg (although these objects also fed into the long-distance trade networks) (Ulmschneider and Pestell 2003; Henning 2007, 4–5). In addition, it is now clear that the large *emporia* known from written sources were part of an extended settlement hierarchy including other types of trade, exchange and craft production sites, deeply embedded within their rural hinterlands (eg Hamerow 2007; Henning 2007, 4; Pestell 2011). Still, the perceived mercantile character of the *emporia*—especially the above-mentioned sites existing at the larger end of the spectrum—remains dominant.

Discussions about who controlled the *emporia* have evolved from kings and regional rulers to the coastal communities themselves, but the question of who were the people who lived, died and were buried in these places has not been as thoroughly addressed (Hodges 1982; Loveluck and Tys 2006). John Blair (2018, 166) recently repeated the long-held opinion that the *emporia* 'existed primarily thanks to the activities of *international seaborne merchants* (my emphasis), without whom they would have had no raison d'être', although he also acknowledges the close relations that the inhabitants must have had with the surrounding rural regions. This nevertheless glosses over several key issues.

First, we do not know what *proportion* of the population of these trading settlements could be classed as 'international seaborne merchants', in the sense that they personally and regularly traversed the North Sea. Besides, not all of those who travelled across the

[11] Historical place names are rendered in italics throughout the text.

FIG 1
Map of North Sea *emporia* and Birka (the Channel sites of *Hamwic*/Southampton and *Quentovic* have not been included). *Background imagery © Bing.*

North Sea would have been merchants, as historical references to missionaries, envoys, and Viking leaders who were periodically granted areas of land by the Carolingian rulers—including *Dorestad* and Domburg—indicate (eg Coupland 2003; ten Harkel 2013, 2019). Although the historical sources give little away about the lower echelons of society, it does not require a major leap of faith to suppose the presence of other individuals such as mercenaries, wives, prostitutes, and—as the artefactual evidence indicates—artisans and local traders. Second, we do not know how different the lifestyles of these populations were—in terms of their mobility and diets—compared to those of contemporary (or earlier) 'rural' sites. Third, in the published literature, little attention has been paid to the question whether—and what kind of—differences existed between *emporia*, or what changes occurred over time.

Given the inherent difficulties in reconstructing the identities of people based on the distribution of portable artefacts, two successive pilot projects have been completed that focused on the bioarchaeological study of the human remains from *emporia* sites. The first of these, *Investigating the Dead in Early Medieval Domburg* (IDEMD), undertook a detailed and multi-disciplinary analysis of the few preserved human skeletons from the Domburg area, which is ill-understood because its remains were largely destroyed by tidal action prior to the age of modern archaeological excavation. Five skeletons in varying states of preservation and completeness were subjected to a detailed, multi-disciplinary study combining radiocarbon dating, multi-isotopic analysis ($\delta^{13}C$, $\delta^{15}N$, $\delta^{18}O$ and

$^{87/86}$Sr) and biological anthropology of the skeletal material with dendrochronological study and use-analysis of available coffins, in order to extract as much information as possible from this small but important assemblage. The second project, *Medieval Migrants of the North Sea World* (MMNSW), consisted of an inventory of existing multi-isotopic and biological-anthropological data, alongside funerary and artefactual evidence, from *emporia* sites in England, the Netherlands and Scandinavia, shedding light on dietary practises and mobility, thereby placing the small Domburg assemblage in its wider, international context.

Together, these two projects—one aimed at optimising information from a very limited assemblage, and the other taking a larger-scale comparative approach—led to tantalising new insights and highlighted the need for more collaborative research to investigate the people who were buried in association with the North Sea *emporia*. This paper first presents the evidence from Domburg. Second, it provides more background to the IDEMD and MMNSW projects. Third, it presents the results of the various analyses and draws preliminary conclusions.[12] It finishes by making some suggestions for a more comprehensive and collaborative research agenda to improve our understanding of early medieval trading communities in the southern North Sea region.

THE ARCHAEOLOGY OF DOMBURG/*WALICHRUM*

Domburg/*Walichrum*, situated on the former island of Walcheren in the Scheldt estuary, is one of the least-understood of the *emporium* settlements, largely because the remains of the supposed *emporium* were destroyed by tidal action and coastal erosion prior to the age of modern archaeological excavation (Braat 1954, 137–42; Deckers 2022). Sketch drawings detailing aspects of a settlement (henceforth referred to as 'the *emporium*') and its associated cemeteries on the beach c 1 km to the north-east of the present-day beach resort of Domburg survive from the 19th century. Two inhumations with associated coffin planks, from a cemetery location known as (Oostkapelle-) Berkenbosch (Fig 2, Cemetery IV), were preserved in the archaeological storage facilities of Erfgoed Zeeland (Zeeland Heritage) but never studied in detail (Deckers 2014, 363–7; ten Harkel et al 2016). It seems that inhumations from (Oostkapelle-) Berkenbosch were unfurnished and therefore likely of late 7th-century date or later, as the rite of furnished inhumation burial had largely ceased in the southern Low Countries by this time (Deckers 2014, 363–7; Capuzzo et al 2020, 1820; Brownlee 2021). Additional dispersed human bone material (likely also from inhumations, as none of the surviving bone fragments showed any evidence of cremation), was also preserved in the archives and reportedly found along the beach between Domburg and (Oostkapelle-) Berkenbosch, but this was entirely without contextual information.

For information about the other cemeteries from the Domburg/*Walichrum emporium* area, we rely solely on antiquarian descriptions and drawings, which suggest an extended chronology spread across different burial foci (Fig 2). These inform us that Cemetery II, 'Duinvliet', was likely of Merovingian to Carolingian date, as it included 41+ inhumations—some containing gravegoods commensurate with a date around c AD 700—on various alignments in coffins including a hollowed-out tree trunk. Cemetery

[12] The IDEMD project was carried out piecemeal between 2014 and 2018. The MMNSW project was largely carried out during the COVID-19 pandemic and completed in 2020.

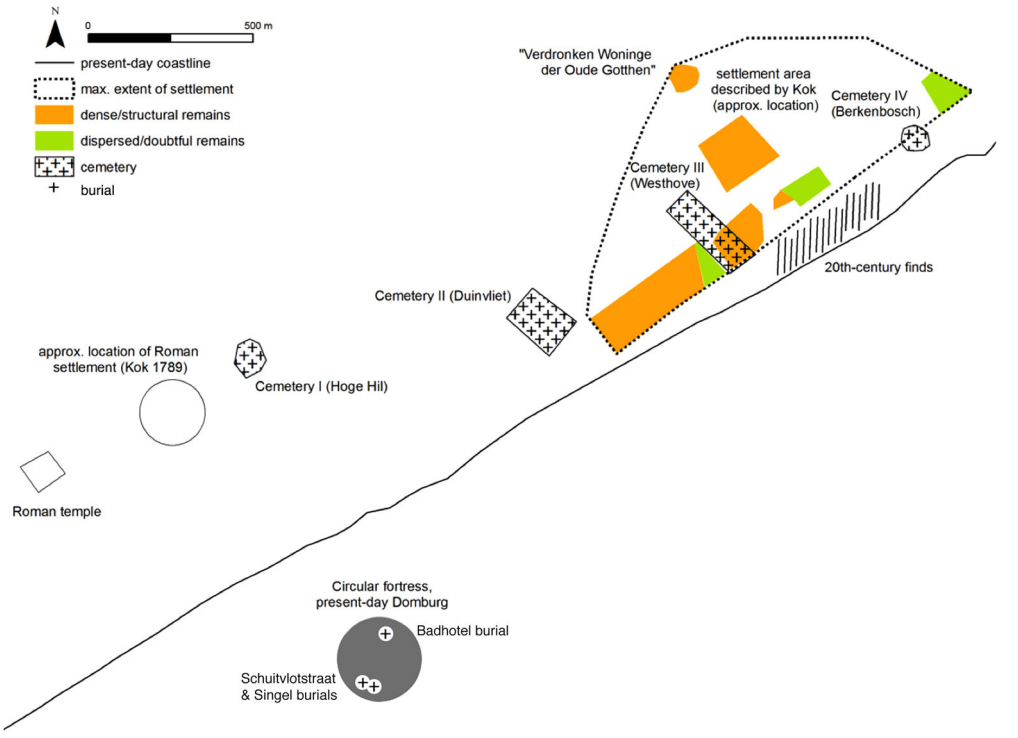

FIG 2
Location of Roman and early medieval remains in the coastal strip between Domburg and Oostkapelle-Berkenbosch, and the Domburg ringfort with the positions of the skeletal remains discovered underneath. *Drawing by Pieterjan Deckers (Deckers 2014, 369, fig 62), adapted by Letty ten Harkel.*

III, 'Westhove', consisted of about 50 coffined burials, and was also likely of later 7th–9th-century date because of the rare occurrence of gravegoods. Cemetery I, 'Hoge Hil', yielded about 23 W/E oriented inhumations in wooden coffins, with no reported gravegoods but found in connection with a single 8th-century silver arm ring, and may therefore belong to the 8th and/or 9th centuries (Deckers 2014, 363–7, 369, fig 62).

In addition to the burials and settlement remains, a wealth of artefactual material—in the form of portable antiquities—was furthermore collected prior to the period of artificial beach suppletion in the middle of the 20th century and preserved in the archives of the Koninklijk Zeeuws Genootschap der Wetenschappen (Royal Zeeland Scientific Society; hereafter Zeeuws Genootschap) (eg Rethaan Macaré 1837, 1856; Capelle 1974; Coupland 2002; Deckers 2014). This finds assemblage includes the typical range of traded goods found at *emporia,* such as pottery and quern stones from the Rhineland, but also a sizeable collection of metalwork. A considerable quantity of 7th- to 9th-century coin finds (which peak during the 8th century), emphasising long-distance connections with the wider coastal region, were instrumental in attributing *emporium*-status to the settlement remains from the beach (Coupland 2010; Deckers 2014).

It was long assumed that the *emporium* went out of use in the 9th century and was replaced by a ringfort at c 1 km distance, whose remains have been excavated piecemeal during developer-funded excavations in the modern beach town of Domburg ('the dune fortress') (Fig 2) (ten Harkel 2013, 2019; Deckers 2014, 2022). The question of who was

responsible for the construction of the ringfort (and other similar sites in the region) has been extensively discussed elsewhere, ranging from local magnates to rulers from further inland seeking to subject the coastal regions to their power; in any case it is likely that they included individuals who were keen to benefit from and/or control the trade corridor from the Scheldt river to the North Sea region (eg Loveluck and Tys 2006; ten Harkel 2013, 2019; Tys et al 2016). A recent study by Deckers, however, draws attention to the overlapping chronologies of the *emporium* and the ringfort, suggesting that the two settlement cores co-existed for some time, raising different possibilities for our understanding of the early medieval settlement pattern in the Domburg area (Deckers 2022).

First, Deckers' re-assessment of the beach finds indicated that activity at the *emporium* continued—albeit with reduced intensity—into the 10th century or even beyond. Second, in the ringfort area, two burials, radiocarbon dated to the 7th or 8th century, were found during developer-funded excavations at the Badhotel and the Singel sites in the 1990s and early 2000s (Fig 2) (Van Heeringen et al 1995, 31; Van Dierendonck 2009, 263). Third, during more recent developer-funded excavations in the area of the ringfort, anthropogenic layers were recognised that *pre-date* the construction of its rampart (Meijlink pers comm). Together, these factors tentatively suggest that the area of the later ringfort already may have been a focus for human activity during the heyday of the *emporium* site in the 8th or even 7th century, and that activity at the *emporium* site continued after the construction of the ringfort. Taking a small leap of faith, this implies that the areas of the *emporium* and of the ringfort formed part of a polyfocal settlement pattern, not dissimilar to those identified in England and the Low Countries, including possibly at *Dorestad* (Loveluck and Tys 2006, 145; Blair 2018, 166–74, 254–6). Such polyfocal settlements combined locales of differing hierarchical or ceremonial functionality, including *emporia*, as 'components of structured groups' (Blair 2018, 166). This emphasises the importance of taking a landscape-based, rather than a site-specific, approach and considering the burials from the ringfort and *emporium* sites together.

MATERIALS AND METHODS

INVESTIGATING THE DEAD IN EARLY MEDIEVAL DOMBURG (IDEMD) PROJECT

The IDEMD project involved a multidisciplinary analysis of five surviving skeletons from the Domburg area, in order to retrieve maximum information about the deceased (Tab 1 for a list of all surviving skeletal material). These included the human remains of three individuals buried in the ringfort area, and two individuals (ZAD00066 and ZAD00067) buried in wooden coffins in the cemetery at (Oostkapelle-) Berkenbosch (Fig 2, Cemetery IV), which gradually eroded between 1921 and 1938. A further six bags of additional fragmentary skeletal remains from different locations along the beach, corresponding to approximately eight individuals, were also discovered in the depot of Zeeuws Erfgoed (Tab 1, ZG numbers).

Starting with the cemetery of (Oostkapelle-) Berkenbosch, ZAD00067 was discovered in 1921 and survives only very partially, in association with a coffin plank. ZAD00066 followed two years later, in 1923, when a group of six coffins was exposed but—due to rough winter weather—only ZAD00066 was lifted. The fragmentary skeletal remains are to this day still in situ adhered to the surface of the base plank of its oak coffin (Fig 3). No gravegoods were reported, but on the basis of reports about

TABLE 1
Overview of surviving skeletal material from the Domburg and (Oostkapelle-) Berkenbosch sites.

Number	Location/date	Burial container	Description
Burials from the beach sites			
ZAD00066	Oostkapelle Berkenbosch (1923)	Wooden coffin	Human skeletal remains embedded in soil on a wooden board, representing the base of a wooden coffin
ZAD00067	Oostkapelle Berkenbosch (1921)	Wooden coffin	'Bones and teeth' collected from a wooden board, probably the base board of a wooden coffin
ZG0467-1	Domburg beach	Unknown	Fragment of human femur shaft, found among collected animal bones. No specific information on the burial context
ZG0545-17	Oostkapelle between beach posts 41–42 (11-1938)	Unknown	Two sets of milk teeth
ZG0545-17A	Oostkapelle between beach posts 41–42 (11-1938)	Unknown	Teeth of two individuals, presented as individuals A and B. No specific information on burial context
ZG0545-17B	Oostkapelle between beach posts 41–42 (11-1938)	Unknown	Teeth of two individuals, presented as individuals A and B. No specific information on the burial context
ZG0545-20	Domburg beach behind Westhove (winter 1923/1924)	Unknown	Fragment of a skull, found among collected ceramic sherds of Carolingian date (Andenne and Meuse Valley wares)
ZG0545-21	Oostkapelle beach	Wooden coffin	Fragments of long bones (including femur) and of a mandibular and teeth. According to the description, these finds were collected from a burial with remnants of a wooden coffin. One of the femur fragments had traces of iron corrosion, suggesting placement against an iron object, possibly a gravegood
ZG0915-14	Domburg Oostkapelle, Oosterstrand (eastern beach)	Unknown	Fragment of a femur from the collection of PJ van der Feen. Found on the beach, 'washed ashore'

(*Continued*)

TABLE 1
(*Continued*).

Number	Location/date	Burial container	Description
Burials from the ringfort sites			
ZAD1256-5	Domburg Badhotel (1991)	Burial pit	Human skeletal remains found in pit, directly below the earthwork of the ringfort. 7th or 8th century AD (14 C date human bone)
ZAD1320-1	Domburg, Schuitvlotstraat (1992)	Wooden coffin	Burial in a wooden coffin, below the earthwork of the ringfort. Previous studies of the human remains by Maat and Mastwijk (1992) and Klaassen (1995). Second half 9th century (based on dendrochronological date of coffin wood)
ZAD2194-44	Domburg, Singel 6 (2001)	Unknown	Burial context unknown, skull and some fragments of ribs collected from a section of the excavation trench. Previous studies of the human remains by Laarman (2006). 7th or 8th century AD (14 C date human bone)

spatially associated artefactual material, the cemetery was dated to the 8th and/or 9th centuries (Meerkamp van Embden 1922, xv; 1924, x; Roes 1954; Deckers 2014, 367; Feldbrugge 2017).

In 2014–2015, the bone material from ZAD00066 and ZAD00067 was subjected for the first time since their recovery to radiocarbon dating, multi-isotopic analysis ($\delta^{13}C$ and $\delta^{15}N$ of bone collagen and $\delta^{18}O$ and $^{87/86}Sr$ of tooth enamel) and biological-anthropological study (Tabs 2–5 below). The coffin wood was analysed dendrochronologically, which also allowed for provenancing of the wood. Signs of previous use of the wood were also studied. In situ burial ZAD00066 was subjected to structured light and CT scans to enable non-destructive study, supporting earlier reports that ZAD00066 was unfurnished (Fig 4) (Van Dierendonck et al 2017, 8–9). It also evoked some public interest, making newspaper headlines as 'Nico', 'the oldest skeleton from Zeeland' (*het oudste skelet van Zeeland*), and is now part of the permanent display in the Zeeland Museum (*Zeeuws Museum*) in Middelburg (AD 2016; Van Damme 2016; Feldbrugge 2017). The fragmentary remains from the beach were only subjected to basic biological-anthropological analysis (Tab 4 below). These multi-disciplinary techniques resulted in detailed new information about the dating of the burials as well as the dietary habits, potential geographical childhood origin and wider connections of the deceased, which will be discussed in the Results section.

Three additional burials were found during different developer-funded excavations in the area of the ringfort, here jointly referred to as 'the ringfort sites' (Fig 2). In 1991, during excavations at the Badhotel site in the N part of the ringfort, a supine extended skeleton of a woman (ZAD1256–5) was excavated underneath the rampart at approximately 0 m NAP (Normal Amsterdam Level, the Dutch datum level). The remains were oriented roughly NE/SW, parallel to the line of the rampart, although the relationship

FIG 3
Oostkapelle-Berkenbosch: composite photograph of ZAD00066 with the skeletal remains concreted to the coffin base board (shown lying on its side edge after excavation in the 1920s). The leg bones can be seen pointing towards the right of the image. The ends of the plank have apparently been scraped clean by this time, possibly during excavation. © *Zeeuws Archief, Zeeuws Genootschap, Zelandia Illustrata III, no 477b.*

with the rampart was unclear as a result of the limited depth of excavation. The burial was apparently unfurnished and there was no evidence for a coffin. As the section through the rampart deposits partially collapsed during excavation, the skeleton could not be retrieved completely (the smaller foot and hand bones remained behind).

During post-excavation analysis, 14 C dating of the left femur gave a date of 1280 ± 20 BP, calibrated as AD 684–777 (95%), while 14 C dates from structural timbers from the rampart higher up in the sequence were radiocarbon dated to the 8th to 10th centuries (Fig 5). The question was therefore raised whether this burial pre-dated the construction of the ringfort, belonging to an earlier cemetery core possibly associated with the *emporium*; or whether the ^{14}C date might have been affected by marine (or freshwater) reservoir effects, with implications for our understanding of the settlement history of the coastal zone (Van Heeringen 1992, 122; Van Heeringen et al 1995, 31, 36–9).

A similar question arose from a discovery made in 2001 at the Singel 6 site, in the S part of the ringfort, at c 0.3 m NAP (Fig 6). There, the skeleton of a child (ZAD2194–44), apparently buried without a coffin, was only partially retrieved because—again—the section through the rampart collapsed during excavation. Radiocarbon dating yielded a date of 1348 ± 43 BP (originally calibrated as cal AD 621–629, 639–727 and 739–775 at 95%) (Dijkstra 2006, 19–20; Laarman 2006, 33). These questions about the impact of possible reservoir effects on the dating could be answered as a result of the multi-disciplinary methodology of the IDEMD project and are discussed below.

In 1992, a supine extended skeleton of a woman (ZAD1320–1) was discovered during excavations in the Schuitvlotstraat, underneath the rampart to the west of the postulated southern entrance to the ringfort (Fig 2) (Van Heeringen 1993, 193–4). She was buried in an oak coffin c 1.82 m long, consisting of six loose timber planks, held together with dowels made of oak, ash and alder, identified as reused timbers from a riverine vessel (Fig 7) (Vermeersch and Van Dierendonck 2017, 484). The coffin wood was subjected to dendrochronological dating returning a terminus post quem in 851 ± 8, leading to a likely date for the burial in the second half of the 9th century, roughly contemporary with the suggested construction date for the rampart (but no radiocarbon date was obtained for the skeletal material) (Van Heeringen 1993, 194; Jansma and Spoor-Hanraets 2011).

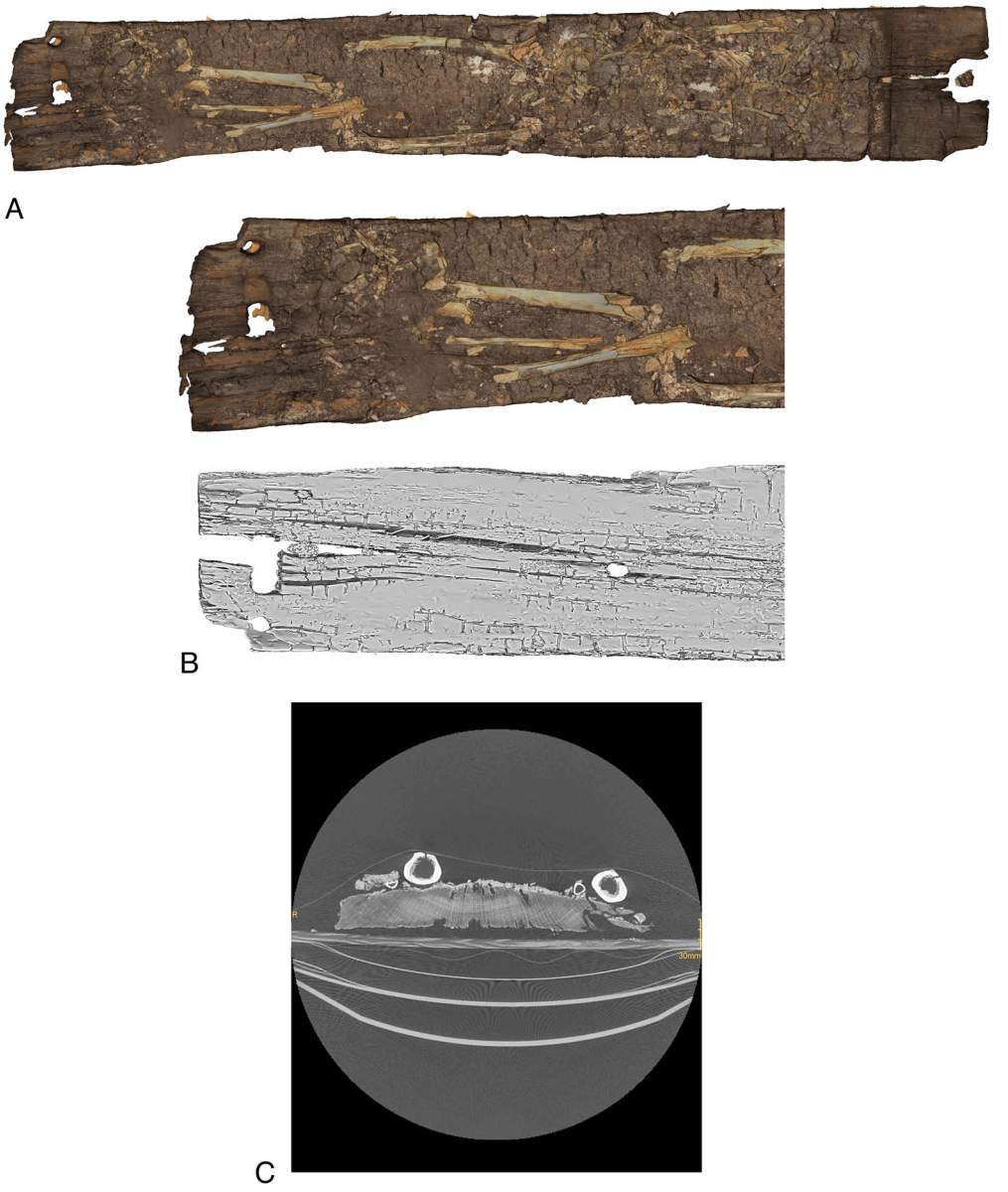

FIG 4
Domburg-Schuitvlotstraat: ZAD00066 in 2017.
(A) top view of the in situ burial on the plank. The photo-realistic render is the result of the structured light scan. (B) top and bottom view of part of the burial. The bottom view was created through manipulation of the CT data. This revealed signs of reuse of the wood, such as the hole in the middle of the plank, which are otherwise obscured by the in situ remains. (C) CT cross-section, near the top of the femurs.
Images by Panoptes Heritage.

The coffin was oriented WNW/ESE and placed at 1.15+ m NAP, supported on its S side with deliberately placed vertical alder posts, whilst on its N side the sods making up the body of the rampart were stacked neatly against the coffin (Fig 8). It lay on

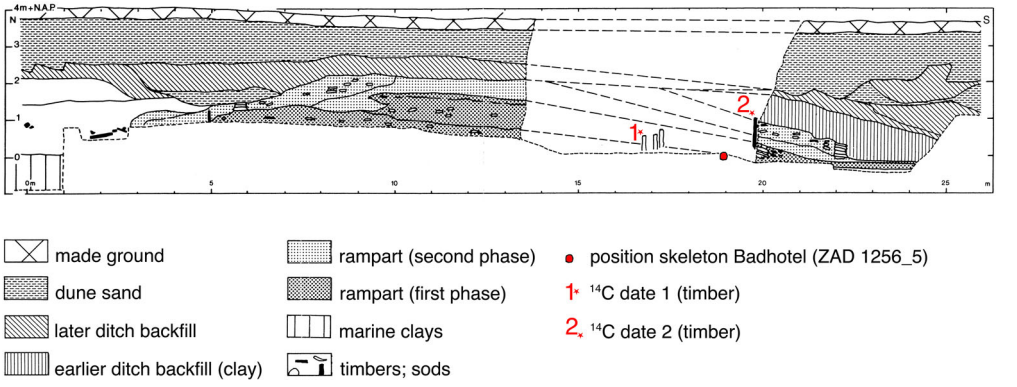

FIG 5
Domburg-Badhotel: W-facing section drawing, showing position of ZAD1256–5 in relation to the rampart and other ^{14}C dates.
Drawing adapted by Letty ten Harkel from Van Heeringen et al 1995: 31, fig 19.

top of a layer of sand mixed with clay and sods that was likely deposited as a foundation layer or artificial increment of the ground prior to the construction of the rampart, later also noted during the 2001 Singel excavations nearby (Fig 6G). The central part of the mandible was missing, with evidence for reactive growth of bone material suggesting that this happened while she was alive (see below for more discussion). This burial has been interpreted as a foundation deposit and dates the construction of the ringfort rampart to the second half of the 9th century (Van Heeringen 1993, 193–4).

The IDEMD project sought to refine the dating of these three skeletons through an assessment of the likely influence of any reservoir effects, thereby addressing the question as to whether the Badhotel burial (ZAD1256–5) and child burial from Singel (ZAD2194–44) were part of an older cemetery pre-dating the ringfort. For this reason, the existing radiocarbon dates for the Badhotel burial ZAD1256–5 and child burial ZAD2194–44 were recalibrated, and δ^{13}C and δ^{15}N stable isotope analysis of bone collagen was carried out. In addition, Schuitvlotstraat burial ZAD1320–1 was subjected to radiocarbon dating (to compare to the existing dendrochronological date) and multi-isotopic analysis (Tabs 3–5 below). The results were compared to those from (Oostkapelle-) Berkenbosch.

THE MEDIEVAL MIGRANTS OF THE NORTH SEA WORLD (MMNSW) PROJECT

The MMNSW project (2019–2020) was a feasibility study for investigating patterns of human mobility and migration in the medieval North Sea world on a large scale.[13] Focusing on bioarchaeological material, in particular biological anthropology and stable isotopes, it aimed to compile an inventory of available physical-anthropological, paleopathological and isotopic data from North Sea *emporia* and other relevant sites to identify spatial and temporal trends in human health, diet and mobility.

The project designed and constructed a database in Filemaker Pro that allowed for the entry of data on multiple spatial scales, including cemetery, cemetery phase, grave, and skeleton, with spatial coordinates so that spatial trends could also be

[13] <*https://www.arch.ox.ac.uk/medieval-migrants-north-sea-world*>

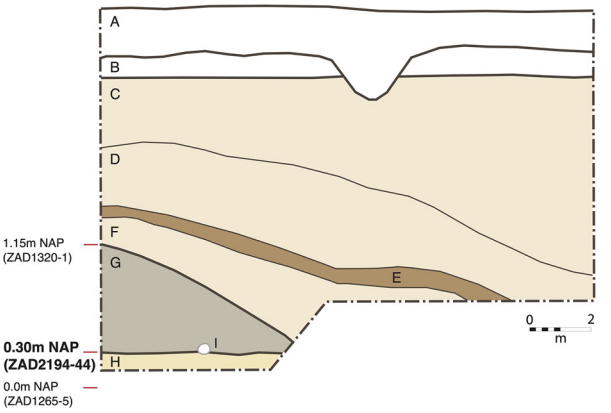

FIG 6
Domburg-Singel: Simplified section drawing showing ZAD2194–44 and indicating the height NAP of the vertical locations of nearby ZAD1320–1 from the Schuitvlotstraat and ZAD1256–5, from the Badhotel site on the opposite end of the ringfort.
(A) modern topsoil. (B) 18th-century soil. (C) rampart make-up. (D) humic layer. (E) rampart make-up. (F) rampart make-up. (G) layer of sand with clay and sods (foundation layer for rampart/artificial increment of ground level). (H) old dune sand. (I) skull of ZAD2194–44.
Drawing by Letty ten Harkel, based on field drawing ROB 2003–00805 held in the Zeeuws Archeologisch Depot.

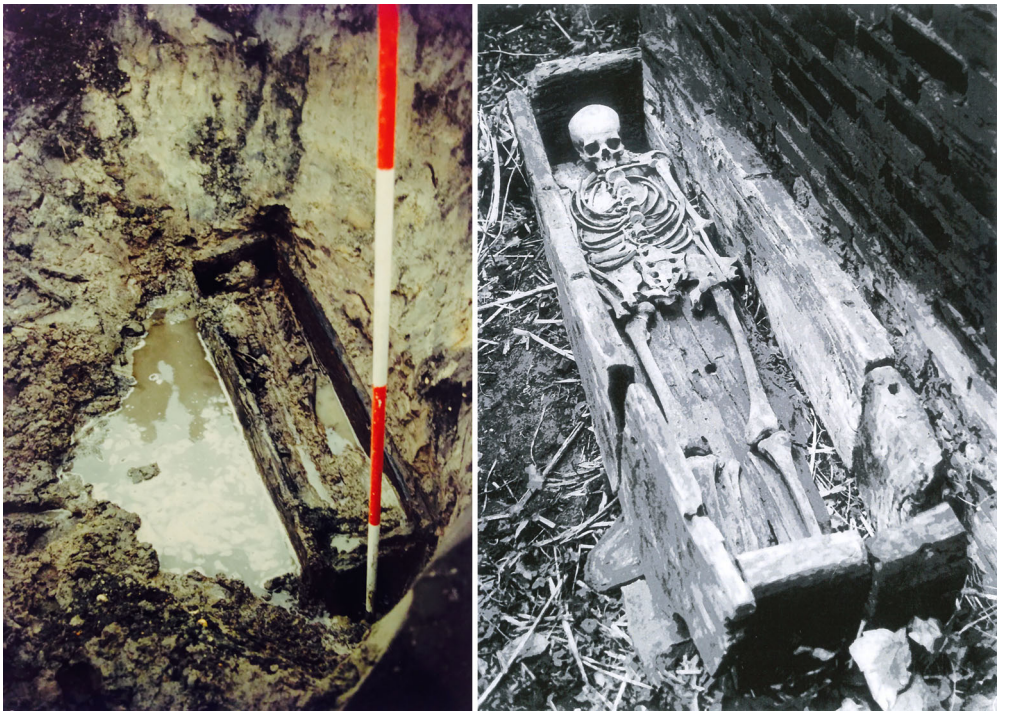

FIG 7
Domburg-Schuitvlotstraat: ZAD1320–1 during (R) and after (L) excavation and reconstruction.
Excavation photograph © ROB (State Service for Archaeological Investigations—Rijksdienst voor Oudheidkundig Bodemonderzoek—now Rijksdienst voor het Cultureel Erfgoed). Post-excavation photograph by R Oreel (previously published in PZC on 5 February 1993). Reproduced with permission of Zeeland Heritage (Erfgoed Zeeland) and R Oreel.

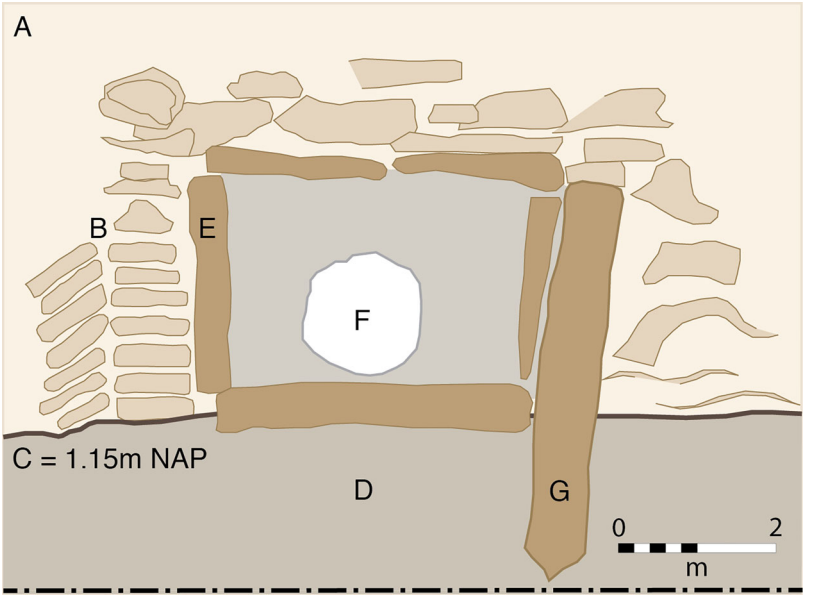

FIG 8
Domburg-Schuitvlotstraat: Schematic representation of ZAD1320–1: WNW facing profile showing deliberately placed timber posts and sods.
(A) Rampart make-up. (B) Sods. (C) Top of foundation layer for construction rampart. (D) Dune sand mixed with clay and sods (same as Fig 6G). (E) Coffin of ZAD1320–1. (F) Skull of ZAD1320–1. (G) Wooden post. *Drawing by Letty ten Harkel, based on field drawing ROB 1995–00509 held in the ZAD and subsequent re-interpretations after the Singel excavations.*

analysed. In line with the bioarchaeological focus of the project, the database was set up for the recording of biological-anthropological, paleopathological, isotopic and radiocarbon data, including built-in capacity to record information at a sub-skeletal level. In addition, the database allowed for the recording of information about burial rites, grave construction, gravegoods (if present), and associated settlement features (if any), so that the bioarchaeological analyses could be placed in their appropriate archaeological and landscape contexts. Finally, the ability to record meta-data relevant to the scientific data (such as information about laboratories and publications) ensures that all entries can be checked.

During the pilot project, data from 21 sites associated with six modern settlements were entered, corresponding to 1,841 graves, 1,789 skeletons, 632 gravegoods and 889 laboratory analyses. These included the sites of Stoke Quay, Boss Hall and Buttermarket in Ipswich (Suffolk, UK) (Scull 2009; Brown et al 2020; Farber 2020); Royal Opera House, Peabody, Long Acre, Covent Garden, Southampton St, Bull Wharf, and Aldermans House in London (Greater London, UK) (Johnson 2012; Ayre and Wroe-Brown 2015); Belle Vue House/Lamel Hill and St Andrew Fishergate in York (North Yorkshire, UK) (Thurnam 1849; York Archaeological Trust 1983; Stroud and Kemp 1993; Müldner and Richards 2007a, 2007b); the aforementioned sites of Badhotel, Schuitvlotstraat, Singel 6, and (Oostkapelle-) Berkenbosch in and near Domburg (Van Heeringen et al 1995; Van Dierendonck 2009; ten Harkel et al 2016); and—for wider comparison—the cemeteries from Ribe and Birka in Denmark and

TABLE 2
Results of the 14 C and dendrochronological dating.

	^{14}C dates			**dendrochronology**		
skeleton	**^{14}C Age (^{14}C yr BP, ±1σ)**	**published calibrated date (95% probability range)**	**recalibrated date (IntCal20, 95% probability range)**	**felling date tree**	**provenance**	**comments**
ZAD00066	1265 ± 27 BP (OxA-33063, 2016)	–	AD 667–828	After AD 692 ± 11 (KZGW no. G2853, Doeve and Jansma 2015)	German Rhineland	Re-used ship wood
ZAD00067	1292 ± 25 BP (OxA-33062, 2016)	–	AD 665–774	After AD 751 ± 18 (KZGW no. G2852; Doeve and Jansma 2015)	Brabant/Flanders	Evidence for re-use, possibly shipwood
ZAD1256–5	1280 ± 20 BP (Domburg IV (Badhotel), 1990s)	AD 684–777 (Van Heeringen et al 1995, 38)	AD 671–774	–	–	–
ZAD1320–1	1218 ± 26 BP (OxA-33061, 09-02-2016)	–	AD 705–885	After AD 851 ± 11 (DCCD P:1992011, Jansma and Spoor 2011)	German Rhineland	Re-used ship wood
ZAD2194–44	1348 ± 43 BP (UtC Nr. 11766, 06-01-2003)	AD 621–629, 639–727 and 739–775 (Dijkstra 2006, 19)	AD 606–775	–	–	–

Sweden (Linderholm et al 2008; Price et al 2018; Croix et al 2020a). After completion of the pilot project, further comparative $^{87/86}$Sr data for select sites in the Netherlands were added (Kootker and Heeren 2022). The recorded assemblages covered roughly the 4th to 15th centuries, but this paper only uses data from the 5th to the 11th centuries to focus more narrowly on the period of the *emporia*, set within a slightly broader chronological framework.

RESULTS

This section briefly presents the main results from the analysis of the five burials from the Domburg area, placed in the context of the wider perspective offered by the MMNSW project and published material. Results are summarised thematically, starting with the chronology of burial activity and a discussion of contemporary funerary practices in the Low Countries, demography and health, diet, and longer-distance contacts. In the Appendix, further detail about the scientific methodologies and a table combining all the results from the dating and isotopic analyses are provided.

CHRONOLOGY OF BURIAL ACTIVITY AT DOMBURG AND CONTEMPORARY FUNERARY PRACTICES

None of the broader questions about the *emporia* populations—posed in the introduction to this paper—can be answered without a firm grasp on the chronology of the various burials. One of the main aims of the IDEMD project was therefore to refine the dating evidence, which would also further elucidate the relationship between the *emporium* of Domburg/*Walichrum* and the ringfort of Domburg (Tab 2; Appendix Tab A1). This section first discusses the burials from (Oostkapelle-) Berkenbosch, for which no scientific dates had yet been established, and then those from the ringfort sites, the dating of which has been discussed above. Once the chronology has been established, comparative material from other *emporia* sites and rural cemeteries from the Low Countries will be discussed.

The burials from (Oostkapelle-) Berkenbosch were radiocarbon dated to AD 667–828 (95%) (ZAD00066; R ulna) and AD 665–774 (95%) (ZAD00067; R second mandibular premolar dentine) respectively. These broad date ranges were further refined with the establishment of dendrochronological terminus post quem dates on the coffin wood, to after AD 692 ± 11 for ZAD00066 and after AD 751 ± 18 for ZAD00067 (Fig 9B and C) (Jansma et al 2012; Doeve and Jansma 2015; DCCD P: 15.0156). Like the coffin from the Schuitvlotstraat in the ringfort area, the coffin from burial ZAD00066 was confirmed to have been made of reused wood originating from a flat-bottomed river barge (Vermeersch 2017). ZAD00067 was not formally analysed, but similar signs of reuse suggested it might have been recycled boat wood too. Allowing for a period of use of approximately two decades, this pushes the date of both burials from (Oostkapelle-) Berkenbosch into the 8th century, in line with the suggested 8th–9th-century date for the cemetery and contemporary with the heyday of the *emporium* as suggested by the coins and metalwork finds.

Comparison of the (Oostkapelle-) Berkenbosch coffins to the dendrochronological terminus post quem date for the coffin from the Schuitvlotstraat in the ringfort area—after AD 851 ± 8, but also made from reused boat wood—clearly indicates that the ringfort burial belonged to a different phase, in the second half of the 9th century (Fig 9A).

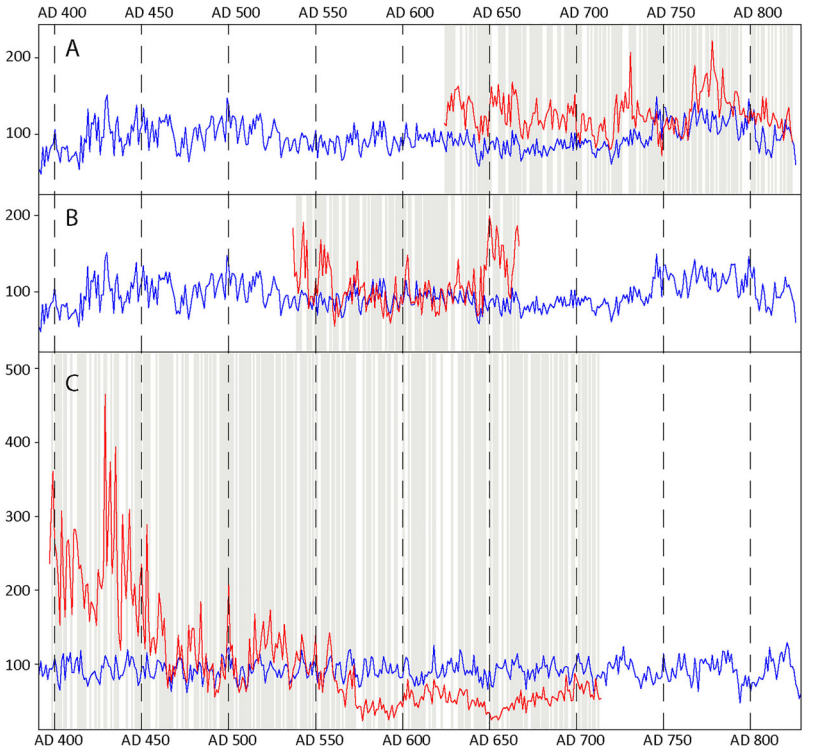

FIG 9
Agreement between the growth patterns (raw data) of the coffin planks (red) and the reference chronologies (blue) used to derive the chronological age and provenance of the planks.
X-axis: calendar years; Y-axis: ring width (0.01 mm). Grey: intervals with synchronous ring-width variations. (A) ringfort burial ZAD1320_1 vs the early-medieval German Rhineland chronology developed by Jansma and Van Lanen (2015; blue; $t_H = 8{,}02$, %PV = 68,2, P = 0,000008). (B) beach burial ZAD00066 vs the same reference chronology (blue; $t_H = 7{,}65$, %PV = 68,30, P = 0,000014). (C) beach burial ZAD00067 vs Noord-Brabant/Flanders chronology NLVLAA01 developed by Jansma and Hanraets (2004; blue; $t_H = 10{,}4$, %PV = 63,2, P = 0,000001).
Figure by Petra Doeve

This is in line with the newly obtained 14 C date range for the skeleton of cal AD 705–885 (95%). In order to finetune the chronology of the other two (uncoffined) ringfort burials and in the light of the possible reservoir effect, several steps were taken. First, the existing radiocarbon dates for the ringfort burials from the Badhotel and Singel 6 sites were recalibrated to AD 671–774 (95%) and AD 606–775 (95%) (Tab 2; Appendix Tab A1).

Second, δ^{13}C and δ^{15}N stable isotopes were measured for all five skeletons (Tab 3; Appendix Tab A1). Isotopic δ^{13}C values at between −20.1‰ and −18.5‰, and δ^{15}N values between 11.6‰ and 13.9‰, were somewhat elevated, which could be suggestive of some intake of marine foods. although other possible explanations exist (more on which below) (Richards and Hedges 1999; Pollard et al 2012). Indeed, similar results are commonly thought to open up the possibility of a reservoir effect affecting the dating by up to 100–150 years, a figure that was also reported in the initial laboratory report from the Oxford Research Laboratory for Archaeology and the History of Art (RLAHA) who carried out the dating. However, the presence of associated dendrochronological dates

TABLE 3
Results of the $\delta^{15}N$ and $\delta^{13}C$ stable isotope analysis (two-point corrected values of triplicate averages).

Sample	$\delta^{15}N$ (Sam) DeltaAir	$\delta^{13}C$ (Sam) DeltaPDB	location
ZAD00066 (Berkenbosch)	13.9	−18.5	beach
ZAD00067 (Berkenbosch)	12.1	−18.9	beach
ZAD1256-5 (Badhotel)	11.6	−20.0	ringfort
ZAD1320-1 (Schuitvlotstraat)	12.2	−20.0	ringfort
ZAD2194-44 (Singel)	13.9	−20.1	ringfort

allowed for an informed assessment of the impact of the reservoir effect, which was the third step.

The values for the (Oostkapelle-) Berkenbosch burials were generally higher than those for the ringfort sites (the higher $\delta^{15}N$ for ZAD2194-44 from the Singel is likely partially the result of the nursing effect—a breastfeeding child exists higher in the food chain than his or her mother—and should therefore be excluded in this discussion), and the dendrochronologically determined terminus post quem nevertheless fell inside the 14 C range in both cases. This suggests that reservoir effects had a limited impact on the 14 C dates, despite the relatively high $\delta^{13}C$ and $\delta^{15}N$ values, leading to the conclusion that a 7th- to 8th-century date for the burials from the Badhotel and Singel sites remains likely. In other words, these burials pre-dated the construction of the ringfort defences, and are likely to indicate the presence of another 7th- to 8th-century burial focus in the coastal Domburg area (Fig 2).

The later 8th and 9th centuries are ill-represented in the burial record of the coastal regions of the Low Countries. Carolingian graves are relatively rare in this area: most Merovingian cemeteries went out of use by the early 8th century, and evidence for formal churchyard burial does not start until the 10th century (Theuws 2018, 40–1; also see Capuzzo et al 2020, 1820; Brownlee 2021, 143). Frans Theuws has postulated that this may be because the skeletal remains were often not preserved, while the unfurnished nature of the graves impedes accurate dating and may lead to accidental destruction of burial grounds (Theuws 2018, 41).

An important exception are the extensive cemeteries associated with the *emporium* of *Dorestad* (Panhuysen 2010; Van Es and Verwers 2015, 201–54; Smits and Heeren 2021). At least five or six different large burial foci have been identified for the settlement, in addition to numerous smaller burial locales interpreted as 'private cemeteries on house yards' (Van Es and Verwers 2015, 361). At De Geer, a Merovingian cemetery that possibly continued into the Carolingian period, containing approximately 25 inhumations and cremations, was found in the middle of the 20th century (Van Es and Verwers 2015, 361; Smits and Heeren 2021). The Carolingian end date was based on a single radiocarbon date that gave a range of 1275 +/− 55 BP, calibrated as AD 660–874 (95% probability range), and the possibility that a reservoir effect affected the date by 100–150 years (Smits and Heeren 2021, 368).

In 2010–2011, another cemetery—De Geer II—with 546 inhumations, five of which were subsequently radiocarbon dated to the later 7th to later 8th or 9th centuries, came to light during routine developer-funded investigations (Williams 2011; Van Es and Verwers 2015, 361). The skeletons were all orientated W/E, and it seems that at

least some of the burials were contained in coffins or shrouds; gravegoods were extremely rare (Williams 2011, 45).

A third cemetery was first discovered at De Heul in Dorestad in the 19th century, with reports of tombstones or sarcophagi being retrieved alongside large quantities of human bones (Van Es and Verwers 2015, 201). The site was excavated on numerous occasions in the course of the 20th century, and it is estimated that it may have contained as many as 1,000 inhumations, largely orientated W/E, grouped into distinct clusters and sub-groups (Van Es and Verwers 2015, 201–9). Not many gravegoods were found, but those present suggest a date in the later 7th to 8th century, which would place the De Heul cemetery in the later 7th or earlier 8th to 9th centuries (Van Es and Verwers 2015, 209–17; Panhuysen pers comm).

Yet another cemetery, also of later 7th- to 9th-century date and likewise containing a large number (500+) of W/E aligned and closely spaced inhumation graves with very few gravegoods, but no evidence for stone sarcophagi, was excavated in the 1960s at De Engk (Van Es and Verwers 2015, 215–18; Panhuysen pers comm). In comparison with other medieval cemetery populations from the Netherlands, adult individuals had a slightly taller-than-average stature; children were poorly represented but this could have been a result of poor preservation (Heikoop 2020, 40). The preserved skeletal material stood out in comparison to that from De Heul for the relatively high percentage of sharp-force trauma (cut marks) on long bones (both from the arms and legs), some pelvic bones, and skulls. A recent unpublished dissertation concluded that—despite many uncertainties resulting from poor preservation of bone material—these were biased towards young adult males and most likely the result of violent incidents (Heikoop 2020).

The presence of multiple burial locales with (partly) overlapping chronologies seen at *Dorestad* can also be observed at other *emporia* such as Ipswich, York, London, and Hedeby, although clear variations exist in the size of the excavated burial grounds (although this may be to some extent an artefact of modern excavation bias) and the burial ritual (with furnished burial continuing much longer in Scandinavia) (Eisenschmidt 2011; Williams 2011; Van Es and Verwers 2015, 361–2; Mainman 2019; Farber 2020). Based on the limited archaeological evidence in combination with the antiquarian records discussed in the introduction, it seems plausible that the Domburg area also fits the pattern.

In the case of *Dorestad*, Van Es and Verwers (2015, 361) used spatial analyses to suggest that they correspond to distinct neighbourhoods within the settlement agglomeration. In Ribe, isotope analysis in combination with the discovery of a Mayen pot cremation urn has highlighted the likely presence of a small number of foreign individuals in an otherwise 'local' cemetery population (Croix et al 2020a, 2020b). A similar interpretation is suggested for Hedeby, based on burial ritual and gravegoods, although differences in social status and religion—or rather, a combination of status, religion and geographical origin—are also brought forward as possible explanations (Eisenschmidt 2011, 95–100). More large-scale comparative analyses are needed to shed further light on this phenomenon, although it seems likely that it indicates a degree of diversity and complexity characteristic of more complex settlements.

In contrast to the trading sites of Dorestad and Domburg, rural Carolingian burial sites in the Dutch and Flemish coastal zone are few and far in between. The remains of at least 50 unfurnished inhumation burials in wood coffins were discovered in 1964 at

Haamstede on the island of Schouwen, just north of Walcheren. Three individuals have recently been radiocarbon dated to AD 675–775 (95% probability range), and a fourth to AD 675–870. They can be related to the nearby church (historically attested in AD 776), and more generally with an area that shared some of Domburg's central importance in trade along the Scheldt estuary. As at Domburg, a ringfort was built in the vicinity in the late 9th or early 10th century (Dekkers 2021, 37–40).

In present-day Belgium, a recently discovered cemetery at Koksijde, situated c 80 km further to the south-west as the crow flies and close to the Merovingian cemetery at De Panne, was dated to the later 7th to mid-8th century (Dewilde et al 2019; Spros et al 2022). The practice of depositing gravegoods was rare and, similar to the burials from (Oostkapelle-) Berkenbosch, the inhumations were deposited in oak coffins (Dewilde et al 2019, 95–7). At Varsenare near Bruges, situated on the dryland edge c 50 km south-west of Domburg, five burials have been found, at least partly in wooden coffins and without gravegoods, which were dated to before 900 (Hollevoet 2002, 178). At nearby Dudzele, dispersed human bone belonging to a single individual was retrieved from marine sediment and radiocarbon dated to AD 670–860 (95% probability range) (in'tVen et al 2006).

In the present-day Netherlands, north of the Domburg region, a handful of 8th- to 9th-century burials are known from the coastal zone. At Katwijk-Klein Duin, approximately 100 km further north along the coast, in the modern province of Zuid-Holland, a mixed cremation/inhumation cemetery of later 6th- to 8th-century date was excavated in the 1910s. One cremation in a vessel of Badorf ware, as well as three rich inhumation graves containing weapons on a NE/SW orientation, can be dated to the late 7th or possibly early 8th century (Dijkstra 2011, 235–6). This cremation grave is the youngest-known cremation grave from the region, as the practice seems to have gone out of use by the late 7th century (Dijkstra 2011, 268). Two of the weapon graves were later cut by a group of 29 unfurnished graves on a W/E orientation, which likely belong to the 8th century (Dijkstra 2011, 235–6). At nearby Valkenburg, another weapon grave of possible late 7th- to 8th-century date, orientated W/E, was found in the SW quadrant of a former Roman castellum and underneath the wall of a later, possibly 8th- to 9th-century church. Several other W/E orientated graves likely also belong to this period and later, but the dating of these graves and the church itself needs revision (Dijkstra 2011, 256–64). The presence of 8th- to 9th-century burial phases in later churchyards has been recognised in a handful of other instances in the coastal zone. At Rijnsburg-Abdijterrein, a few kilometres further inland from Katwijk, a group of W/E aligned inhumations was found in association with an 8th-century chapel, the oldest phase of which could be radiocarbon dated to the later 8th or 9th centuries (Dijkstra 2011, 123–5, 265). Remains of wooden coffins were also found (Dijkstra pers comm).

Recent radiocarbon dating of four skeletons from a large inhumation cemetery at Blokhuizen, approximately 200 km north in the modern province of Noord-Holland, included one possible and two definite Carolingian individuals, possibly representing members of a rural community associated with the nearby Abbey of Egmond (De Koning et al 2019, 163). They were uncoffined and unfurnished, and buried on a WNW/ESE alignment. It is possible that the cemetery, demarcated by a ditch, predated the construction of a church on the site. It was suggested that burials of this date may be rare because of the practice of churchyard clearance at periodic intervals,

which, over time, would have caused the destruction of all but a few of the burials belonging to the earliest phases (De Koning et al 2019, 162).

Finally, at Limmen-De Krocht, the isolated burial of a man aged c 24 was found on a NW/SE alignment, with slightly flexed knees and arms crossed over the chest. There was no indication of a coffin, but the grave contained several objects including a knife and a buckle, and seven silver *sceattas* were found in different locations in the grave. On the basis of the finds and radiocarbon dating, the burial was dated to the 8th or early 9th centuries (Dijkstra et al 2006, 86–8, 126–8).

Although not always well preserved, the funerary practices evident from these late Merovingian to Carolingian burials in the coastal region of the Low Countries appear relatively consistent: coffined inhumation, few or no burial gifts, mostly W/E orientation, and grouped in cemeteries that may, in some instances, already have belonged to churches. Most importantly in the current context, there are few differences in funerary practices between the rural and *emporium* contexts that cannot be attributed to chronology, while differences in burial ritual between contemporary contexts from, for example, the Low Countries and Scandinavia *can* be observed. As such, funerary practices provide little indication of non-local origin and long-distance mobility among the *emporia* populations, despite the connectivity evident from other find categories in this period.

DEMOGRAPHY AND HEALTH

The skeletal assemblage from the Domburg area included two adult women and a child (all from the ringfort sites) and two adult men (both from (Oostkapelle-) Berkenbosch). In addition, the fragmentary remains from the beach included individuals of different age groups including children (Tab 4). This suggests the presence of individuals from different age categories and sexes, as tends to be observed in other *emporia* sites including *Dorestad* and Ipswich, and indicates that these populations were permanent rather than seasonal (eg Williams 2011; Van Es and Verwers 2015; Farber 2020; Smits and Heeren 2021). Their stature was in line with other medieval populations observed in the Netherlands and Britain (eg Roberts and Cox 2003; Panhuysen 2005). All skeletal pathologies observed in the adults were common and consistent with their age. Two of the children, including the individual from the Singel site, showed signs of illness or malnourishment, including enamel hypoplasia and scurvy. As briefly mentioned in the next section, these types of physiological stressors could impact bone collagen isotopic values, with increased $\delta^{15}N$ associated with catabolic states including nutritional stress and prolonged illness (Katzenberg and Lovell 1999; Fuller et al 2005; Beaumont et al 2015; D'Ortenzio et al 2015). In addition to changes in $\delta^{15}N$, starvation can lead to decreased $\delta^{13}C$ due to the breakdown of body fat deposits, which have lower $\delta^{13}C$ than other tissues such as muscle (Tieszen and Fagre 1993; Neuberger et al 2013; Beaumont and Montgomery 2016;).

The later 9th-century burial from the Schuitvlotstraat, a 30–40-year-old adult female, had the most interesting pathology. She suffered from minor osteoarthritis in the thoracic vertebrae and osteophytosis with Schmorl's nodes in her spine, but most striking was that the mandibular body was missing anterior to second molars 37 and 47 on either side (Fig 10). Osteomyelitis was confirmed as the most likely cause, either through trauma or an infection. Based on the presence of abrasion on her teeth and the formation of dental calculus on her top incisors and canines (which would have occurred after

her lower jaw had been infected), it is clear that she lived for some time after the infection, but it is difficult to establish for how long.

It is likely that this disability would have severely affected her control over her mouth as well as her visual appearance, as a number of muscles would have lost their attachment to the anterior portion of the mandible. According to an initial analysis by Klaassen (1995), these would have included M. triangularis, M. quadrat. labii mand., M. mentalis, M. incicivus lab. mand. inf., part of M. buccinatorius, M. myehyoideus, M. geniohyoideus, M. biventer, and venter mandibulare. The hyoid bone would have dropped backwards, rendering it difficult to swallow or articulate. The absence of a chin would have resulted in a marked malformation whilst cloaca, formed to drain pus and liquids caused by the infection, may have disfigured the face further.

Known archaeological parallels for this pathology are rare, and to the authors' knowledge none are quite as severe as the Domburg woman. Other, published severe cases include an adult female from a late to post-medieval cemetery at St Andrew's Church, Castle Combe, Wiltshire (UK) (Conlin et al 2022, 282), a young child from the 5th to 13th century AD from northern Japan (Lieverse et al 2022), as well as a young child from Siberia dated to c 5,000 BC (Waters-Rist 2018). Similar pathologies became more common during the Industrial Revolution, when so-called 'phossy jaw' or phosphorus necrosis of the jaw was a common disease among 19th- to early 20th-century matchstick workers due to the (new) addition of yellow phosphorus to match heads (Conlin et al 2022, 282; Isaac 2018).

The fact that the Domburg woman lived with this infection for some time suggests that medical care was provided. The careful integration of the coffin into the ringfort rampart shows this to be a special deposition. The visible deformation of the face of the deposited woman is particularly intriguing, as it raises the question whether her disability (or 'otherness') was a contributing factor to the decision to inter her as a foundation deposit.

Different studies of the funerary treatment of disabled individuals in Anglo-Saxon England, based on historical and archaeological evidence, suggest that the majority of people with impairments were buried in ways indistinguishable from other people without disabilities (Hadley 2010; Brownlee 2017). However, a small but significant proportion received burial rites that deviated from the norm. In the earlier, pre-Christian period, these were often spatially associated with women and children or buried in marginal locations (Bohling 2020). In the later, Christian period, these 'deviant' burials could either be interpreted as attempts at ostracisation (those believed to have been disabled as punishment by God, which constituted the majority of examples) or veneration (those believed to have been blessed) (Brownlee 2017, 66–7). No direct parallels for the Schuitvlotstraat burial in terms of its burial location are known from Anglo-Saxon England. However, at Birka in Sweden, the burial of a male was integrated into the rampart of the Birka fortress, although this individual did not have notable palaeopathological marks (see below for further discussion) (Wåhlander 2000).

DIET

δ^{13}C and δ^{15}N stable isotopes provide broader information about people's diets than merely shedding light on potential reservoir effects (Tab 3). As stated previously, all values are relatively high. The adult δ^{15}N values from the Domburg sites are fairly tightly clustered, varying between 11.6‰ and 13.9‰. Although the sample size is too small to draw any form conclusions from this, their δ^{13}C values diverge into two groups,

TABLE 4
Results of the physical-anthropological and palaeopathological analyses.

Beach site burials			
Number	**Age/sex**	**Stature**	**Pathology**
ZAD00066	Adult (20+ yrs) male	1.76 m	Degenerative changes in spinal column. Indications of healed periostitis in both lower limbs. Ossification of muscle attachments in L elbow joint, possibly early stage of DISH
ZAD00067	Adult (30+ yrs) male	Unknown	No pathologies observed
ZG0467-1	Adult?	Unknown	No pathologies observed
ZG0545-17	Child x 2 (younger than c 5 yrs)	Unknown	No pathologies observed
ZG0545-17A	Adult	Unknown	No pathologies observed
ZG0545-17B	Child (4–6 yrs)	Unknown	Enamel hypoplasia in first molars of upper and lower jaws
ZG0545-20	Adult?	Unknown	No pathologies observed
ZG0545-21	Adult?	Unknown	Indications of healed periostitis in right femur and significant wear on all teeth
ZG0915-14	Adult?	Unknown	No pathologies observed
Burials from the ringfort sites			
Number	**Age/sex**	**Stature**	**Pathology**
ZAD1256-5	Adult (45–49 yrs) female	1.58 m	Developmental disorder of spine. Possibly healed fracture in distal end of fibula. Peripheral osteoarthritis of knee and hip joints, commensurate with age
ZAD1320-1	Adult (35–45 yrs) female	1.66 m	Severe mandibular osteomyelitis. Minor osteoarthritis in thoracic vertebrae and osteophytosis with Schmorl's nodes in spine
ZAD2194-44	Child (1–3 yrs)	Unknown	Indications of scurvy, cribra orbitalia and possibly tubercular meningitis

FIG 10
Domburg-Schuitvlotstraat: Mandible of ZAD1320–1.
(A) Both halves of the mandible; (B–C) close-ups of the reactive growth of bone following the injury.
Photographs by Raphaël Panhuysen.

those from the two (Oostkapelle-) Berkenbosch men at −18.5‰ and −18.9‰, and those from the two ringfort-area women around −20.0‰.

As discussed above, it should be noted that the $\delta^{13}C$ and $\delta^{15}N$ of bones and tooth dentine are influenced by the formation time and remodelling rate of the tissue in question. Because different bones were sampled here out of necessity, the results are not directly comparable in terms of the period of dietary inputs captured. Ribs (sampled for ZAD1256-5, ZAD1320-1, and ZAD2194-44) remodel more frequently and are therefore thought to reflect a relatively short number of years before death, while the ulna (sampled for ZAD00066) would likely remodel more slowly, though the precise rate of turnover is unknown (Hedges et al 2007). However, both ribs and the ulna would reflect an average of the dietary inputs over several years. In contrast, dentine from the second mandibular premolar (sampled for ZAD00067) forms during childhood (approximately 5.5–11.5 years of age) and does not remodel, thus reflecting the childhood diet (AlQahtani 2009). However, because the period of dentine formation for this tooth occurs well after the typical age of weaning, the $\delta^{13}C$ and $\delta^{15}N$ for this individual are likely not impacted by the trophic effects of nursing.

The relatively high $\delta^{13}C$ and $\delta^{15}N$ values can be explained in different ways. The establishment of a location-specific baseline from animal samples from the same contexts would be ideal in order to interpret the results, but this was beyond the scope of the current study (and impossible for (Oostkapelle-) Berkenbosch due to the lack of securely stratified material). However, a separate study by Ervynck and colleagues analyses $\delta^{13}C$ and $\delta^{15}N$ isotope values from human, herbivore, marine and freshwater fish from roughly contemporary (historical) Flemish coastal and riverine sites in the Scheldt basin, and this can serve as a proxy (Ervynck et al 2014). $\delta^{13}C$ and $\delta^{15}N$ data from 69 herbivore (sheep and cow) samples from the sites at Leffinge, Brugge and Uitkerke (all West Flanders, Belgium) were selected as comparisons based on their relative proximity, comparable landscape character and roughly contemporary chronology (Ervynck et al 2014, 783). The mean faunal values, +/− 1 standard deviation, serve as a basic faunal baseline to aid in interpreting the human results. Humans consuming a mixed terrestrial diet are estimated to have $\delta^{13}C$ values approximately 1‰ higher than the faunal mean, and $\delta^{15}N$ approximately 3–5‰ above the faunal mean.

Fig 11 directly plots the adult human data from the ringfort sites and (Oostkapelle-) Berkenbosch against the herbivore data. The animal values vary widely, which raises interesting questions about the make-up and relative mobility of the herds. Many of the sheep had enriched $\delta^{13}C$ and $\delta^{15}N$ values in comparison to the cattle, likely caused by a reliance on coastal salt marshes for sheep husbandry, a practice identified more widely in the coastal Netherlands during the first millennium CE (eg Nieuwhof 2015, 240–3; Spros et al 2022). The two females from the ringfort area plot roughly one trophic level above the faunal mean, suggesting a mixed diet mainly consisting of terrestrial plant and animal products, similar to the interpreted diet for the Flemish humans included in the Ervynck et al study (Ervynck et al 2014, 781, fig 1, 783, fig 3). The (Oostkapelle-) Berkenbosch males also plot at least one trophic level above the faunal mean for $\delta^{15}N$, but the even more elevated male $\delta^{13}C$ values could indicate a greater reliance on marine fish or mutton raised on salt marshes, more on which below.

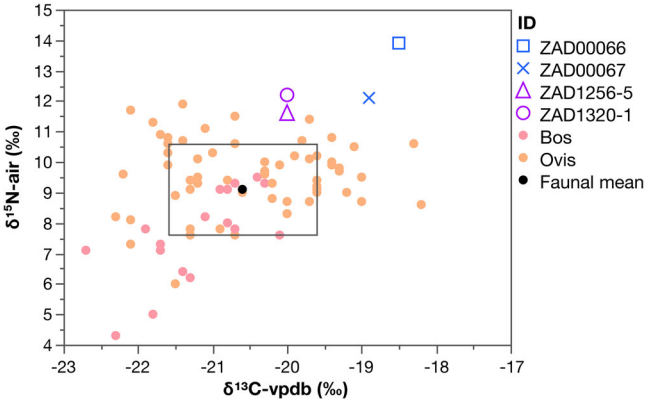

FIG 11
Plot of $\delta^{13}C$ and $\delta^{15}N$ for Domburg adults (n = 4) along with sheep (n = 60, pale orange) and cow (n = 19, pale red).
The faunal mean is shown in black, with a black outline representing the +/− 1 SD range from the mean ($\delta^{13}C = -20.6‰$ +/− 1; $\delta^{15}N = 9.1‰$ +/− 1.5). Domburg females and one of the males plot approximately one trophic level above the faunal mean, while both males have more elevated $\delta^{13}C$ values.
Data from Ervynck et al 2014 (coastal sites of Leffinge, Brugge and Uitkerke). Figure by Eleanor Farber.

A largely terrestrial diet may be surprising in an estuarine area located close to the sea, with evidence for maritime connections, but similar patterns are observed elsewhere in the Netherlands, including at the aforementioned site at Blokhuizen (similarly located close to large bodies of salt and fresh water) and the 5th–8th-century site of Oosterbeintum in the modern province of Friesland (McManus et al 2013; Schats et al 2022, 149–50). By contrast, the more recent urban site of Alkmaar, situated close to Blokhuizen but dated to the 15th–16th centuries—and thus post-dating the so-called fish-event horizon that took place around c AD 1000—yielded higher values that were interpreted as evidence for increased access to more heterogenous and high trophic-level types of food resulting from international trade and other socio-economic changes (Barrett et al 2004; Schats et al 2022, 149, 152–3).

When the Domburg data are placed within their wider, North Sea context and analysed over a longer chronological time period, some interesting patterns emerge. Fig 12 plots δ^{13}C and δ^{15}N values for the Domburg area in the context of the combined adults from the English sites in Ipswich, York and London, categorised by the site phase they belong to. Although the data from these different sites were measured at different laboratories using different equipment, resulting error margins are likely insignificant for

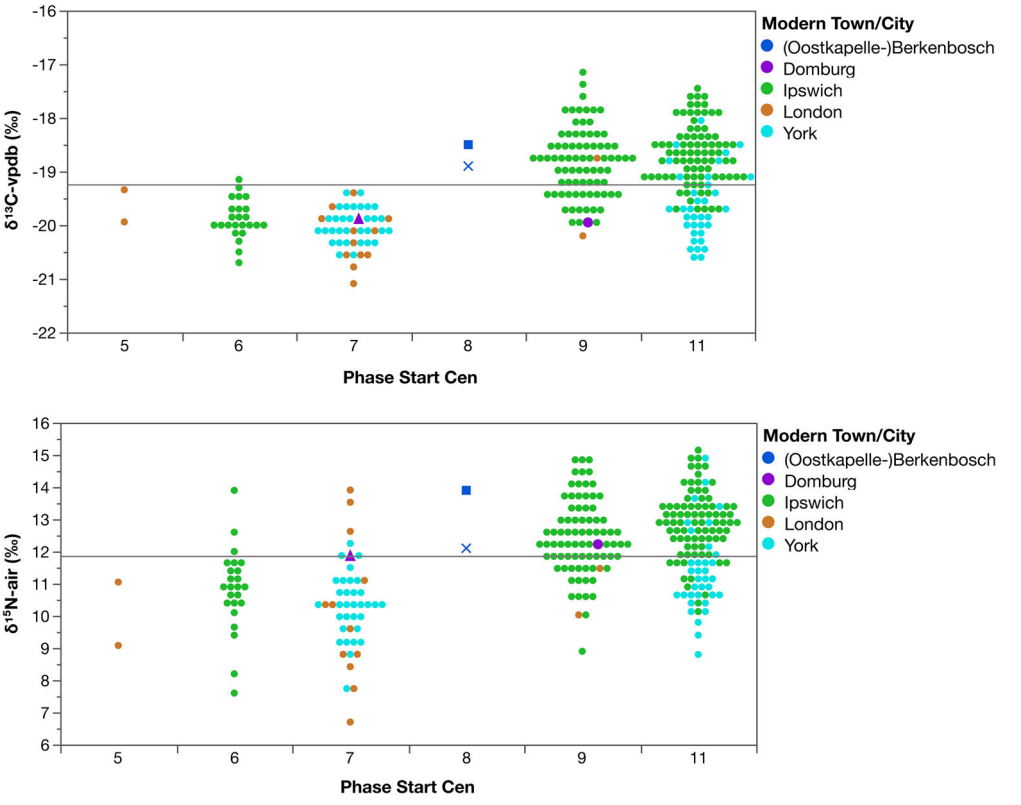

FIG 12
δ^{13}C and δ^{15}N by site-phase starting century for Domburg and (Oostkapelle-) Berkenbosch adults, plotted with adults from comparative sites. Samples from Ipswich, London, and York are shown in different colours to illustrate the variation and range of values for each emporium more clearly. Purple sites are Domburg. Dot = ZAD1320-1. Triangle = ZAD1256-5. Blue sites are (Oostkapelle-)Berkenbosch. Cross = ZAD00067. Box = ZAD0066. Cen = century (AD).
Figure by Eleanor Farber.

the present interpretations, while quantification of likely error margins was beyond the scope of the pilot projects, and therefore no uncertainty or error has been added to Figs 12 and 13 below. The numbers represent the century in which the phase begins, and most last 100–200 years. The majority of pre-8th-century individuals have $\delta^{13}C$ values below −19.0 ‰, while over half of those from the 8th century and after have values above −19.0 ‰. Similarly, over half of pre-8th-century individuals yielded $\delta^{15}N$ values below 12 ‰, and over half of 8th-century and later individuals yielded values above 12 ‰. Due to the small sample sizes from 8th-century (Oostkapelle-) Berkenbosch and 5th-century London (n = 2 for each site), these two periods are included in the figure but excluded from statistical analysis.

The data distributions for each period were analysed for normality using a Shapiro-Wilks test, and all were normally distributed (see Appendix) (Fig 13). A Tukey-Kramer HSD test was performed to compare the means for each time period (except the 5th and 8th centuries), for both $\delta^{13}C$ and $\delta^{15}N$. Based on these analyses, there are statistically significant differences between the means for the 6th and 7th centuries compared to the 9th and 11th centuries, for both $\delta^{13}C$ and $\delta^{15}N$. The two males from (Oostkapelle-) Berkenbosch plot with the 9th- and 11th-century values for both isotopic systems. Though the two Domburg females also fit the broader trends, ZAD1256–5 has a $\delta^{13}C$ value close to the 7th-century mean but an above-average $\delta^{15}N$ value, while ZAD1320–1 is near the bottom of the 9th-century $\delta^{13}C$ range but has an average $\delta^{15}N$ value.

The statistically significant differences between the 6th–7th and 9th–11th centuries suggest that the increase in values over time observed at Domburg may represent a broader dietary shift occurring in the 7th–8th century (Leggett 2020, 2021; Leggett and Lambert 2022). Different explanations for this can be offered. As the average $\delta^{13}C$ and $\delta^{15}N$ values both increase, an increase in marine food consumption (such as herring) may seem plausible (eg Müldner 2016). Although this significantly predates the aforementioned fish-event horizon, an early increase in marine fish consumption fits a wider pattern observed at *emporia* sites such as *Hamwic*, York, Ipswich and London (Barrett et al 2004, 622, 630).

A counter argument to this is provided by the fact that fish bones are rare finds during archaeological excavations of this period on Walcheren—including in Domburg—and the Flemish coastal zone, although of course the contextual evidence for the skeletons from (Oostkapelle-) Berkenbosch has long been destroyed by the sea (Meijlink pers comm; Spros et al 2022). However, marine protein could also have been consumed in the form of shellfish such as cockles and mussels—which would slightly raise $\delta^{13}C$ values but would not measurably raise $\delta^{15}N$ values—evidence for which is frequently found, although systematic study is rare (Van Dijk et al 2011, 117–20; Ervynck et al 2012; Van Dierendonck pers comm).

Rather than an increased consumption of marine foods, it is also possible that the changes relate to the agricultural extensification of the 7th to 8th centuries, as recently identified in England (Hamerow et al 2020; Hamerow forthcoming). In that case, the importance of the rural context of Domburg—rather than its maritime connections—is emphasised. The average enriched values for $\delta^{15}N$ could then be explained by reference to increased manuring, especially needed on the dune sands (plough marks were noted on the thin layer of sand underlying the Domburg ringfort) (Ufkes 2011, 93–4). Meanwhile, an increased reliance on mutton reared on salt marshes could contribute to the shift in average $\delta^{13}C$ values. This scenario would again point to a largely terrestrial

diet for the Domburg individuals and is consistent with the high occurrence of sheep bones found during archaeological excavations in the area, including in Domburg, but also at rural sites such as Leffinge-Oude Werf and Serooskerke (Van Dijk et al 2011, 117–20; Ervynck et al 2012, 155). What is more, the economic importance of sheep husbandry in the salt marshes around the Scheldt estuary, where landholdings of the great monastic houses of Ghent and Echternach were located, is also historically attested and was linked to the importance of the trade in Frisian cloth (*pallia fresonica*) (Van Heeringen 1987; Verhulst 2002, 66; Van Dijk et al 2011).

On the basis of the surviving data, it is impossible to determine whether the difference in $\delta^{13}C$ values from the two adult women from the ringfort sites compared to those from the two men from (Oostkapelle-) Berkenbosch constitutes a real pattern. It is certainly not unthinkable: a recent isotopic study of the above-mentioned 7th–8th-century site of Koksijde in modern-day Belgium resulted in the identification of two distinct dietary groups within a single cemetery, although here the difference lay in the measured $\delta^{15}N$ values. (Spros et al 2022, 8–10). If so, this may indicate a difference in dietary habits between different settlement cores, a chronological difference, or a difference in gender or status. The possibility of a gendered difference would not be entirely unfeasible: the 15th–16th-century assemblage from Alkmaar revealed statistically meaningful differences in $\delta^{15}N$ values between men and women, whereby values for men were consistently more enriched (Schats et al 2022, 148–9).

Finally, the $\delta^{15}N$ value of the child burial from Singel 6 at 13.9‰ is elevated in comparison with the other two burials from the ringfort, although not by as much as the c 3–5‰ indicative of a trophic level (the nursing effect). A clearer nursing signal would be picked up by isotopic analysis of tooth dentine, but because the element sampled was a rib, the isotopic results reflect the average diet over a longer period, and likely indicate that the child was old enough to have started eating a mixed diet (Hedges et al 2007). Alternatively, the elevated $\delta^{15}N$ of the Singel burial may be the result of physiological stressors such as starvation or prolonged illness (as stated previously, the skeletal remains show evidence of scurvy). However, in that case one might expect to see a decrease in $\delta^{13}C$ values, so the equally elevated $\delta^{13}C$ values may contradict this (Katzenberg and Lovell 1999; Fuller et al 2005; Beaumont et al 2015).

LONG-DISTANCE CONTACTS

Despite the evidence for the importance of Domburg's rural context, the burial evidence from the area also hints at the long-distance connections of the deceased. Strontium and oxygen isotopes ($\delta^{18}O$ and $^{87/86}Sr$) can be used to infer migration when the values measured from tooth enamel differ from those in the area in which an individual is buried. The IDEMD project analysed $\delta^{18}O$ and $^{87/86}Sr$ for the (Oostkapelle-) Berkenbosch burials and the possible foundation burial from the Domburg Schuitvlotstraat (Tab 5; Fig 13); the two burials underneath the S part of the ringfort had no surviving teeth. The MMNSW project collated existing published data from a number of sites, which placed the examples from the Domburg area in their wider context (Fig 14).

The $^{87/86}Sr$ values of the enamel samples from the Domburg area were tightly clustered, either within the baseline range of 0.7088–0.7092 established for the Holocene marine soils of the coastal Netherlands, or—in the case of in situ burial

TABLE 5
Results of the $^{87/86}Sr$ and $\delta^{18}O$ analysis, including strontium concentrations.

Skeleton	Material	$^{87/86}Sr$	±2 Sigma internal	Sr ppm (%RSD)	$\delta^{18}O$	$\delta^{18}O_W$
ZAD00066	Right second mandibular premolar (4.5), enamel	0.709511	0.000011	89 (0.306)	−4.698	−7.29
ZAD00066	bone	0.709223	0.000010	938 (0.831)	N/A	N/A
ZAD00067	Right second mandibular premolar (4.5), enamel	0.709188	0.000013	117 (0.251)	−4.051	−6.31
ZAD00067	Bone	0.709143	0.000011	947 (0.620)	N/A	N/A
ZAD1320-1	Left second maxillary molar (2.7), enamel	0.709237	0.000013	113 (0.313)	−4.558	−7.11
ZAD1320-1	Bone	0.709105	0.000010	299 (1.110)	N/A	N/A

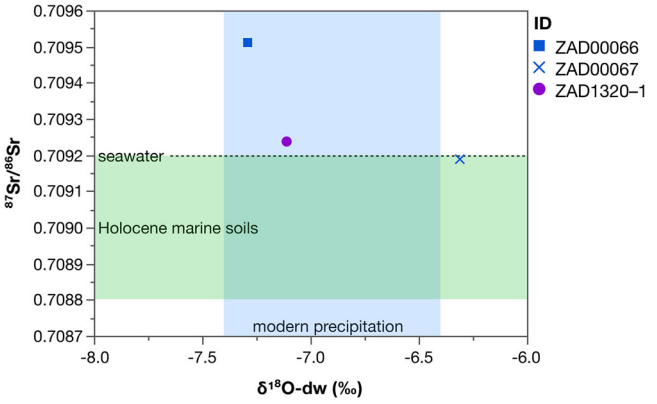

FIG 13
$^{87/86}Sr$ and $\delta^{18}O_W$ for the three Domburg area individuals.
The dotted line indicates the $^{87/86}Sr$ value of seawater, and the blue and green shaded areas indicate the $\delta^{18}O$ range for modern precipitation in the Netherlands, and the $^{87/86}Sr$ range for coastal Holocene marine soils in the Netherlands, respectively (Kootker et al 2016, 8, fig 5; Kootker 2014).
Calculated using Daux et al 2008, eq 6. By Eleanor Farber.

ZAD00066—conform to baseline values between 0.7091–0.7095 that occur fewer than 60 km further inland (Kootker et al 2016, 8, fig 5). These strontium values occur in many locations around the North Sea littoral—as a result of the so-called sea-spray effect, which homogenises bioavailable strontium isotope ratios as a result of the deposition of marine strontium on coastal soils—and realistically, therefore, no more can be said on their basis than that the individuals grew up in a coastal area away from older soil formations (eg Frei and Frei 2011 for Denmark).

The $\delta^{18}O$ values of the three analysed individuals were also closely clustered, within a 1‰ range, suggesting that they grew up with access to water and nutrients that had similar $\delta^{18}O$ values. The enamel for the maxillary second molar and mandibular second premolars forms at roughly the same time (c 2.5–9.5 years of age), so this would indicate that they spent their early childhoods in similar locations (AlQahtani 2009). After their values were recalculated to approximate drinking water ($\delta^{18}O_W$), they fell

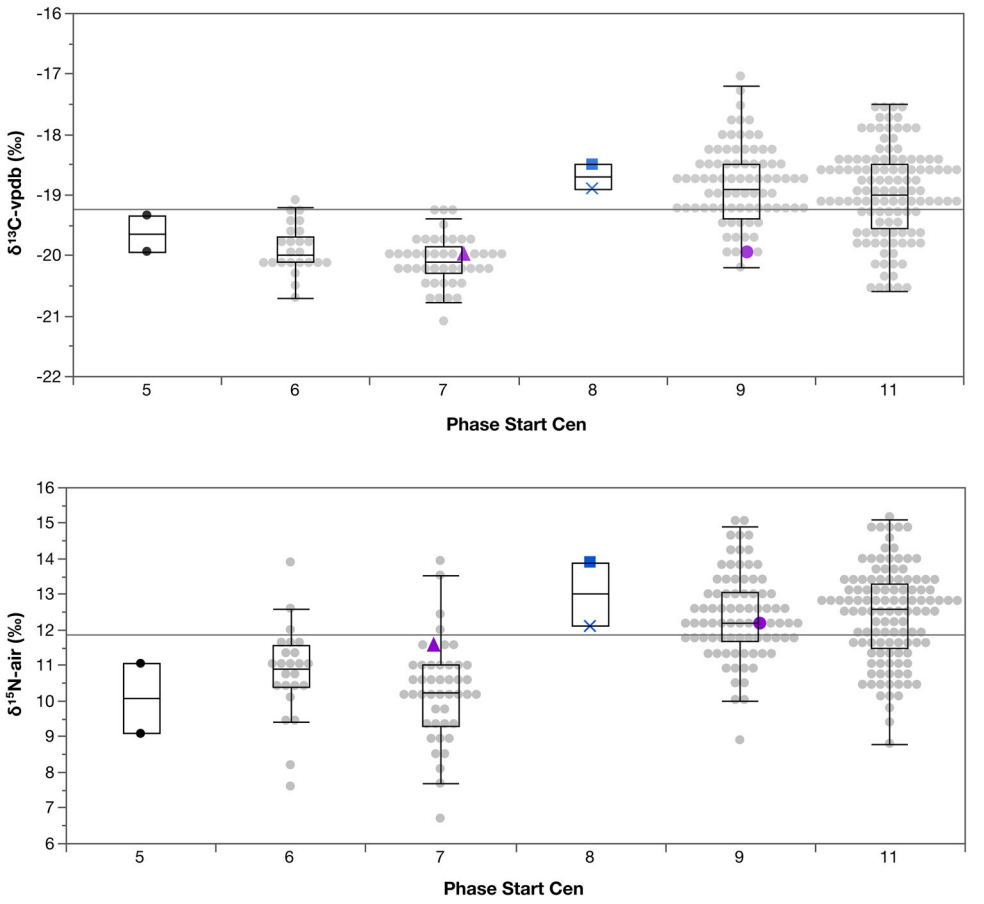

FIG 14
δ^{13}C and δ^{15}N values with boxplots for Domburg and (Oostkapelle-) Berkenbosch adults, along with adults from sites in Ipswich, London, and York, by site-phase starting century. Purple sites are Domburg. Dot = ZAD1320-1. Triangle = ZAD1256-5. Blue sites are (Oostkapelle-)Berkenbosch. Cross = ZAD00067. Box = ZAD0066. Cen = century (AD).
Figure by Eleanor Farber.

inside or close to the range of −6.4‰ to −7.4‰ for δ^{18}O of modern precipitation in the Netherlands (Kootker 2014). Only ZAD00067 was slightly heavier, but the error margins inherent in this method probably render such a small difference insignificant (Pollard et al 2011).

Comparison of the $^{87/86}$Sr values with other sites shows some interesting similarities and differences (Figs 15 and 16). As with the δ^{13}C and δ^{15}N data, although the data from these different sites were measured at different laboratories using different equipment, resulting error margins for the $^{87/86}$Sr results are likely insignificant for the present interpretations. As quantification of likely error margins was furthermore beyond the scope of the pilot projects, no uncertainty or error has been added to Figs 15 and 16. (Resulting error margins when comparing δ^{18}O measured at different laboratories using different equipment would have been substantially larger and for that reason no attempt has been made at inter-site comparison of δ^{18}O values.)

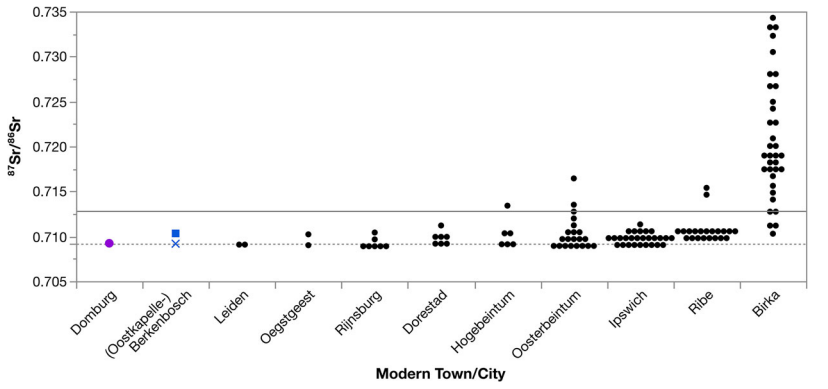

FIG 15
$^{87/86}$Sr values for Domburg area individuals plotted with values from comparative sites in the Netherlands and North Sea *emporia*.
The grey line indicates the group mean, and the dotted line indicates the value of seawater.
Figure by Eleanor Farber.

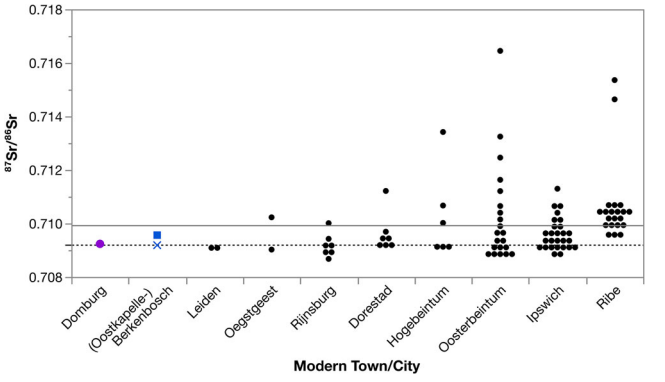

FIG 16
$^{87/86}$Sr values for Domburg area individuals plotted with values from comparative sites in the Netherlands and North Sea *emporia*, excluding Birka for the purposes of better visualising the variation for the other sites.
The grey line indicates the group mean, and the dotted line indicates the value of seawater.
Figure by Eleanor Farber.

Firstly, it should be noted that the teeth included in this comparative analysis were nearly always second molars and premolars for all sites except for Birka (for which no information on tooth type is given), meaning that the same period of development was captured for each individual (Price et al 2018). Fig 15 clearly shows the wide variation in $^{87/86}$Sr at the Swedish site of Birka, which differs from the more tightly clustered values seen at the other sites. The greater variability at Birka is likely a reflection of the more complex and varied geology of the area, although it should also be remembered that Birka is an outlier in Fig 15 because it was located in the Baltic, rather than the North Sea, and therefore directly connected to historically and archaeologically attested long-distance connections stretching all the way to the Byzantine and Islamic realms (Price et al 2018).

Focusing on the North Sea sites (Fig 16), the $^{87/86}$Sr values from the Domburg area were comparable in their overall values and tight clustering to those from Stoke

Quay, Ipswich, as were some 18 unpublished samples from the 7th–8th-century Veilingterrein site in *Dorestad* and four samples from the 8th–9th-century cemetery at De Heul, *Dorestad* (Kootker and Heeren 2022; for De Heul [not included in Fig 13]; Kootker pers comm). Samples from the 5th–8th centuries from other sites along the Dutch western coast, at Leiden, Oegstgeest and Rijnsburg, also fell into this range. Moving further north along the North Sea coast, however, to the Frisian sites of Hogebeintum and Oosterbeintum, and the Danish site of Ribe, more outliers can be identified (McManus et al 2013; Kootker and Heeren 2022).

Although necessarily speculative, this may have implications for our understanding of mobility networks in the sense that, if they existed, they occurred on relatively well-defined (if possibly still fairly expansive) spatial scales. In other words, it is likely that the individuals buried at Domburg, Ipswich, *Dorestad*, Leiden, Oegstgeest and Rijnsburg were born within the broad southern North Sea region and adjacent territories, whereas individuals buried at Birka likely originated in the Baltic Sea region or surrounding territories. Individuals buried at Ribe or the Frisian sites occupied the space in between, with most individuals displaying values that fall within the typical coastal range, but also a handful of individuals that grew up further afield. More extensive sampling, including multiple teeth that are formed during different age brackets from the same individuals, can shed more light on the relative mobility of people during their lives.

Provenancing of dendrochronological samples and analysis of previous use of coffin wood from the two burials from (Oostkapelle-) Berkenbosch sheds additional light on potential long-distance contacts. This had previously been noted in connection with ship wood found in 2010 during an excavation in the Badstraat within the Domburg ringfort. This originated from a late 8th-century Anglo-Saxon clinker-built vessel from the immediate surroundings of Southampton, probably from the *emporium* of *Hamwic*, underlining the maritime connections of the settlement (Lange 2012, 20–5; Doeve and Jansma 2015, Bijlage 3; Vermeersch and Van Dierendonck 2017, 483–4).

The coffin plank from ZAD00066 was identified, not as a maritime vessel, but as part of a flat-bottomed river vessel or barge, like the coffin wood from the female burial from the Schuitvlotstraat (Vermeersch 2017). Interestingly, the wood from ZAD00066 could be provenanced to the German Rhineland. The coffin plank from ZAD00067 represents a tree that grew in the Pleistocene area of Brabant/Flanders and shows traces of reuse as well, but was not analysed further due to budget constraints (Doeve and Jansma 2015; Van Lanen et al 2016, Supplementary Materials B). The Rhineland connection is particularly interesting, as the distribution of Rhineland timbers across the Low Countries and North Sea littoral, including at *emporia* like Ipswich, *Dorestad* and Ribe, and now also the Domburg area, is restricted to riverine vessels and stave barrels and can thus be argued to reflect nodes in a trading network (Fig 17) (Doeve and Jansma 2015; Jansma and Van Lanen 2015; Van Lanen et al 2016; Jansma et al 2017). If burial practices were used actively in the construction of past communal identities, the reuse of riverine, rather than maritime, vessel timbers to construct burials would suggest that riverine connections between the Domburg area and inland regions were particularly significant.

Other aspects of the observed burial practices at Domburg can shed further light on the cultural affinities of the deceased and the communities to which they belonged. All of the burials from Domburg and (Oostkapelle-) Berkenbosch included in this paper were unfurnished inhumations, as were all if not most of the burials from the now-destroyed sites of Westhove and Hoge Hil. As stated previously, this is a common

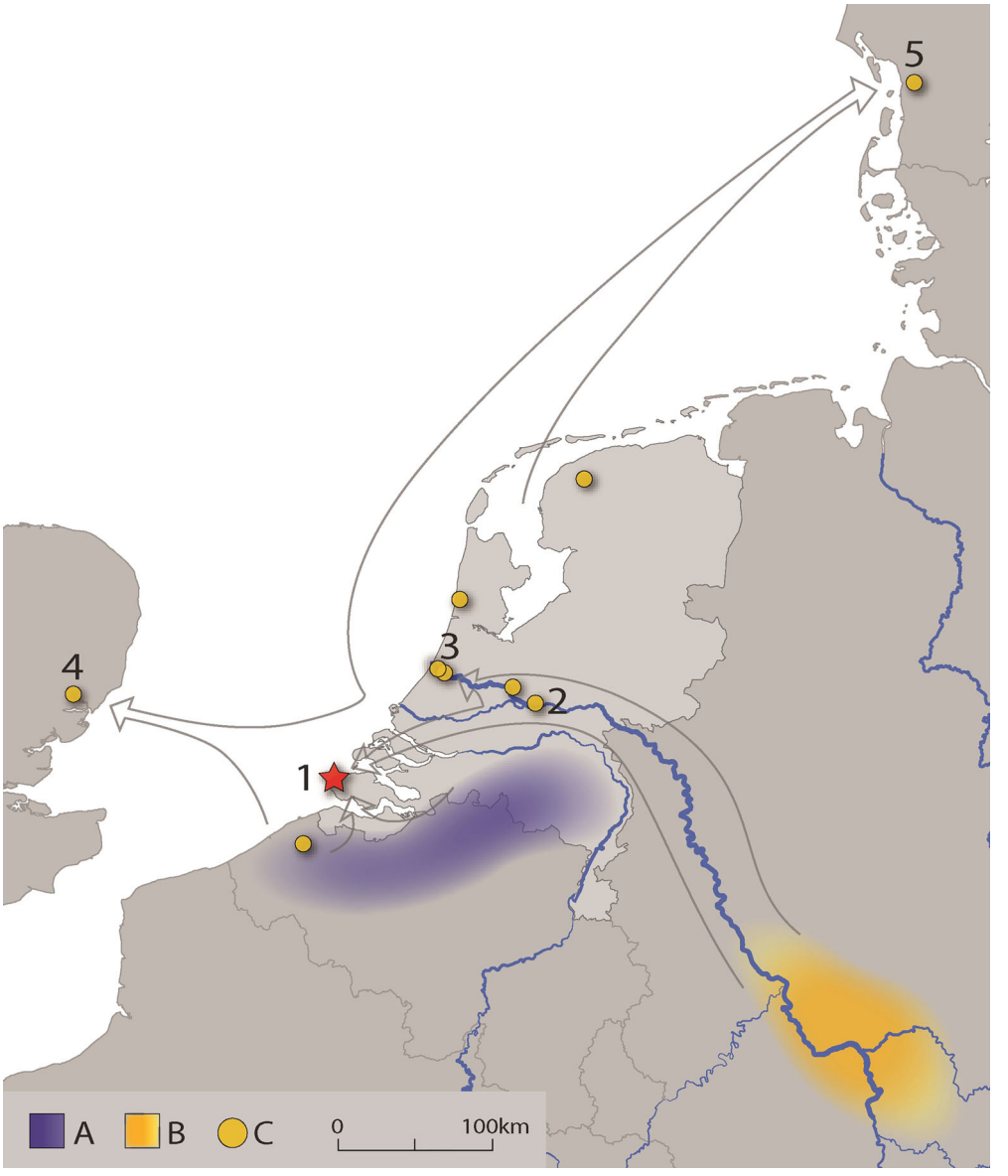

FIG 17
Provenance of the coffin timbers from burials ZAD1320_1, ZAD00066 and ZAD00067, and broader distribution of Rhineland timbers across the North Sea region. North is at the top of the image.
Beach burial ZAD00067 came from area (A) Pleistocene region of Noord-Brabant (Netherlands) and Flanders (Belgium). Beach burial ZAD00066 and ringfort burial ZAD1320–1 came from area. (B) German Rhineland. (C) Distribution of the archaeological timber finds included in the German Rhineland chronology. (1) Domburg-Oostkapelle. (2) Wijk bij Duurstede (Dorestad). (3) Oegstgeest and Katwijk. (4) Ipswich. (5) Ribe.
Figure by Petra Doeve, adapted from Doeve 2015; Jansma and Van Lanen 2015.

pattern in the southern Low Countries and neighbouring regions from the later 7th century onwards. In England, furnished burial seems to have come to an end in the final decades of the 7th century, while the practice lingered on into the early 8th century in

the Frankish regions (Capuzzo et al 2020, 1820; Brownlee 2021, 143). In Scandinavia, on the other hand, including at the Ribe and Hedeby *emporia*, more varied practices including furnished burial continued into the 10th century or beyond (eg Eisenschmidt 2011, 97–8; Croix et al 2020a).

The causes for the shift from regionally variable burial practices to a fairly homogenous unfurnished inhumation rite have been extensively discussed, including the dominant influence of Christianity, developing socio-political structures, changing perceptions of the dead, and the homogenisation of cultural practices as a result of long-distance contacts (Capuzzo et al 2020, 1824; Brownlee 2021, 143–4, 156). Unfurnished inhumation became the norm in Christian medieval Europe, but this does not mean that the 8th- and 9th-century individuals from the Domburg area were necessarily Christians themselves. Documentary evidence suggests that, although missionary activity to Walcheren started in the late 7th century, it may have continued into the first half of the 9th century or even beyond (ten Harkel 2019, 232–3). Given the cosmopolitan character of the area, it is just as plausible that people with different religious beliefs and customs lived alongside each other, but conformed to dominant social practice when it came to burying their dead. In this respect, they shared a common cultural repertoire with the Frankish and Anglo-Saxon worlds, but not so much with the Scandinavian territories.

A tantalising question is raised by the foundation burial of the disabled woman underneath the rampart of the Domburg ringfort in the later 9th century. Given the rarity of excavated 9th-century burials in the Netherlands, it is difficult to assess the significance of this burial from a contextual point of view, but possible parallels exist from around the North Sea littoral.

Burials of the 8th to 9th century are rare in Anglo-Saxon England as well, although a growing number of normative (as opposed to deviant) burials is known from middle Anglo-Saxon to late Saxon settlement contexts, peaking in the 8th century. Like the burial from the Schuitvlotstraat, some of these were associated with boundaries and entrances, a practice that has been suggested to strengthen the relationship between living communities and their ancestors, possibly in the context of claims to land (Hamerow 2010, 71, 73, 76; Sofield 2015, 383). A few showed traces of pathologies that may have affected quality of life, although not enough to suggest a pattern (Sofield 2015, 368). Cliff Sofield (2015, 363) notes a possible preference for infants and younger individuals and an absence of mature adults aged 40 or over, although adults aged 20–40 are relatively common. Given the different age brackets used in this study, it is unclear whether the woman buried at the Schuitvlotstraat, at 35–45 years of age, fits this pattern.

Marianne Eriksen (2020, 2017) has analysed the pattern in Scandinavia for the period c 500 BC–AD 1050, noting some 125 examples of (partial) human burials in settlement contexts, with a preference for infants and crania (and some headless bodies). A particularly interesting parallel from Scandinavia, because of its burial location, is a burial mound containing the chamber grave of a male buried in an E/W-aligned coffin with a secondary burial on top, discovered in 1996 during investigations of the rampart of the fortress at Birka, into which it was incorporated (Fennö Muyingo 2000; Wåhlander 2000). This burial, whose E/W orientation and coffined inhumation rite seem out of place in a period mainly characterised by cremation, was accompanied by gravegoods including a wooden box, an iron knife, and bronze tweezers. An adult stallion of three to four years old was buried at the foot of the coffin, whose teeth were radiocarbon dated to the late 7th or 8th century. The secondary burial was a possible sacrificial victim, and evidence

for feasting in the location of the burial, possibly over a prolonged period of time, was also recognised. The burial has been interpreted as a claim to power, possibly by the founding family of the Birka fortress, although it has also been suggested that the whole assemblage should be interpreted in the context of the cult of Freyr, a god who was associated with fertility and sovereignty (Wåhlander 2000).

Although future discoveries may alter the picture, at present these other examples point to connections across the North Sea. Current evidence is not capable of commenting on the childhood origin of the woman who was buried at the Schuitvlotstraat beyond the fact that she probably came from the southern North Sea coastal region, although her pathology would have made her stand out among her community. If this burial was meant to cement ties between the living and their ancestors in the context of a claim to landed property, it seems tentatively plausible, therefore, that those responsible for the construction of the ringfort at Domburg were themselves coastal dwellers, and not, as has been argued elsewhere, representatives of inland elites seeking to superimpose power over the coastal region (Loveluck and Tys 2006; ten Harkel 2013, 2019; Tys et al 2016).

DISCUSSION: TOWARDS A COMPARATIVE RESEARCH AGENDA FOR THE HUMAN REMAINS FROM THE EARLY MEDIEVAL NORTH SEA *EMPORIA*

Returning to the questions posed at the start of this paper, the combined evidence from the IDEMD and MMNSW projects provides some answers, but much more work is needed before life and death in the North Sea *emporia* can be fully understood. What proportion of the population of these trading settlements could be classed as 'international seaborne merchants'? What we can say is that, going on current evidence, only a small percentage was born further afield in regions with significantly different underlying geologies. Before it can be determined how many of the people who were buried at *emporia* sites regularly traversed the North Sea, however, more isotopic data needs to be generated, combining $\delta^{13}C$, $\delta^{15}N$, $\delta^{18}O$ and $^{87/86}Sr$ but also other elements such as $\delta^{34}S$ (sulfur), integrating dietary and mobility interpretations as both can indicate belonging to different communities (eg Bataille et al 2021). Sampling multiple tissues from single individuals can shed light on changes during an individual's life course.

Detailed phase- or site-specific animal baselines are needed to contextualise the human data; in the light of the possibility that domesticated animals could also move across large areas during their lifetimes, this needs to include archaeological wild fauna. Such detailed baselines can further refine the picture created by broad-brush national or regional baselines and strengthen interpretations concerning local vs non-local origin (Price 2021). These high-quality isotopic data need to be generated on an international scale, placed in the context of biological-anthropological, palaeopathological and archaeological information, and interpreted in the light of geospatial and historical knowledge on multiple temporal and spatial scales. In this context, it is promising to note that large-scale meta-analyses and data repositories of early medieval isotopic data are increasingly emerging (eg CIMA; Cocozza et al 2021; Leggett 2021; Leggett et al 2021).

Second, current evidence suggests that there were more similarities than differences in terms of mobility and diet between the populations of the different *emporia* and other contemporary 'rural' sites. Subsistence strategies were likely to have included animal husbandry

(especially sheep), although exploitation of marine fish may have occurred slightly earlier at *emporia* sites than elsewhere. The evidence for the Rhineland connections serves to remind us that connections with regions further inland via the riverine network were also of prime importance, confirming the role of the *emporia* as gateways between inland centres and the wider North Sea region. Future studies should therefore consider the existence of multi-directional connectivity on different spatial scales: long-distance seaborne *and* riverine, but also short-distance connections with the rural countryside and other nearby settlements.

Third, in terms of differences between *emporia* and changes over time, it is clear that more comparative bioarchaeological work on an international scale needs to take place. The emphasis that many scholars have placed on the *emporia* as a trading 'network', drawing attention to similarities in the material culture signature of these places, may have glossed over the fact that the burial records indicate significant differences between the Low Countries and Britain on the one hand, and Scandinavia on the other. Again, enough bioarchaeological data is now being generated that such internationally focused studies become increasingly attainable. This will also help to shed further light on the dynamics that caused the observed changes in dietary practices that took place in the 8th century.

Specific routes for further investigation are beginning to emerge. We need to better understand the phenomenon of multiple cemetery cores with overlapping chronologies, observed at many *emporia* sites. It is likely that the key to unravelling the potentially more complex make-up of *emporia* populations—as suggested by other evidence—and the relationships between merchants and artisans, locals and foreigners, wives and prostitutes, mercenaries and farmers, lies here. Again, detailed, multi-isotopic and interdisciplinary approaches will be needed, as the limitations of the scientific techniques—such as the so-called sea spray effect on strontium values—imply that any observed differences will likely be subtle. Only then may the life stories of the individuals who were buried at the *emporia*, and the factors that may have contributed to their burial in specific cemeteries, be pieced together.

There is an urgent need for more comparison between the *emporia* and 'rural' cemetery populations, not just within the coastal region but also further inland. Here, the relative lack/absence of 8th- and 9th-century burials in the Low Countries may be problematic, but comparison with earlier and later cemetery assemblages could potentially serve as a proxy. For the Low Countries, especially the earlier period between the 5th and 7th centuries is key. For this period, more data already exist, possibly in part because this period still had extensive furnished burial, allowing for comparisons between gravegoods and bioarchaeological information (Brownlee 2021). Taking a solid understanding of the relationship between bioarchaeological information and burial rites in this earlier period as a starting point for any new bioarchaeological analyses of material from the period c 700–1100, any emerging patterns can be placed in a longer-term interpretative framework. Comparison to contemporary, 8th- and 9th-century Scandinavian contexts—where furnished burial still occurred—will be invaluable for similar reasons.

Finally, the wider impact of this kind of research must be considered. The analysis of ZAD00066 or 'Nico' in the CT scanner of a local hospital evoked public interest, with newspaper headlines dubbing him 'the oldest skeleton from Zeeland', highlighting the perceived relevance of this c 1,300-year-old find for 21st-century local identities, further emphasised by his subsequent inclusion in the Zeeland Museum displays. What is more, the coffin plank from ZAD00067 was used in an exhibition in 2019–2020, organised by the Zeeuws Genootschap to celebrate the 250-year anniversary of the Society. There was no scope within the IDEMD project to address public perspectives on the research, but it

was nice to see that both burials from (Oostkapelle-) Berkenbosch featured in public exhibitions following the renewed attention they received because of our research. If we want archaeological research to be and remain relevant to contemporary society, issues including the ethics of studying human remains (especially in the case of destructive analyses) and the different values that such research may hold to different groups within society should be an integral part of future endeavours. In sum, if we really want to know who the people who inhabited these *emporia* were, and what they are to us, we will need to think big, work collaboratively, and do so on an international scale.

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Résumé

Vestiges humains du Haut Moyen-Âge à Domburg (Pays-Bas) et dans d'autres communautés littorales dans une perspective internationale : vers un programme de recherche internationale pour les cimetières des comptoirs de la mer du Nord par Letty Ten Harkel, Robert Van Dierendonck, Eleanor Farber, Michael Dee, Petra Doeve, Helena Hamerow, Esther Jansma, Petrus Le Roux, Raphaël Panhuysen et Pieterjan Deckers

Ce papier pose la question de l'identité des personnes enterrées dans les comptoirs de la mer du Nord datant du Haut Moyen-Âge. Les conclusions relatives au caractère mercantile des comptoirs de la mer du Nord sont souvent fondées sur la culture matérielle des petits objets. Conscients du fait qu'il est difficile de tirer des conclusions sur l'identité des personnes en se basant sur les assemblages de vestiges, deux projets pilotes ont fait intervenir des analyses bioarchéologiques des populations funéraires associées à ces sites. Le premier projet, Investigating the Dead in Early Medieval Domburg (Enquête sur les défunts de Domburg du Haut Moyen-Âge), a procédé à des analyses multidisciplinaires des (très petites) populations funéraires ayant survécu sur les sites, en grande partie détruits, dans la zone de Domburg (Pays-Bas) ; il combine l'analyse isotopique, la datation radiocarbone, l'anthropologie biologique, la dendrochronologie, ainsi que l'étude de la provenance et des utilisations antérieures du bois des cercueils. Le second projet, Medieval Migrants of the North Sea World (Migrants médiévaux du monde de la mer du Nord), a inventorié les témoins isotopiques disponibles pour les vestiges humains provenant des comptoirs en Angleterre, aux Pays-Bas et en Scandinavie, parallèlement aux informations archéologiques contextuelles. Ce papier présente les deux projets, en replaçant les informations détaillées issues de Domburg dans leur contexte international, et en soulignant la nécessité d'un programme de

recherche complet pour combler les lacunes actuelles dans nos connaissances sur les populations des comptoirs au Haut Moyen-Âge.

Zussamenfassung

Die menschlichen Überreste aus dem frühmittelalterlichen Domburg (Niederlande) und anderen Küstengemeinden in internationaler Perspektive: Hin zu einer internationalen Forschungsagenda für die Friedhöfe der Nordsee-Emporien von Letty Ten Harkel, Robert Van Dierendonck, Eleanor Farber, Michael Dee, Petra Doeve, Helena Hamerow, Esther Jansma, Petrus Le Roux, Raphaël Panhuysen und Pieterjan Deckers

Dieser Artikel befasst sich mit der Frage, wer die Menschen waren, die in den frühmittelalterlichen Handelsplätzen im Nordseeraum begraben wurden. Rückschlüsse auf den merkantilen Charakter der Nordsee-Emporien werden häufig auf der Grundlage der beweglichen materiellen Kultur gezogen. Da es jedoch schwierig ist, anhand von Fundstücksammlungen Rückschlüsse auf die Identität der Menschen zu ziehen, wurden zwei Pilotprojekte abgeschlossen, die bioarchäologische Analysen der mit diesen Stätten assoziierten Friedhofspopulationen umfassten. Beim ersten dieser Projekte, Investigating the Dead in Early Medieval Domburg (Den Toten des frühmittelalterlichen Domburg auf der Spur), wurden anhand einer Kombination von Isotopenanalyse, Radiokarbondatierung, biologischer Anthropologie, Dendrochronologie sowie Provenienzforschung und Untersuchung der früheren Verwendung von Sargholz multidisziplinäre Analysen an der (sehr kleinen) erhaltenen Bestattungspopulation aus den größtenteils zerstörten Stätten im Gebiet von Domburg (Niederlande) durchgeführt. Das zweite Projekt, Medieval Migrants of the North Sea World (Mittelalterliche Migranten der Nordseewelt) bestand in der Inventarisierung verfügbarer Isotopennachweise für menschliche Überreste aus Handelsstätten in England, den Niederlanden und Skandinavien, ergänzt durch kontextuelle archäologische Informationen. Dieser Beitrag stellt beide Projekte vor, wobei die detaillierten Informationen aus Domburg in einen breiteren, internationalen Kontext gestellt werden. Er verdeutlicht, dass eine umfassende Forschungsagenda notwendig ist, um die derzeitigen Lücken in unserem Verständnis der Populationen der frühmittelalterlichen Emporien zu schließen.

Riassunto

I resti umani dell'altomedievale Domburg (Paesi Bassi) e di altre comunità costiere in una prospettiva internazionale: verso un programma di ricerca internazionale per i cimiteri degli empori del Mare del Nord *di* Letty Ten Harkel, Robert Van Dierendonck, Eleanor Farber, Michael Dee, Petra Doeve, Helena Hamerow, Esther Jansma, Petrus Le Roux, Raphaël Panhuysen *e* Pieterjan Deckers

Questo studio affronta la domanda: chi erano le persone sepolte presso gli empori altomedievali del Mare del Nord? Le conclusioni relative al carattere mercantile degli empori del Mare del Nord si basano spesso sulla cultura materiale di oggetti portatili. In riconoscimento del fatto che è difficile trarre conclusioni sull'identità delle persone in base agli assemblaggi dei reperti, si sono compiuti due progetti pilota che hanno implicato analisi bioarcheologiche delle popolazioni cimiteriali associate a queste località. Il primo di questi, il progetto *Investigating the Dead in Early Medieval Domburg* (Ricerche sui defunti nell'altomedievale Domburg), ha intrapreso analisi multidisciplinari delle popolazioni inumate (assai scarse) giunte fino a noi dai siti in gran parte distrutti della zona di Domburg (Paesi Bassi), combinando l'analisi degli isotopi, la datazione al radiocarbonio, l'antropologia biologica, la dendrocronologia, e inoltre l'accertamento della provenienza e lo studio relativo all'uso precedente del legno delle bare. Il secondo progetto, *Medieval Migrants of the North Sea World* (Migranti medievali nel mondo del Mare del Nord), ha inventariato la documentazione isotopica disponibile relativa ai resti umani di siti che erano empori in Inghilterra, nei Paesi Bassi e nella Scandinavia, insieme a informazioni archeologiche contestuali. Questo studio presenta entrambi i progetti, fornendo le informazioni particolareggiate su Domburg nel suo più ampio contesto internazionale e sottolineando la necessità di un progetto di ricerca esauriente per colmare le attuali lacune nella nostra comprensione delle popolazioni degli empori altomedievali.