Anglo-Saxon style pottery from the Northern Netherlands and North-western Germany: fabrics and finish, regional and chronological patterns, and their implications

Final author version

This paper presents the results of a study of Anglo-Saxon style pottery in the northern-Netherlands and north-western Germany, involving macroscopic and microscopic analysis of fabrics and finish. Both regions show similar developments in form and decoration in the pottery of the 4th and 5th century AD, the Late Roman and Migration Period, resulting in the typical decoration and shapes that are known as the Anglo-Saxon style. In the northern Netherlands, this style is traditionally associated with Anglo-Saxon immigrants. It has, however, been suggested that this style was rather part of an indigenous development in areas in the northern Netherlands where occupation was continuous, though influenced by stylistic developments in north-western Germany. That hypothesis is supported by the analysis of fabrics and finish presented here. The characteristic of fabrics and surface treatment indicate technological continuity. The use of local clay sources for Anglo-Saxon style pottery and for contemporary regional types indicates that most of the Anglo-Saxon style pottery in the northern Netherlands was not brought by Anglo-Saxon immigrants or as imports, but must have been made locally. That applies to settlements with continuous habitation, as well as settlements in the coastal area that were not inhabited during the 4th century AD.

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INTRODUCTION
Before medieval embankment, the coastal area of the northern Netherlands was a salt marsh region, where habitation was only possible on artificial dwelling mounds, the so-called terps. The terp region is believed to have been almost unoccupied during most of the 4th century AD and to be repopulated by immigrants from the German coastal area in the 5th century, bringing with them a new material culture. The pottery of the 5th century is markedly different from the period before the occupation hiatus. This often abundantly decorated pottery is very similar to pottery from north-western Germany and the coastal areas of Schleswig-Holstein and southern Denmark, which are usually considered to be the homelands of the Angles and Saxons. For this reason it has traditionally been termed ‘Anglo-Saxon pottery’. There is an ongoing debate about the way this hand-built pottery was introduced. Except for introduction by immigrants or through importation, these changes in material culture might alternatively be explained by stylistic influences within a socio-cultural network (Nieuwhof 2008, 2011, 2013, 2016; Nicolay 2014). To avoid confusion and ethnic connotations, the term ‘Anglo-Saxon style pottery’ is preferred here over ‘Anglo-Saxon pottery’.
Anglo-Saxon style pottery also occurs in the inland province of Drenthe, the Pleistocene hinterland of the Holocene coastal area, although the population there remained more or less stable during the 4th century (fig. 1). The development from the pottery of the previous period towards Anglo-Saxon style pottery seems to be continuous and local here, although influenced by the Anglo-Saxon style (Taayke 1996, V/195; Nieuwhof 2008). Household production is likely, as no two pots look the same.

In Drenthe and in continuously inhabited coastal settlements such as Ezinge, a continuous development is indicated by a gradual change in shapes and decoration. In 4th and 5th century contexts, Anglo-Saxon style pottery is found together with undecorated local types; decoration in Anglo-Saxon style is sometimes added to local shapes (Taayke 1996, II/52; Nieuwhof 2013, 2014b). For that reason, Lanting and Van der Plicht (2010, 130-131) have suggested that the new inhabitants of the coastal area might come from Drenthe rather than from north-western Germany.

The lack of consensus on the processes that took place during the Migration Period, roughly the 4th and 5th centuries, shows that much is still unknown about this period. The study of Anglo-Saxon style pottery can make an contribution to the discussion on the important themes of migration and cultural interaction during this period. Was this pottery imported or taken by immigrants or produced locally? In this paper we attempt to answer this question by focusing on the fabrics and finish of the pottery. Difference in fabrics and finish between Anglo-Saxon style pottery and the local pottery types of the 4th and 5th century from the same site may indicate that Anglo-Saxon style pottery was imported or introduced by immigrants.

The pottery of this period will be examined and compared on three levels. Firstly, the pottery of the 3rd century (so-called Driesum-style ware, following Taayke 1996, V/169-180), from before the occupation hiatus in the Dutch coastal area, is compared to the pottery of the 4th and 5th century in local and Anglo-Saxon style and to the pottery of the 6th century, Hessens-Schortens ware or weiche Grauware (see fig. 2). Secondly, Anglo-Saxon style pottery and local pottery types of the 4th and 5th century in the northern Netherlands are compared to contemporaneous pottery in north-western Germany. Thirdly, pottery from settlements in different areas within the terp area of the northern Netherlands, the Pleistocene hinterland of Drenthe and north-western Germany are compared.

First, an extensive macroscopic study was conducted (table 1). To test the results, a thin-section analysis was carried out as a small-scale pilot-study, for which a small number of sherds from each region and pottery type were selected (fig. 3 and table 2). Such an analysis can provide more detailed information about clay and tempering agents than macroscopic analysis can. The potential of such analysis has been shown by previous research (for example Nösler and Wolters 2009; Nösler and Stilborg 2010; Vince 2005).

### ARCHAEOLOGICAL CONTEXT

Several regions can be discerned within the northern Netherlands (fig. 1). In the mainland coastal area, inhabitable areas consist of the higher parts of the salt marsh landscape, where the terps (artificial dwelling mounds) are located. These areas are divided by sea arms, which form natural boundaries (Knol 1993; Vos and Knol 2015; Nicolay 2014). It was a dynamic landscape, influenced by regular flooding and an increasing sea level over time (Vos 2015). Sandy and less sandy clays with fine sands kept being deposited in this area until the first dikes were made during the later Middle Ages. Living on the terps was an adaptation to this natural environment. The inhabitable part of Drenthe consists of the higher Pleistocene areas; the surrounding peat areas were unoccupied (Spek 2004). The studied sites are located in the regions of Oostergo (Hallum: Tuinstra, Veldhuis and Nicolay 2011), Westergo (Wijnaldum: Besteman et al. 1999), Hunzegoe (Ezinge: Van Giffen 1936; Nieuwhof 2014a) and northern Drenthe (Midlaren: Nicolay 2008). Taayke (1996) has shown that during the Iron Age and the Roman Period, there were stylistic similarities but also differences between these regions. The pottery from the selected sites can be considered representative for their regions. Anglo-Saxon style pottery in the northern Netherlands comes from settlements as well as cemeteries (Knol 2009, 2011). In Germany, several well documented funeral sites are available, such as Westerwanna (Röhrer-Ertl 1971), but only a limited number of settlements.
Anglo-Saxon style pottery has a distinctive decoration and a diversity of forms. The German typology by Plettke (1921) is still widely used. The Dutch typology by Taayke (1996) for the regional pottery types of the pre-Roman and Roman Iron Age, and the typology of Wijster by Van Es (1967) for Roman Period and Anglo-Saxon style pottery are referred to in German literature as well (Schmid 2006). Nieuwhof (2013) provides an illustrated overview of the types of this period (see fig. 2). From the 3rd century AD onwards, the pottery from the entire coastal area of the northern Netherlands and north-western Germany is very similar. The large pots with long rims of the 3rd century Driesum-style occur in the coastal areas of both countries (Taayke 1996, V/179ff). In the coastal area of the Netherlands habitation largely comes to an end in the 4th century, but in inland Drenthe, where habitation is continuous, pottery shapes and decoration continue to change gradually. The local pottery types of the 4th century (G7 – large pots, K4 – beakers, S4 – dishes, and S5 – bowls in the typology of Taayke 1996) still occur in the 5th century, next to Anglo-Saxon style pottery (narrow-mouthed pots and wide carinated bowls: Schalenurnen), and are sometimes decorated in Anglo-Saxon style. These types are also found on those few sites in the terp area where occupation was continuous (Nieuwhof 2013, 2014). The earliest radiocarbon dates in the Netherlands of Anglo-Saxon style pottery are from northern Drenthe (Lanting and Van der Plicht 2010). Comparable pottery occurs in north-western Germany, for instance on the Feddersen Wierde (Schmid 2006). The Drenthe-types are used here to refer to the local types of the coastal area because a comparable typology for that area is lacking, due to the small number of terps where occupation is continuous. Anglo-Saxon style pottery was produced until the late 5th and early 6th century; later Anglo-Saxon style pottery is more uniform in decoration, with vertical Buckel and dents and a sandpaper-like surface (Knol 1993; Nieuwhof 2013, 61).

From the end of the 5th century, Anglo-Saxon style pottery is gradually replaced by a coarser, rather clumsily shaped and mostly undecorated type of pottery, the weiche Grauware or Hessens-Schortens ware, named after the German sites of Hessens and Schortens (Tischler 1956), both in Germany and the Netherlands (Nieuwhof 2008, 2013; De Clercq and Taayke 2004). Radiocarbon dates from the Netherlands indicate that the early Hessens-Schortens ware can be dated to the end of the 5th century (Lanting and Van der Plicht 2010, 151).

**METHODOLOGY**

Settlement sites were selected in order to compare the Anglo-Saxon style pottery to the local pottery types of the 4th and 5th century. The choice of material for each was determined by the available material. From Wijnalduim, local types of the 4th and 5th century and Anglo-Saxon style pottery were examined. This pottery has not yet been published. The material from Hallum (Beckerman 2011) contains mostly Hessens-Schortens ware and intermediate types between Anglo-Saxon style pottery and Hessens-Schortens ware. The hand-built pottery from Ezinge was published by Nieuwhof (2014b). A small sample of the local 4th and 5th century types and Anglo-Saxon style pottery from these sites was examined anew for the purpose of this study. The material from Midlaren (Nieuwhof 2008) is the largest sample of this study. It contains all of the studied pottery types. The terp of Feddersen Wierde (Schmid 2006) served as a comparison site for north-western Germany. Table 1 shows the number of pottery individuals that were studied for each site, and the types of pottery.

In view of macroscopic analysis, surface treatment, level of evenness, temper, visibility of temper, colour, hardness and thickness of the sherd were recorded. Dominant grain sizes were measured per sherd in categories of 1 mm. Microscopic analysis is more suitable for distinguishing temper, such as stone particles, sand, shell and organic material, from naturally occurring inclusions in the clay, because more details can be recorded. Tempering agents can also be determined when these have different characteristics than the inclusions that can be expected to occur naturally in the clays of the region (Quinn 2013, 156-171).

Stone particles and coarse sand do not occur naturally in the marine clays of the coastal region (personal communication P.C. Vos, Deltares). When these occur, they can be considered as temper. Large amounts of shell fragments with evenly distributed particle sizes are also undoubtedly temper, rather than natural inclusions. Organic (vegetal) temper is usually destroyed by fire, so that only cavities in the clay indicate its presence. Small, charred residues of plant material may remain in the cavities.
When plant material is used as temper, it usually consists of chopped stem fragments from grass or straw, which leave elongated cavities. The fragments will be comparable in size and evenly distributed in the sherd (Quinn 2013, 161). Sometimes grog (pottery grit) was used as temper. Grog can be distinguished from naturally occurring argillaceous particles because it is mostly angular and hard; sometimes cracks can be seen at their edges, as well as its original temper, especially microscopically (Stilborg 1997, 106; Cuomo di Caprio and Vaughan 1993; Whitbread 1986, 1989; Quinn 2013).

To obtain detailed data about the used base clays and about tempering materials, 24 sherds, representing each region and type of pottery, were analysed microscopically (table 2). A vertical edge on each sherd was flattened and polished to make the texture and the temper more visible. Using a reflected-light microscope, components of the temper, grain size and the amount of temper were examined. Thin-sections were prepared to determine the mineralogical composition of the clay, using a polarizing microscope. The results of the thin-section analysis are shown in table 2. Fig. 4 shows twelve of the thin-sections. [A colour version can be viewed at wileyonlinelibrary.com] Classification of the base clays in fine, medium and coarse is based on the proportions of the natural fractions of silt and sand in the clay. Accessory minerals, the natural content of mica, plant material and diatom were recorded, as well as calcareous and ferruginous minerals (Quinn 2013, 79-97). Because diatom species were not determined, it is not possible to distinguish clays from marine or fluvial deposits. Identification of diatom species would not be conclusive, as pointed out by Quinn (2008, 282), because in this part of north-western Europe freshwater diatoms can be found in clay deposits close to the coast, where rivers discharge into the sea, and marine and brackish diatoms can be found some distance inland due to periodic flooding. The petrographic compositions, such as the occurrence of minerals, the grain sizes and the amount of inclusions, of different coastal clay deposits are variable. Therefore sherds of which thin-sections show strong similarities in significant petrographic features, indicate the use of the same clay deposit and the same technological practices (Quinn 2013, 77, 137).

**FABRIC GROUPS**

To classify the material into fabric-groups manually, both the fabric and the finish of sherds were taken into account, since these characteristics are clearly related. Based on the most distinctive variables, i.e.: inside surface treatment, the evenness of the inside of the sherd and the tempering material, four fabric groups were discerned macroscopically. Bar charts show, that the distinctive variables mentioned above have a logical distribution from fabric group to fabric group, from finer fabrics to rougher fabrics. [These bar charts can be viewed at wileyonlinelibrary.com]. Several Two-Step and K-mean cluster analyses were run in SPSS, testing combinations of the described variables, entered as ordinal variables. Surface treatment and evenness of the sherds (inside and outside), as well as the tempering material were suitable for clustering the data. The K-means cluster method showed that the F-value in the ANOVA-table was by far the highest for inside surface treatment and inside evenness, confirming that these are distinctive variables. Using the Two-step method, the rapidity of the decline of the Akaike’s Information Criterion confirmed that distinguishing four groups is the most suitable for this dataset (distance measure: Log-likelihood). The scores for the centroids for the Two-step method (using four clusters and Euclidian distance measure) and the final cluster centres of the K-means clusters, show the cluster profiles match the description of the fabrics groups as described below.

**B1 fabrics (fine fabrics)** are mostly associated with 4th and 5th century pottery. The inside surface is smooth and well evened out, the outside is smooth, often polished and well evened out. B1 is tempered with fine stone grit (crushed stone; <1 mm), stone grit (1-2 mm) or sand (quartz sand). The sherds are relatively thin. Only on very rare occasions, organic, shell or grog temper is used, mostly in combination with fine stone grit or sand. The temper does not show on the outside and only rarely on the inside.

**B2A fabrics (finer intermediate fabrics)** are associated with 4th and 5th century wares and intermediate types between these and Hessens-Schortens ware. These are still fine fabrics, though less so than B1. The inside surface is less well finished, less evened out. The same types of temper are used, although the average grain size is slightly larger. The temper is sometimes visible on the inside of the sherd.
B2B fabrics (coarser intermediate fabrics) are mostly used on intermediate types between 4th / 5th century pottery and Hessens-SHORTENS ware and some of the rougher Driesum-style ware. The inside surface is mat or rough, the outside smooth or mat. The inside is somewhat uneven or very uneven. Fine stone temper occurs next to moderately coarse temper (2-3 mm) and sometimes organic temper, shell or grog temper. B3 fabrics (coarse fabrics) are mostly associated with Hessens-SHORTENS ware. Sherds are relatively thick and have an uneven surface, often on both sides. The temper is mostly moderately coarse or coarse stone grit (>3 mm); sometimes organic temper, shell or grog is used, separately or in combination with stone grit. The inside surface is rough, the outside often as well. On the inside the temper bulges the surface or protrudes through it and it is often visible on the outside.

RESULTS
Comparing the pottery of the 3rd century with that of the 4th/5th centuries, some differences appear between Dutch inland and coastal sites. The macroscopic study shows that in the Drenthe Pleistocene area the fabrics of the Driesum-style pottery of the 3rd century are not distinguishable macroscopically from the fabrics of the 4th and 5th centuries (see also Taayke 1996, Nieuwhof 2008). This is confirmed by the microscopic study. In the coastal areas of Oostergo and Groningen, the Driesum-style pottery of the 3rd century is often tempered with other materials, as it was in earlier periods (organic, grog or shell), but stone temper is more often used than in the previous period. The material is coarser than in Drenthe (Taayke 1996). The macroscopic study shows that during the 4th and 5th centuries there are no such differences between the Dutch coastal area and the Drenthe Pleistocene area. The fabrics and finish of 4th/5th century pottery of all the studied sites are highly similar. Both the local types and Anglo-Saxon style pottery mostly have a B1 fabric and a fine stone grit, stone grit or sand temper and a well finished, smooth surface. The pottery is well fired and usually very dark in colour. In the coastal region very rarely grog, shell or organic temper is used, but that is an exception. Of the local types, the large pots and beakers (Drenthe G7 and K4) have the same type of fabric and finish as the Anglo-Saxon style pots. The dishes and bowls (Drenthe S4 and S5) are the only exception, with similar percentages of B1 and B2A-fabrics and some B2B or B3 fabrics. These types were used over a much longer period, well into the early Middle Ages when coarser fabrics were common (Taayke 1996, II/62-63). During the transition from Anglo-Saxon style pottery towards the Hessens-SHORTENS ware of the Merovingian Period, fabrics gradually become coarser and less attention seems to have been paid to the shapes of pots; most pots are undecorated. Stone temper is common, but it is coarser than in the previous period, although, as Van Es already noted, finer fabrics occur beside coarser fabrics (Van Es 1979, 207-225). In Hallum most of the Hessens-SHORTENS pottery is relatively late (7th or even 8th century) and the emphasis is on B2B and B3-fabrics. In Midlaren more intermediate types between the 4th and 5th century pottery and Hessens-SHORTENS ware is included and a bigger portion of the material has a B2A-fabric.

In Feddersen Wierde the fabrics and finish of the pottery of the 4th and 5th centuries are the same as in Drenthe: fine B1 fabrics with mostly fine stone grit and sand temper, both for the Anglo-Saxon style pots and undecorated pottery. The transition towards Hessens-SHORTENS ware is also the same as in Drenthe. [Bar charts of fabrics and temper per site and pottery type can be viewed on wileyonlinelibrary.com]

The results of the macroscopic and microscopic analyses are largely in agreement concerning the use of tempering agents. However, the microscopic analysis shows that in some cases in the sherds from Feddersen Wierde a very fine organic temper was used in addition to stone temper, where this could not be detected macroscopically.

The base clay used for the sherds from Midlaren is heterogenic. The clay that was used for four of the pots is similar, but probably not from the same clay source. Base clays of four sherds from Ezinge agree in their main petrographic features, to such an extent that it is likely that the same clay source (deposit) was used for this pottery (fig. 4a-b; 214: later Anglo-Saxon; 241A: Anglo-Saxon; 241B: Schalenurne; 805: beaker). The same is true for two sherds from Hallum. One of these is of a local type (363: G7), one is in Anglo-Saxon style (410).
DISCUSSION
The macroscopical study suggests that in the sand area of Drenthe and north-western Germany, only fine stone temper and sand is used during the Migration Period. In the coastal area of the northern Netherlands other tempering agents, such as organic material, shell and grog, were occasionally used, usually in addition to stone grit. The 3rd century pottery from Germany is stone tempered and has a fine fabric, both in the coastal area and in the Pleistocene hinterland (De Paepe and Van Impe 1991; Nösler and Wolters 2009, 380-387; Nösler and Stilborg 2010, 109; personal communication D. Nösler). In the German coastal area, stone temper was used during all periods, probably because the Pleistocene hinterland (Geest) is closer to the coast and stone was more readily available. The microscopical analysis showed, however, that occasionally small amounts of fine plant material were used in addition to stone fragments, in the coastal area of Germany as well, and in one sherd from the sand area of Drenthe. Because of the high amount of stem fragments it can be excluded that this organic material was a natural component of the clay. Also grog was sometimes detected. In fabrics from the coastal area of the northern Netherlands, the occasional use of plant material could be detected macroscopically, which indicates the size of the fragments of plant material tends to be larger here.

The occasional use of these tempering agents in the coastal area seems to be related to the geographical location of the sites, and therefore the availability of stone and sand temper, which was more easily available near or in the Pleistocene sand area. This is probably not the only reason, as the use of temper varied over a greater period of time in the coastal region, from mainly grog and stone grit in the middle pre-Roman Iron Age, to mainly grog and organic material between around 200 BC and AD 250, to mainly stone grit in the period that is discussed here (Nieuwhof 2014b). Cultural preferences might be behind this variation.

The clay that was used for the sherds from Midlaren is heterogenic. This is in line with the variety of locally available clay sources. Midlaren is situated on the western slope of a Pleistocene valley system, the Hunze valley, which was a tidal wetland with occasional marine inundations. Periglacial fluvial sediments as well as marine clays, with freshwater, brackish and marine diatom species, are found in this valley (Vos 2008).

In the coastal area, all clay has been deposited in a marine environment. That does not imply that clay deposits are homogeneous. The composition of the clay, which usually includes some degree of fine sand and silt, is determined by factors such as the distance to the shore at the time of deposition, energy in the local tidal system, the prevailing wind, the availability of sediment, and the presence of river mouths. Sediment comes from the shallow seabed, eroded parts of the coast, and rivers. The contribution of the latter, however, is low (Vos 2015, 38).

The heterogeneity of the locally available clay deposits means that potters had a choice. They could exploit specific sources to collect clay that was easy to work with and that resulted in the fabrics they desired.

There are indications from the microscopic analysis that the same clay deposits were used for pottery from different periods and styles. That is the case for four sherds from Ezinge: one sherd from a 4th/5th century local beaker-type and three sherds from Anglo-Saxon style pottery. This supports the continuity in the pottery tradition that has been argued for this site (Nieuwhof 2013, 2014b). In Hallum, which was not inhabited during the 4th century, a sherd from a local G7 pot and a sherd in Anglo-Saxon style, both from the 5th century, were made of clay from the same deposit. This indicates local production of the Anglo-Saxon style pot.

Most clays in the microscopic analysis did not show the characteristics needed to determine the use of specific clay deposits. In general, fine clays are the main component of all the sherds that were selected for the microscopic analysis. It should be noted that especially fine clays contain little petrographic information so that conclusive evidence about the use of specific clay deposits is not possible with this type of analysis.

Since this was a pilot study, the microscopic analysis was conducted on only a small number of sherds (n=24), but that does not make it insignificant. This small sample confirms the results of the macroscopic analysis. Since macroscopic analysis appears to be as reliable as microscopic analysis, and the macroscopic
analysis can be performed on a much larger number of sherds, macroscopic analysis is suitable for a study on a larger scale, while keeping in mind that macroscopic analysis does not show every detail. Such a study could establish whether the outcomes of the current study apply to other sites within the same regions as well.

The high level of similarity between the fabrics in all studied regions during the 4th and 5th century does not prove or disprove migration. The argument that the coastal area of the northern Netherlands was repopulated after the 4th century still stands. Based on the fabrics of the pottery, immigrants may have come from areas in the Netherlands that were not abandoned, notably northern Drenthe, as well as from areas in north-western Germany. In any case, new inhabitants started making their own pottery in local materials, soon after they arrived, using the same techniques and very similar clays.

Despite the high level of similarity in fabrics, regional stylistic differences do exist. There are also differences in the composition of pottery assemblages, even between sites in the northern Netherlands (Nieuwhof 2013, 2014b). To learn more about these differences and about the origin of stylistic elements, further research into stylistic differences between regions along the entire coast of the northern Netherlands, north-western Germany and southern Denmark, ideally resulting in a typochronological overview, is required. That is the aim of the PhD-research project of the first author.

CONCLUSIONS
There is an ongoing debate about the way Anglo-Saxon style pottery was introduced into the northern Netherlands around AD 400. The new pottery may have been taken to the area by immigrants from the homelands of the Angles and Saxons or have been imported. Alternatively, the changes in pottery style may be explained as an adoption of pottery styles from other regions, through cultural interaction. The subject is complicated by the fact that the hiatus in occupation occurred in many, but not all, settlement in the terp region of the northern Netherlands in the 4th century, directly before the introduction of Anglo-Saxon style pottery; also, in the Pleistocene sand area of inland Drenthe, occupation was uninterrupted. The introduction of a new pottery style and the evidence for immigration are important themes in the discussion about the events that took place here during the 4th and 5th century, the Migration Period.

The present study shows that fabrics of the pottery of the 4th and 5th centuries are the same in Drenthe, the coastal area of the northern Netherlands and Feddersen Wierde. The technical aspects of the pottery and the clays that were used were very similar. There are no patterns that indicate migration or importation. At the same time, immigration cannot be excluded on the basis of this research.

The results support the idea that, where occupation was continuous, the Anglo-Saxon style was adopted by local potters, as was already suggested on the basis of the earlier stylistic analysis of the pottery from Midlaren (in Drenthe) and Ezinge, one of the few sites in the coastal area of the northern Netherlands where habitation was continuous. This is confirmed by the similarity in fabrics and finish between local pottery types and Anglo-Saxon style pots. Moreover, the microscopic analysis indicates that sometimes the same clay source was used for local pottery types and Anglo-Saxon style pots.

The study shows that macroscopic and microscopic analyses are almost equally suitable for the study of the fabrics of this kind of pottery. The macroscopic study has the advantages that information about the finish of the pottery can be included, and it can be carried out on a large scale, while the microscopic analysis shows some more detail and enables the recognition of the use of the same clay deposits.

The pots of this period have a fine fabric and mostly a fine stone grit or sand temper. However, in the coastal area occasionally other tempering agents, such as organic material, shell and grog were used, in addition to stone grit. The microscopic study shows for the first time that organic temper was sometimes used in the German coastal area as well. In the German coastal area, however, the organic temper was finer than in the Dutch coastal area, and could not be detected macroscopically.

The close cultural connections between North Sea coastal regions during this period are already well known. The high level of similarity in pottery fabrics and finish that was found in the present study, confirm these
close connections. The terp region of the northern Netherlands was repopulated in the 5th century after the occupation hiatus of the 4th century. It is still likely that a major part of the new population consisted of immigrants from the north-western German coastal area, since the population of the inhabited areas of the northern Netherlands was too small to account for the repopulation of the entire area. However, the people from these areas probably mixed with the immigrants. Their similar material cultures make it difficult to tell them apart. To what extent immigrants contributed to the introduction of Anglo-Saxon style pottery in the northern Netherlands, is subject of further stylistic research. Stylistic research may also reveal the regions of origin of the new inhabitants of the terp region.

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Fig. 1. The studied sites shown on a Palaeogeographical map of the northern Netherlands and part of northwestern Germany around 800 AD, the map that is closest in time to the studied period (after Vos & Knol 2015). The peat areas in Drenthe were uninhabitable; Midlaren is situated on the edge of a Pleistocene sand ridge. The smaller map on the lower right shows the present provinces of the northern Netherlands.
Fig. 2. Pottery types, as mentioned in the text. (Drawings of the Driesum-style pottery, Late Roman/Migration period local ware and pottery in Anglo-Saxon style from Nieuwhof 2013; drawings of the Hessens-Schortens ware from Lanting and Van der Plicht 2012).
Fig. 3. Sherds/pots that were selected for thin-section analysis.
Fig. 4. Thin-sections of pottery from: a: Ezinge 241B (Anglo-Saxon Schalenurne), b: Ezinge 805 (beaker), c: Hallum 254A (large pot), d: Hallum 254B (Anglo-Saxon Schalenurne), e: Middenden 1814A (large pot), f: Middenden 1814D (Hessens-Schortens), g: Wijnaldum 2946 (Anglo-Saxon), h: Wijnaldum 7750 (beaker), i: Feddersen Wierde 901C (early Hessens-Schortens), j: Feddersen Wierde 951F (undecorated, narrow mouthed vessel), k-l: Feddersen Wierde 788B (Drenthe G7). PPL. Width of individual images = 3.0 mm (a-k), 0.6 mm (l).
TABLE 1 The number of pots per category and fabric groups per site and region in the macroscopical study. WIJ = Wijndalum, HAL = Hallum, EZ = Ezinge, MID = Midlaren, FW = Feddersen Wierde; DRIES = Driesum-style pottery, AS = Anglo-Saxon style pottery, LROM/MP = sum of the pottery from the Late Roman/Migration period (Drenthe G7, K4, S4 and S5); HS = Hessens-Schortens pottery; B1, B2A, B2B, B3 are fabric groups (see text).

<table>
<thead>
<tr>
<th>Site</th>
<th>Region</th>
<th>DRIES</th>
<th>AS</th>
<th>G7</th>
<th>KA</th>
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Table 2: Microscopy results of the thin-section analyses. Abbreviations: WJ = Wijnaldum, HAL = Hallum, EZ = Ezinge, MID = Midlaren, FW = Feddersen Wierde; DRIES = Driesum-style pottery, K4 = Drenthe K4, G7 = Drenthe G7, AS = Anglo-Saxon style pottery, HS = Hessens Schortens; s = sorted, f = fine, m = medium-coarse, c = coarse; ++ = very large amount, + = large amount, - = small amount, " = not present; g = granite, s = sand, o = organic, ch = chamotte; FS = fine stone, S = stone, MCS = moderately coarse stone; CS = coarse stone.

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SUPPORTING INFORMATION
Additional Supporting Information may be found online in the supporting information tab for this article.

Figure S1. Percentages of types of temper, inside surface treatment and inside evenness for the fabric groups.
Figure S2. Percentages of fabric groups and types of temper for the 4th and 5th century pottery from the studied sites. AS= Anglo-Saxon style pottery; G7, K4, S4 and S5 are types in the pottery typology for Drenthe from Taayke (1996).