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TESSA N. KROL, MICHAEL DEE AND ANNET NIEUWHOF

THE CHRONOLOGY OF ANGLO-SAXON STYLE POTTERY IN RADIOCARBON DATES: IMPROVING THE TYPO-CHRONOLOGY

Summary. *In the fourth and fifth centuries AD, the Anglo-Saxon style was introduced in north-western Europe. To what extent immigrants contributed to this process for each region is still debated. How and when the Anglo-Saxon style spread is essential in this debate. Handmade pottery is the most common find category, but so far it can only be dated globally. An earlier and a later style have been postulated and the introduction of this pottery is seemingly not simultaneous in every region. Hitherto this could not be supported by the radiocarbon dates. The present study shows that, with the help of Bayesian modelling, it is possible to substantiate these patterns, which is of utmost importance for understanding migration patterns, contacts and exchange along the southern North Sea coastal regions during this period.*

1. INTRODUCTION

During the Migration Period, approximately the fourth and fifth centuries AD, changes in material culture occurred and an expressively decorated pottery style arose in north-western Europe (see Fig. 1, for the regions mentioned in the text). This style is known by the names Anglian, Saxon or Anglo-Saxon in different parts of the southern North Sea coastal area, due to its association with the eponymous population groups. How these changes in material culture took place varied from region to region. An ongoing debate exists about the way the new material culture was introduced, in England, as well as in the Netherlands. Instead of, or in addition to, introduction by immigrants or through importation, the distinct changes in material culture might be explained as stylistic influences within a socio-cultural network (Brugmann 2011; Nieuwhof 2011; 2013; Hills and Lucy 2013; Nicolay 2014). Therefore, the term 'Anglo-Saxon style pottery' (ASSP) is preferred here over 'Anglo-Saxon pottery'.

For England, there are accounts of immigration, and also of co-existence of indigenous populations and newcomers (for instance Härke 2011). In the northern Netherlands, the Holocene coastal area (or terp region – after the artificial dwelling mounds on which people lived) was virtually unoccupied during the fourth century AD, and repopulated by immigrants from the German coastal area in the fifth century; in this same period there was continuous occupation in the adjacent Pleistocene area of Drenthe (Taayke 1996; 2000; Gerrets and Koning 1999;

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FIGURE 1
Map of the regions within the Netherlands and Belgium, mentioned in the text. The terp region of the northern Netherlands is indicated in grey (topographic map: Esri Nederland and community maps contributors).

Bazelmans 2002; Nieuwhof 2008; 2011; 2013). This suggests that immigrants may not be (solely) responsible for the introduction of the new material culture in this region. A regional stylistic development that resulted in pottery of the Anglo-Saxon style can be demonstrated in Drenthe, but also in the northern Netherlands terp region at the few settlements that remained inhabited (Nieuwhof 2008; 2013).

The pottery of the fourth and fifth centuries in the northern Netherlands and north-western Germany is not only very alike on a stylistic level, but also technologically, with high-quality fabrics and finish (Krol *et al*. 2018). Nevertheless, there are regional stylistic differences (for instance: Genrich 1954; Myres 1969; Schmid 1981). Further study of this variation might provide new information on the possible origin of migrants and on cultural interactions. Earlier stylistic elements represent the emergence of ASSP, either introduced by migrants or adopted by local potters. Later elements represent local or regional developments after the introduction, and interactions during that period. Such temporal considerations are important for further stylistic study. However, so far ASSP can only be imprecisely dated. This is due to, amongst other things, a great variety of stylistic elements without clear typological development and with often long periods of use.

So far, it has not been possible to distinguish phases in the development of ASSP using radiocarbon dates, due to a plateau in the calibration curve for this period (Lanting and van der Plicht 2006, 243–4; 2010, 31; McCormac *et al*. 2008). In this paper, Bayesian modelling of a corpus of inventoried radiocarbon dates in OxCal (Bronk Ramsey 1995) is used in an attempt to distinguish such phases. The analysis is aimed at answering various research questions. Can a chronological order be shown for the various types of ASSP-forms and decorations? Can the existence of an earlier and a later Anglo-Saxon style be confirmed by radiocarbon dates? When did ASSP go out of use? In order to answer this last question, available dates for the subsequent early-medieval pottery are included in this study.

2. TYPOLOGY AND TRADITIONAL RELATIVE DATES

ASSP is traditionally dated to the period between AD 350 and 550. Undecorated pottery occurs in this same period, but ASSP here refers to well-finished pottery with a distinctive decoration and specific forms. The German typology by Plettke (1921) is still often used for this type of pottery. The basic types are Plettke A2: beakers (*Trichterpokale*); A4, A5 and A8: wide-mouthed pots; A6 and B2: large narrow-mouthed pots, with simpler decoration and a rounded profile; A7: like A6 but with a biconical profile and often decorated with bosses (*Buckel*) or stamps; C: carinated bowls (*Schalenurnen*). Plettke's chronology has been somewhat improved, by Schmid (2006) amongst others, based on newer dates of metal finds (Böhme 1974; 1987). These dates are still very broad.

The Plettke-typology can be applied to most of the ASSP from other regions; other typologies have been used as well, such as the ones by Myres (1969) for England and by Van Es (1967) for the Netherlands. Some types of decoration are sometimes also thought to have chronological meaning. For example, rosettes and bosses may have come into use in the fifth century (as postulated by Plettke 1921; Krol 2006).

Earlier ASSP, which occurs in the coastal areas of the northern Netherlands, north-western and northern Germany, Jutland and England, is thought to have been produced until the end of the fifth or the early sixth centuries.

Later ASSP is dated to the late fifth and early sixth centuries; it is not included in the Plettke-typology as these later shapes do not (frequently) occur in north-western Germany. Although the existence of a later style is denied by Lanting and Van der Plicht (2010), such a style has been distinguished by several authors (Knol 1993, 54–5; Nieuwhof 2008, 285; 2013, 61). Later ASSP is more uniform in decoration, with rows of stamps or long, vertical bosses and indentations, and groups of vertical lines. It is comparable to the long-boss style, as defined by Myres (1969, figs. 37 and 38) and has a high neck, a rounded or somewhat biconical body and a protruding foot.

In the northern Netherlands, the undecorated ware from the same period is classified in the typology of Taayke (1996) for northern Drenthe, as G7 (large pots), K4 (beakers), S4 (dishes) and S5 (bowls). In Drenthe, these shapes developed from older, Roman Period shapes around AD 300. In the coastal area, they were introduced after the hiatus in occupation, alongside ASSP. The large pots and beakers are occasionally decorated in Anglo-Saxon style. Comparable undecorated ware can be found in other regions as well.

Probably from around the end of the fifth century, ASSP was gradually replaced by a coarser, mostly undecorated type of pottery in a large part of north-western Europe. It is called *Weiche Grauware* (German) or Hessens-Schortens ware (HS; Tischler 1956, 79–87; Bärenfänger 2001). In England, such pots are classified as ASSP. Here, the term ASSP only applies to the earlier, well-finished and decorated ware. HS developed from the fine fabrics of ASSP and type G7. A minority of HS still has fine fabrics (Van Es 1979; Nieuwhof 2013, 61; Krol *et al*. 2018), and ASSP-decoration is occasionally still found on HS pots. In Germany, HS is usually dated to the seventh or eighth centuries (Stilke 2001). However, it may at least partly also date to the sixth century (Nösler 2017). Attempts to distinguish different subtypes of HS have as yet not been successful (Kuiper 2018).

From *c*.AD 700, HS is replaced by globular pots, which occur primarily in the northern Netherlands and north-western Germany, but also in Zuid-Holland and parts of Denmark and Belgium (Verhoeven 1998, 4; Dijkstra 2011, 312).

Although ASSP was not introduced simultaneously in all regions, it can be assumed, on account of the intensive contacts that were maintained (Nicolay 2014), that specific pottery types and stylistic elements in different regions are contemporaneous. This makes it possible to use the spread of these stylistic elements to date the migrations and cultural interactions, which they reflect.

ASSP seems to originate in Denmark and northern Germany, then spreads to the northern Netherlands and England (Kennett 1978, 11; Knol 1993, 196–8; Hills and Lucy 2013, 301–20). In the northern Netherlands, it was introduced in the fourth century, wherever habitation was continuous in this period (Nieuwhof 2013). Abandoned areas here were repopulated in the course of the fifth century. Lanting and Van der Plicht (2010, 129–34) date the beginning of repopulation *c*.AD 440 in Friesland, possibly somewhat earlier in Groningen, with reference to the supposed Anglo-Saxon invasion of England as related in historical sources. However, recent research indicates that at least some of the ASSP in England probably dates earlier, *c*.AD 400/420 (for instance Hills and Lucy 2013). The introduction of ASSP in the terp area of the northern Netherlands, and therefore its repopulation, may even be earlier.

ASSP supposedly went out of use in Germany and Denmark before the end of the fifth century, while it continued in the Netherlands and England. Outside the northern Netherlands, ASSP is sometimes found in the Dutch provinces of Gelderland and Zuid-Holland, and further to the south in Flanders and the north of France, probably no earlier than the late fifth century (Hamerow *et al*. 1994; Soulat *et al*. 2012). Here it may have been introduced via England or the northern Netherlands (Dijkstra and De Koning 2017, 62–4). In the (northern) Netherlands, ASSP probably disappeared *c*.AD 525/550; in England, it remained in use into the seventh century (Myres 1969; Hills and Lucy 2013, 301–20).

3. RADIOCARBON DATING

The calibration curve of radiocarbon dates from this research period shows a plateau between *c*.1625 and 1525 BP, which corresponds to the calendar years between AD 420 and 530. That means that results from this period cannot be as precise as we would like them to be (Lanting and van der Plicht 2006, 243–4; 2010, 31; McCormac *et al*. 2008).

The sample type that is dated is an important factor in the reliability of radiocarbon dates. The natural or inbuilt age of the dated material may result in a date that is older than its context, especially for long-lived wood species such as oak. Oak was often used as construction timber or ship wood prior to being burnt. This additional age results in the complication known as the 'old wood effect' (Lanting and van der Plicht 2006, 243–4; 2012, 290–2).

The 'old wood effect' plays an important role when dating cremations, since oak, together with alder, was commonly used as fuel (Van Strydonck *et al*. 2010; Deforce and Haneca 2011). The results for charcoal and cremated bone from the same cremation can thus be contradictory, and both may be too old (Lanting *et al*. 2001; Lanting and Van der Plicht 2012, 290–1; Nieuwhof 2015, 237–40): oak charcoal because of its inbuilt age, and cremated bone because during cremation gases are exchanged between the fuel and the carbonate in the bone apatite. The amount of exchange varies (Cherkinsky 2009; Van Strydonck *et al*. 2010; Olsen *et al*. 2013; Snoeck *et al*. 2014). Charcoal from twigs gives the most reliable result, since the 'old wood effect' does not apply then (Nieuwhof 2015, 240). If cremated bone is dated, then fully cremated bone with completely recrystallized apatite is the most reliable (Lanting and Van der Plicht 2010). Research also showed the importance of a thorough pretreatment for these samples (Van Strydonck *et al*. 2010). For all these reasons, dates from cremations must be used with caution.

When the ranges of individual radiocarbon dates are broad, as is the case in this study, Bayesian modelling can be used to estimate the chronological order of previously defined groups of dates, and their collective lifespan. Such modelling can also compensate for inbuilt age (Dee and Bronk Ramsey 2014), but not for the effect of unreliable archaeological contexts. In order to apply this method, it is necessary both to define sound and reliable categories, in this case pottery types, and to have a sufficient number of dates to examine. If only a small sample would be used, earlier or later examples of the pottery types might not be represented, which can influence the results.

4. METHOD

Radiocarbon dates on ASSP and HS-pottery were collected from publications and by contacting researchers and institutions directly. Many of the dates collected have not been previously published, or were published only in 'grey' literature. For the Netherlands, an overview of radiocarbon dates of ASSP was published by Lanting and van der Plicht (2010; 2012). For England, lists of dates funded by English Heritage have been published, but there is no overview of other dates (Jordan *et al*. 1994; Bayliss *et al*. 2007; 2008; 2012; 2013; 2015; 2017). For other countries there is no such overview, which makes the data less accessible. This leads to an emphasis on the Dutch dates, although a substantial number of dates from England and Germany were obtained (see Table 1). No dates are available for Denmark or northern France and there is only one date available for Belgium.

Most of the dated contexts are cremations (charcoal or bone) (n=103); four are inhumation graves; and the remaining dates are from settlement contexts (n=55; e.g. pottery crust/residue, charcoal from a pit or construction wood). In total 175 dates from 162 contexts were collected.

Table 1 shows the number of dates selected per region and per category. Table 2 shows the information for each date, including typological information. Supplemental Table 3 shows deselected dates, and the reason why they were excluded. Samples may be excluded for the following reasons:

- Dates for contexts that were used for a prolonged period of time (wells, ditches).
- No direct relationship between the context and pottery.

TABLE 1
Number of available dates per category. More than one date can apply to one pot, some dates concern pots in multiple categories. AS = ASSP; HS = Hessens-Schortens ware; HS/EG = intermediate type between Hessens-Schortens ware and early globular pot; IN = contemporary pot, indeterminable; UD = undecorated ware, contemporary with ASSP.

Dates:	**Available**						**Selected**				
Region	UD	AS	HS	HS/EG	IN	**Total**	UD	AS	HS	HS/EG	**Total**
Friesland	5	22	29	2	3	61	3	19	26	2	50
Groningen		4	5	3		12		1	3	3	7
Drenthe	3	24	5		4	36	3	21	5		29
Gelderland		1			1	2		1			1
Zuid-Holland		5	3			8		5	3		8
Total Netherlands:	8	56	42	5	8	119	6	47	37	5	95
Germany	1	10	5	1	5	22	1	4	2	1	8
British Isles	2	8	9		14	33	2	8	9		19
Belgium	1					1	1				1
Total:	12	74	56	6	27	175	10	59	48	6	123

TABLE 2
The dates, in alphabetical order. Region: BE = Belgium; DR = Drenthe; FR = Friesland; GE = Germany; GL = Gelderland; GR = Groningen; BI = British Isles; ZH = Zuid-Holland. Category: see table 1. General type: ASSP1, ASSP2, ASSP3, ASSP4 = types of ASSP; G7 = type in the typology of Taayke (1996) for Northern Drenthe; HSd = decorated HS; HS/ES = intermediate type between HS and Early Globular ware. * = not modelled in this typology. Sample type: CC = charcoal from cremation; CP = charcoal from pit; CR = cremation remains; CS = charcoal from same structure; CW = construction wood well; TW = twig well; HU = bone from inhumation; OP = charcoal from oven pit; PC = pottery crust; WO = wood/wooden object. Calibrated dates: OxCal v4.3.2 Bronk Ramsey (2017); r.5 IntCal13 atmospheric curve (Reimer *et al.* 2013)

Site and no.	Region	Lab No.	Sample Type	Age (yr BP)	Uncertainty	Calibrated date AD (95.4% confidence)	Category	Type	ASSP decorations	HS Form Type	Reference
1. Aalsum 1920/II.2	GR	GrA-44824	CR	1380	35	596–760	HS	HS		B	Lanting and van der Plicht 2010, 147 and fig. 17.21 (after drawing E. Knol)

- Pots that were not depicted in the publication.
- Pots that could not be classified because lack of classifiable characteristics.
- Pots of types for which an insufficient number of dates is available. A minimum of three pots, or four dates on two pots, were used as cut-off points.

Three different typologies were created (see Figs. 2 and 6). In the first, pots were categorized by general type.

1. Undecorated large pots (G7).
2. ASSP1: Narrow-mouthed pots, with sharp or rounded carination halfway up the body. Long neck, somewhat flaring rim. Width and height comparable. This type represents what is thought to be early ASSP.

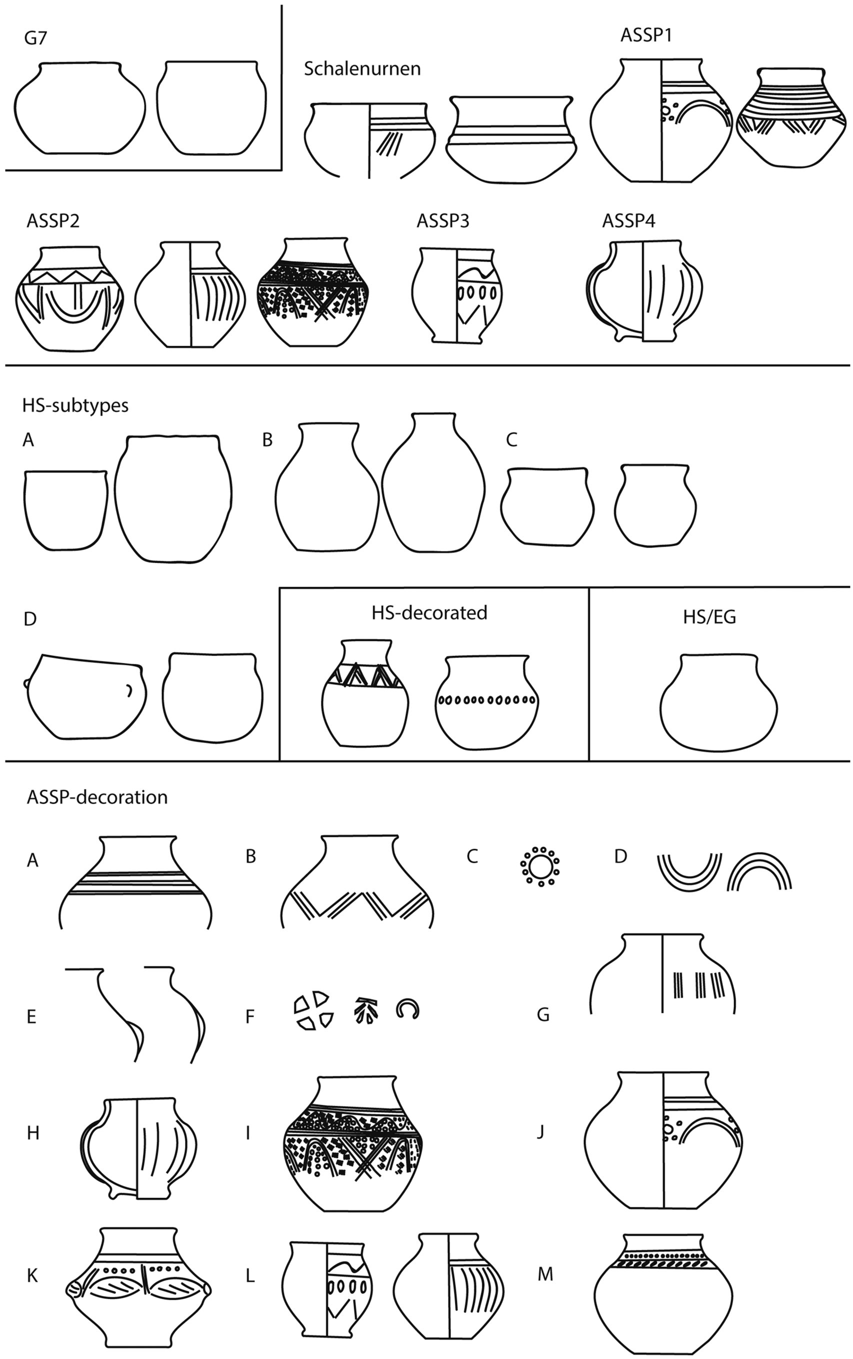

FIGURE 2
Overview of the pottery types in the typologies for general type, ASSP decoration and HS-subtype. (Drawing: first author, based on the pots in the sample).

3 ASSP2: Narrow-mouthed pots, with rounded carination, above the middle or sometimes halfway up the body. Short neck, usually somewhat flaring. Often taller than wider. This type represents supposedly late ASSP.
4 ASSP3: More or less narrow-mouthed pots with sagging profile.
5 ASSP4: melon-shaped pots, with vertical indentations or bosses, often with foot ring.
6 HS.
7 Decorated HS, in order to determine whether or not decoration akin to ASSP occurs only on earlier HS-pots.
8 HS/EG, an intermediate type between HS and early globular ware.

Beakers and carinated bowls were not included because of an insufficient number of dates, and bowls and dishes because of their long lifespan, covering both ASSP and HS.

Secondly, the ASSP decoration was categorized, by single elements, patterns or the location of decoration on the pot.

A: Two or more horizontal lines and often cordons around the neck.

B: Regular pattern of lined chevrons, often under or between horizontal lines.

C: Rosettes.

D: *Hängende* or *Stehende Bogen* (the German technical term; in English: swags or arcs).

E: Round/vertical bosses.

F: Stamps.

G: Vertical bundles of lines, often combined with vertical elongated bosses or indentations.

H: melon-shaped pots, with vertical indentations or bosses (see ASSP4).

I: Decorated zone that is completely filled in with stamps or impressions.

J: Decoration limited to the upper part, above or on carination.

K: The widest part of the pot is emphasized.

L: Decoration not limited to upper part.

M: Decorated cordons around the neck.

As multiple types of decoration usually occur on one pot, most pots are included in more than one category.

In the third typology, subtypes were defined within HS, based on the shapes of the pots.

A: Wide-mouthed, relatively tall pots, small out-flaring rims.

B: Narrow-mouthed, tall pots, more or less out-flaring neck.

C: (Relatively) wide-mouthed pots, out-flaring neck, height and width comparable; sometimes more or less rounded carination.

D: Bowls with short, out-flaring rim.

Some well-dated contexts include more than one pot. If these pots belong to more than one category in the same typology, this can compromise the ability of the model to distinguish between the different types. For example, if a date relates to pots of different HS-subtypes, it is excluded from the model for HS-subtypes, as otherwise that date would be included in different categories within the same model. As the different pots to which this date relates all fall into the category of HS-pots in the model for general types, the date represents only one category in the model for general types. Therefore the date can be included in the model for general types, but not in the model for HS-subtypes. These cases are indicated in Table 2. As most ASSP-pots have more than one type of decoration, it is not necessary or possible to leave out such dates in the model for ASSP-decoration.

A Bayesian model for each typology was prepared in OxCal (version 4.3). Because of its large size, the ASSP-decoration model tended to run best when split into smaller components (see Supplementary Information). The models were all configured in the same manner and followed the approach taken by several previously published studies (e.g. Dee *et al*. 2014; Wengrow *et al*. 2014). All dates for each typology were modelled as single-Phase Sequences, where the Phase was enclosed by a start and end Boundary. It is important to emphasize that no assumption was built into the models *a priori* about the likely ordering of each of the different groups of dates.

All three models employed OxCal's outlier analysis to mitigate the impact of any wayward individual results, and to combat the above-mentioned issue of inbuilt age. Radiocarbon results on materials that were likely to be short-lived, such as pottery crusts, were subject to the General Outlier classification (Bronk Ramsey 2009). The dates on cremation remains, charcoal, and wood are all susceptible to inbuilt age. For these, the Charcoal Plus Outlier model was employed, a technique that has been shown to counteract this problem, where sufficient numbers of dates are available (Dee and Bronk Ramsey 2014). A Sum function was embedded in each Phase. This function generated an estimate of the average date for each group. That is, an average date for each general type, each type of ASSP-decoration, and each subtype of HS-pot. In the final step, these averages were interrogated by OxCal's Order function, which produced a mathematical estimate of their most likely ordering.

5. RESULTS

5.1. General types

Based on the OxCal model, the chronological order of the typology of general types is: G7, ASSP1, ASSP2, ASSP3, ASSP4, HS, HS decorated, HS/EG (Fig. 3). Supplemental Tables 4–6 show the percentages of likelihood of the chronological order. The model shows the overlap between G7 and the earlier ASSP, as well as the contemporary occurrence of HS and the later types of ASSP. Type G7 begins *c*.AD 300. As indicated by the probability distribution, this type appears to belong to the fourth and early fifth centuries, but the number of dates is not very large (n=7; the distribution of the collective dates ranges from *c*.300–450). ASSP1 (with a range of *c*.300–500) starts to become significant *c*.AD 325, with a peak in the first half of the fifth century, and a possible continuation until around AD 500. The distribution of ASSP2 (*c*.450–575) starts in the middle of the fifth century, with its peak in the first half of the sixth century. This type seems to go out of use before the last quarter of the sixth century. The distributions of ASSP3 and ASSP4 show a less clear peak, at least in part due to the small number of dates (respectively six and four dates from four and three pots, both with a wide range, between *c*.425–700) and do not have a clear cut-off point. It seems likely, however, that these types had very little to no overlap with ASSP1, but coincided only with ASSP2. They are likely to belong to the (later) sixth and the first three quarters of the seventh centuries. Although the conclusions drawn about the duration of the types must be treated as a best estimate, their chronological order seems to be reliable, especially the chronological difference between ASSP1 and ASSP2 (n=17 and n=14).

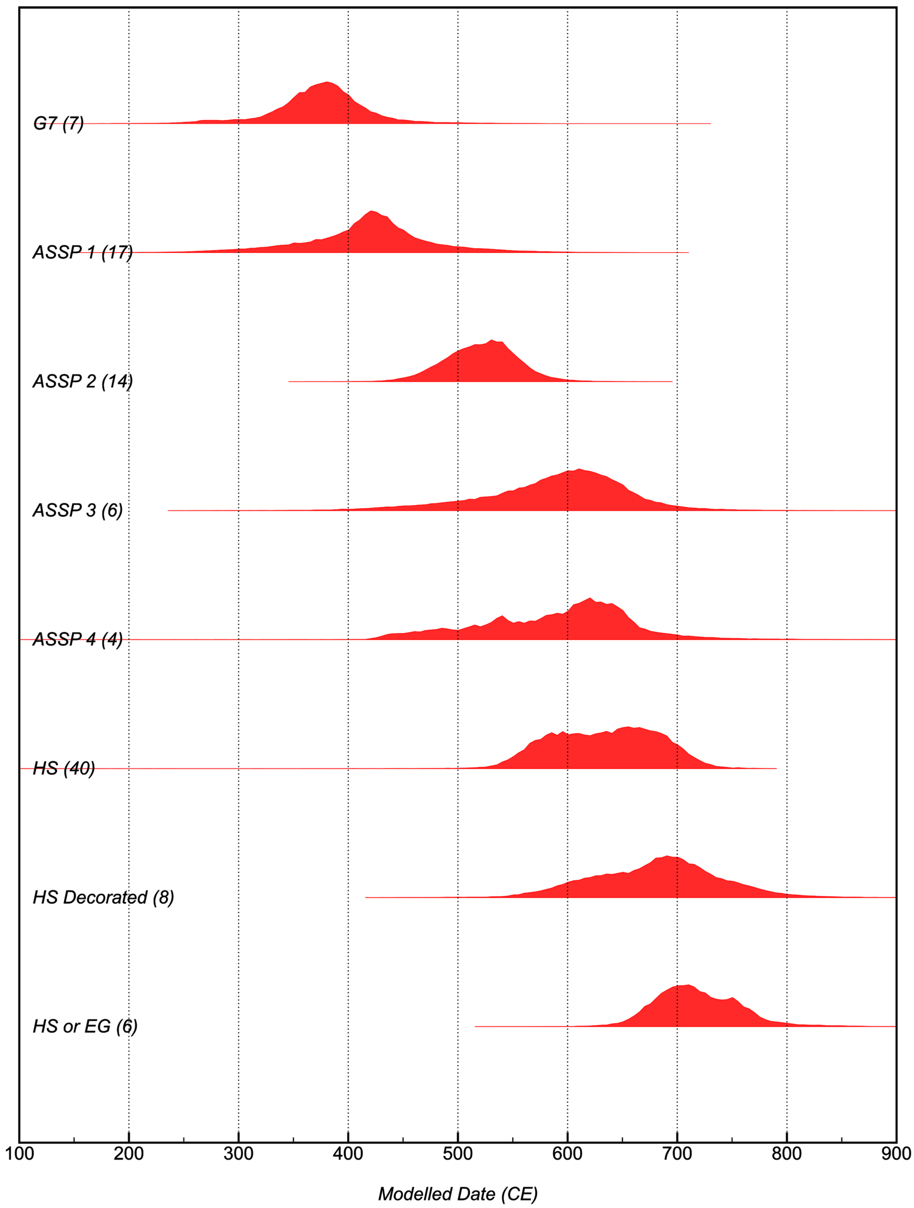

FIGURE 3
Calibrated date ranges for the datasets for the general types and the amount of dates per type, in chronological order. The data were modelled in OxCal (version 4.3; Bronk Ramsey 1995) and interrogated by OxCal's Order function. [Colour figure can be viewed at wileyonlinelibrary.com]

Only one pot from Germany, an ASSP1-pot, could be included in this model. The number of dates from Gelderland and Zuid-Holland is small, but these are all of ASSP2 and later types. From Friesland, Drenthe and England, dates from both earlier and later ASSP are available.

The number of available HS-dates was considerable (n=40). The graph suggests that HS (*c*.525–725 and 550–775 for decorated HS) starts to occur around AD 525 and does not overlap with the undecorated ware of the previous period, represented by G7, and hardly with ASSP1. The HS subtypes, however, show a wider range with a small amount of overlap with G7 as well, especially HS A (*c*.400–650, the peak starting only around 525; Fig. 3), which is more in accordance with the common occurrence of associated finds of HS and G7 (see below). HS overlaps with ASSP2, and even more so with ASSP3 and 4. The undecorated HS, with the largest number of dates, comes to an end in the first quarter of the eighth century. HS is occasionally still decorated with remnants of Anglo-Saxon style elements; these decorations occur during the whole period of use of HS. That the distribution of decorated HS continues into the late eighth century is possibly caused by the relatively small number of dates (n=8), further weighted by two relatively late examples of HS included in this type, which may not be representative (Table 2, nos. 89 and 73). Six dates of the intermediate type between HS and early globular ware are included in the sample (*c*.650–775/800). The results seem to indicate that the transition to early globular ware started as early as the second half of the seventh century, but certainly took hold from at least AD 700 onwards.

5.2. ASSP decoration

Based on the OxCal model, the chronological order of the types of decoration on ASSP is: C, M, J, B, K, D, A, E, G, F, L, H and I (Fig. 4). The ordering is less clear and shows more overlap than was the case for the general types. The types J, B, D and A show a very wide range, covering the whole period of use of ASSP. These, therefore, cannot be used as a chronological distinguishing mark. Types C (with a range between *c*.<300–425) and M (rosettes and decorated cordons around the neck; *c*.<300–500) are relatively early types of decoration, concentrated to before *c*.AD 450, although it must be remarked that C is only represented by four dates. The shape of the probability distributions of types E and G, both characteristic elements of the long-boss style, are nearly similar and cover the greater part of the fifth and the earlier part of the sixth centuries (in both cases covering *c*.400–575).

Types F, L, H and I have a wider range. It seems that these types of decoration do not occur before the second half of the fifth century, especially H and I, although it should be stressed that these two types are only represented by four dates each (three and two pots respectively). However, the basic division into earlier and later types seems to be reliable. The early types of decoration occur mostly on the early types of ASSP and the later types of decoration mostly on the later types of ASSP.

5.3. HS subtypes

Based on the OxCal model, the chronological order of these types is: A, D, B, C (Fig. 5). However, they overlap almost completely. The peak of type A (*c*.400–650, the peak starting only around 525) roughly covers the first half of the peak of the other types, but also has the smallest number of dates (n=5). The early start of this type may reflect its typological connection to the G7-type, while type D (*c*.550–675) may be a slightly later development. The narrow-mouthed pots of type B (*c*.525–775) may have succeeded ASSP2. The peak of type C (*c*.625–725) is relatively late, around AD 650. This wide-mouthed type seems to descend from the ASSP-carinated bowls, but the graph indicates that these may not be related. The ranges of the HS-types overlap with the later ASSP-types.

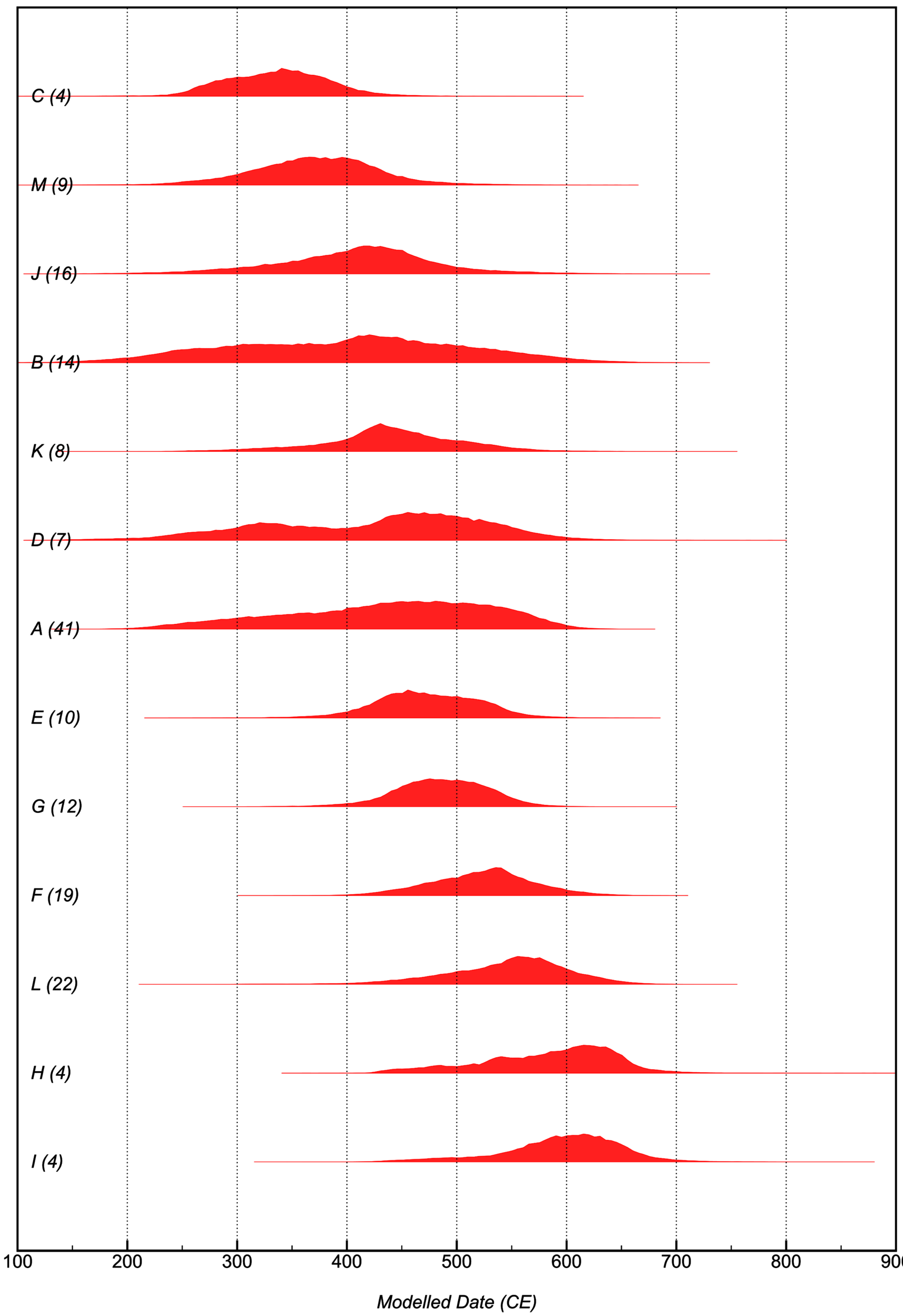

FIGURE 4
Calibrated date ranges for the datasets for the ASSP-decoration typology and the amount of dates per type, in chronological order. The data were modelled in OxCal (version 4.3; Bronk Ramsey 1995) and interrogated by OxCal's Order function. [Colour figure can be viewed at wileyonlinelibrary.com]

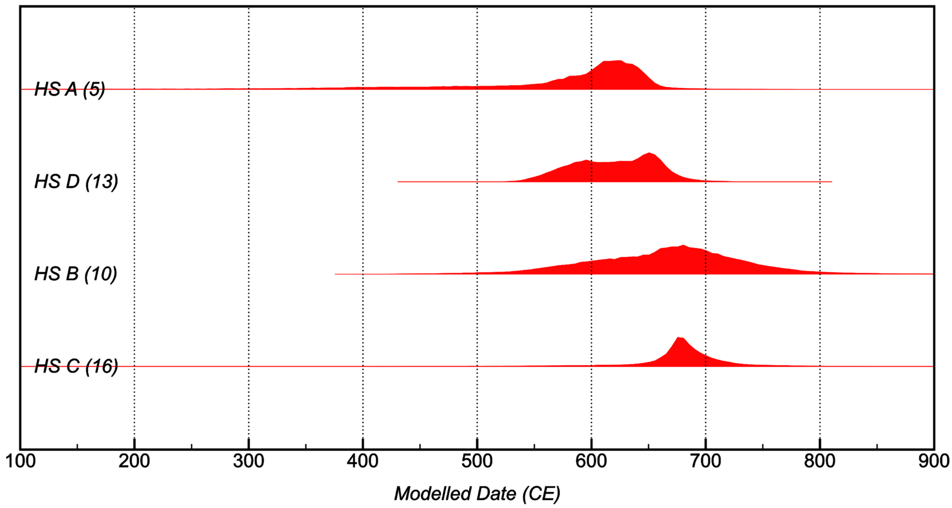

FIGURE 5
Calibrated date ranges for the datasets for the HS-subtypes and the amount of dates per type, in chronological order. The data were modelled in OxCal (version 4.3; Bronk Ramsey 1995) and interrogated by OxCal's Order function. [Colour figure can be viewed at wileyonlinelibrary.com]

6. DISCUSSION

Bayesian modelling is the most mathematically sound means of summarizing the different groups of data and hence offers the possibility to discern at least basic patterns in the same. However, the relatively small number of dates, considering the large research area and time-span, and the broadness of the two-sigma ranges of the underlying radiocarbon dates are limiting factors. Moreover, even though the pottery-types were defined as consistently and objectively as possible, focussing on morphological elements, any classification is always subjective to a certain degree (Whittaker *et al*. 1998, 184; Santacreu *et al*. 2016). There is a wide variety of pottery shapes and decoration of ASSP, which have to be compressed into a few basic types to have a sufficient number of dates per type. A different categorization could be argued, which would change the input, and therefore the results, of the OxCal model.

Despite these possible objections to Bayesian modelling of this dataset, trends in the development of the pottery of this period have become clear. Although conclusions about the durations of the pottery types must be drawn with caution, their chronological order, especially the division between the earlier and later Anglo-Saxon style, and the succession of G7 by HS clearly shows in the graphs. The assumed relationship between HS-type C and the ASSP-carinated bowls was disproved. The carinated bowls-like shapes of HS C may rather be considered a stage in the development towards globular pots. Some of the types of decoration on ASSP can be divided into earlier and later patterns, but not all. Individual elements were in use for a long period of time and the variety of decoration patterns is wide.

Local differences in style and pottery types cannot be reflected in such a compressed typology. Moreover, although this study includes a considerable number of radiocarbon dates, the dataset is not evenly distributed, probably because the selection of the sampled material is often driven by the necessity of dating sites and contexts, rather than by dating the pottery itself. This

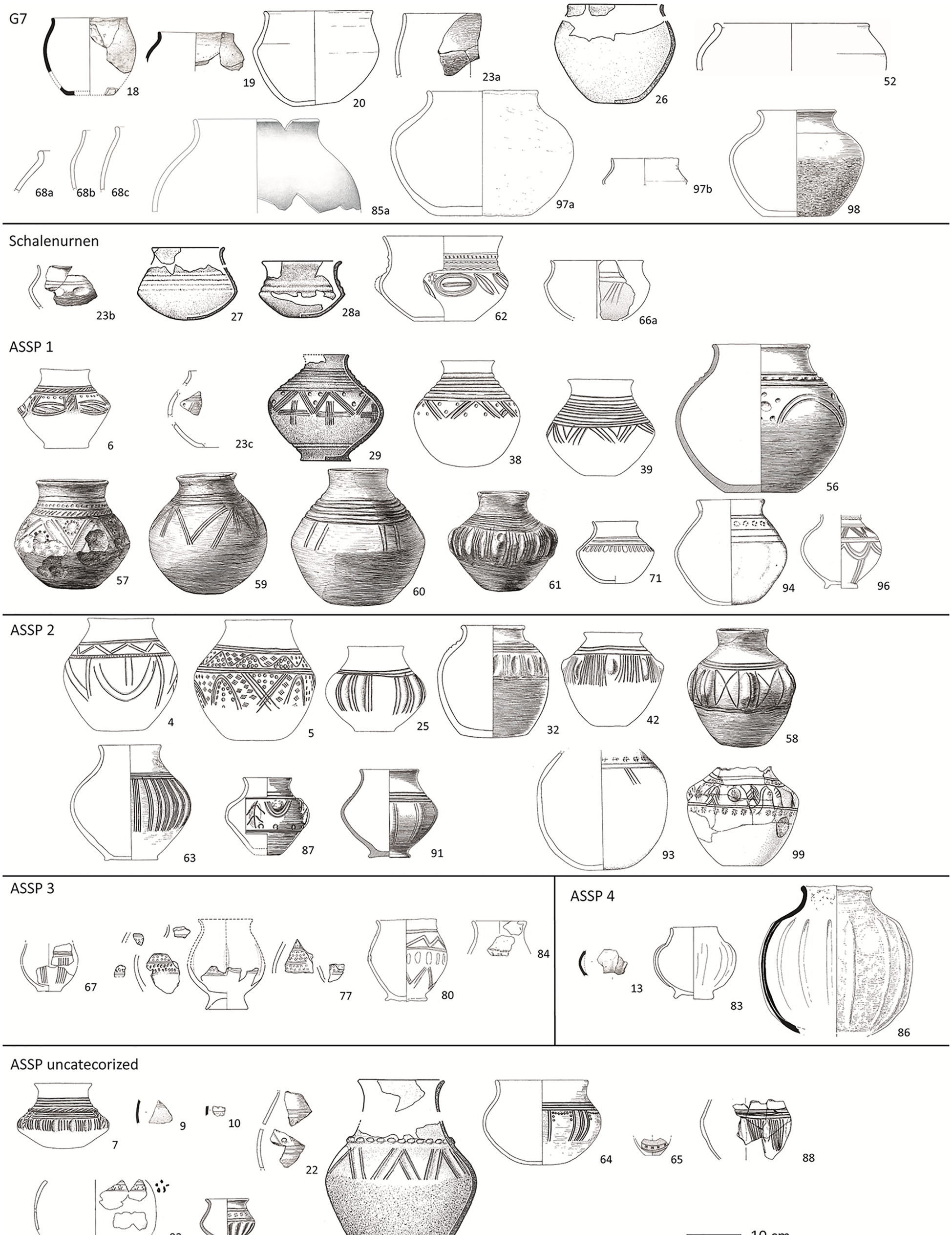

FIGURE 6
The pots from the selected dates. The sources of the drawings are listed in Table 2 [Colour figure can be viewed at wileyonlinelibrary.com]

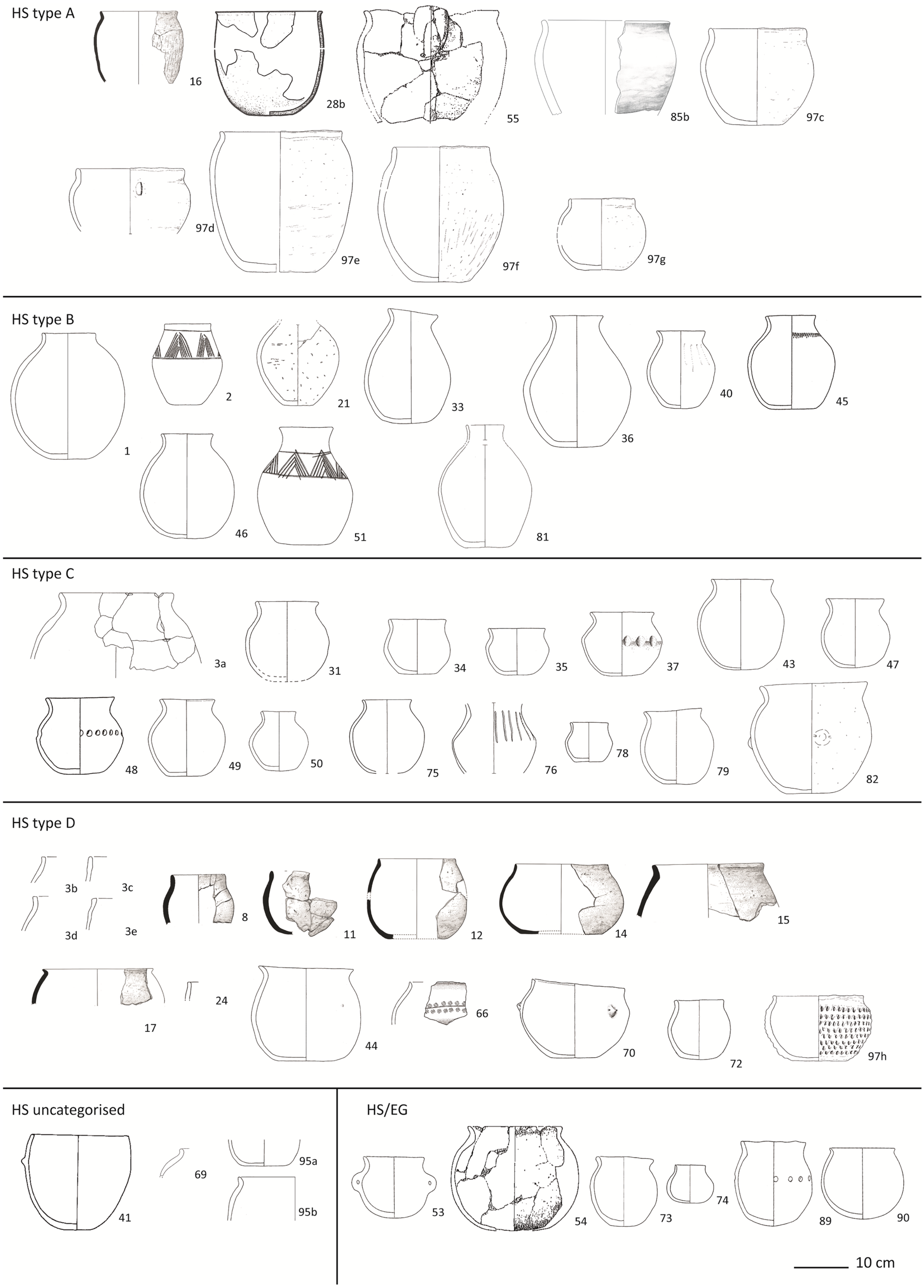

FIGURE 6 (continued)

sporadic distribution of dates means that not all types and stylistic elements are represented equally well. Many of the dated samples come from cremation burials, which leads to an underrepresentation of vessel types common in this period, such as carinated bowls *(Schalenurnen)* and beakers.

The date of introduction of ASSP differs by region (Kennett 1978, 11; Knol 1993, 196–8; Hills and Lucy 2013, 301–2; Nieuwhof 2013, 54). It likely first occurred in Jutland and north-western Germany, followed by the northern Netherlands and England, and only later spread to Zuid-Holland, Gelderland, Flanders and northern France. The available radiocarbon dates of ASSP do not represent every region equally well. There are no dates of ASSP from Denmark, Belgium or northern France. There are only two dated pots from the province of Groningen, one from Gelderland and five from Zuid-Holland. The emphasis of the available dates for ASSP lies on the northern Netherlands (41 selected dates), especially Friesland, followed by England (eight selected dates) and Germany (six selected dates). Nevertheless, the results match the spread of ASSP in the order as stated above.

The spread of the Anglo-Saxon style reflects the cultural changes during this period. The onset of ASSP seems well represented in the data. ASSP1 occurs in Germany (one dated pot) as well as the northern Netherlands (twelve dated pots) and England (one dated pot). The four pots from Germany that were included in the model for ASSP-decoration were ornamented with early decorative motifs. Pottery characteristics that are defined here as belonging to ASSP2 are hardly known in Germany. Bärenfänger mentions one pot from Nordorf (Bärenfänger 2001, 253, figs. 2–3). The later ASSP2 seems to be a development in the regions to which ASSP had spread. From Friesland, Drenthe and England, dates from both earlier ASSP1 and later ASSP2 are available, as well as from HS. In Groningen, ASSP was common and already occurred in fourth century contexts in the terp of Ezinge, as archaeological dates have shown (Nieuwhof 2013). In Gelderland and Zuid-Holland, the dated ASSP-pots are of the ASSP2, ASSP3 and ASSP4-types. This represents the actual situation, as earlier ASSP (ASSP1) is unknown here and only later ASSP and HS occur.

That later ASSP is hardly found in Germany suggests it is more likely to be introduced to Zuid-Holland and Gelderland, and possibly Flanders and north-western France as well, from England or the northern Netherlands rather than directly from the homelands of the Angles and Saxons. Based on prestigious metal finds, Nicolay (2005; 2014) suggests strong influences from Southern Scandinavia during this period. Previous research suggests little evidence of Scandinavian influence in the ASSP of the Netherlands (Krol 2006). For England such influences seem to be more common, especially for Jutland (Myres 1969; Hills and Lucy 2013, 313–14). However, prestigious metal objects and pottery may not have functioned in the same way within socio-political networks. The prestige objects amongst the metal finds are principally part of a political exchange network of an elite society, under strong Scandinavian influences (Nicolay 2005; 2014), which does not extend to Flanders or northern France. These regions were part of the Frankish realm from the late fifth century (Nicolay 2014, 350–2). The ASSP2-pottery in Zuid-Holland, Gelderland, Flanders and north-western France may represent contacts between these regions and Anglo-Saxon communities in England during the end of the fifth and the early sixth centuries, thus showing that these communities were not only focused on the northern socio-political network under Scandinavian influence, but also had contacts with the Frankish world, or even settled there. Further stylistic research is needed to distinguish the cultural interaction that played a role in the distribution of the pottery.

Lanting and Van der Plicht (2010) suggest HS was introduced in the early fifth century. However the OxCal model implies that it did not emerge before *c.*AD 500, a conclusion substantiated by a large number of dates (n=48; *c*.525–775, if likely starting slightly earlier for subtype A). This is also supported by the fact that it is generally found with the later Anglo-Saxon types. HS seems to have directly followed the end of the G7-type, but, as G7 and HS sometimes occur together in the same contexts, it is certain that these types overlapped. This is illustrated by a find from Wijnaldum (Table 2. 96. Wijnaldum-Tjitsma 6438/6451), where sherds of several complete G7 and HS-pots together formed the pavement of a hearth, representing a single event (Taayke forthcoming). A gradual transition of G7 to HS is supported by the gradual change from finer to coarser fabrics (Krol *et al*. 2018).

Contrary to the common view, HS seems to start in Germany around AD 500 as well, at least to a small degree. Only two dates from Germany are available, but the two-sigma ranges for these two dates fall before AD 500.

Although it is not possible to make a detailed typo-chronology based on the available radiocarbon dates, the basic division into earlier and later types is an important result, which supports the earlier, but still controversial identification of these categories on stylistic grounds. The recognition of earlier and later ASSP-styles, and the different starting dates for ASSP in each region, are of utmost importance in understanding migration patterns, contacts and exchange and their chronology along the southern North Sea coastal regions between the fourth and eighth centuries AD.

7. CONCLUSIONS

To date, ASSP can only be dated globally; the existing relative typologies are not fixed by scientific dating. This study confirms the division between early and late types of ASSP. The division applies to the development of the shape of the pots, as well as some types of decoration. The study shows that early ASSP was in use in the 4th and 5th centuries, while later ASSP began around 450 and probably went out of use after the first half of the sixth century, at least in the Netherlands. The intermediate types between ASSP and the following HS (ASSP3 and 4) continued into the later sixth century. The results show no clear chronological development for the HS-types.

According to present opinion, the Anglo-Saxon style was not introduced in every region at the same time and also remained in use longer in some areas than in others. Although the quantity of data is not large, the results are in line with this idea. The pots from Germany are only in the early style, which is commensurate with the idea that the Anglo-Saxon style went out of use earlier in this region. Usable dates from Denmark are not available. In the northern Netherlands, both earlier and later ASSP occurs. Archaeological data show that the style was introduced and adopted here in the 4th century. Most dated pots from England are of the later types, but one pot is of an early type. Although the central and western Netherlands are not well represented in the sample, it is clear that only the later ASSP and intermediate types between ASSP and HS are found here. Dates from northern France are lacking and only one date from a G7-pot is available for Belgium, but here only the later ASSP-types are found. This indirectly confirms that the Anglo-Saxon style only occurred later in these regions. The results provide the necessary information for further stylistic analysis, comparing pottery from different regions.

Bayesian modelling of radiocarbon dates of pottery has the potential to contribute even more to an understanding of the changes that occurred in the so-called Migration Period than the limited dataset of this study allows. For the future, we recommend radiocarbon dating of pottery from this period as a common practice, in particular outside the northern Netherlands, to acquire a fuller picture of the spread of ASSP and thereby of migration patterns and connectivity in the southern North-Sea coastal area.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Data S1 Supporting information

Table 2. The dates, in alphabetical order. Region: BE = Belgium; DR = Drenthe; FR = Friesland; GE = Germany; GL = Gelderland; GR = Groningen; BI = British Isles; ZH = Zuid-Holland. Category: see table 1. General type: ASSP1, ASSP2, ASSP3, ASSP4 = types of ASSP; G7 = type in the typology of Taayke (1996) for Northern Drenthe; HSd = decorated HS; HS/ES = intermediate type between HS and Early Globular ware. * = not modeled in this typology. Sample type: CC = charcoal form cremation; CP = charcoal from pit; CR = cremation remains; CS = charcoal from same structure; CW = contsruction wood well; TW = twigg well; HU = bone from inhumation; OP = charcoal from oven pit; PC = pottery crust; WO = wood/wooden object. Calibrated dates: OxCal v4.3.2 Bronk Ramsey (2017); r.5 IntCal13 atmospheric curve (Reimer et al. 2013)

Site and no.	Region	Lab No.	Sample Type	Age (yr BP)	Uncertainty	Calibrated date AD (95.4% confidence)	Category	Type	ASSP decorations	HS Form Type	Reference
1. Aalsum 1920/II.2	GR	GrA-44824	CR	1380	35	596-760	HS	HS		B	Lanting and van der Plicht 2010, 147 and fig. 17.21 (after drawing E. Knol)
2. Aalsum 1920/II.21	GR	GrA-44825	CR	1290	30	664-770	HS	HSd		B	Lanting and van der Plicht 2010, 142 and fig. 15.12 (after drawing E. Knol)
3. Ballo	DR	GrN-18571	WO	1475	25	548-640	HS	HS		C*,D*	Lanting and van der Plicht 2012, 310; Van der Sanden 1993, fig. 3
4. Beetgum-Besseburen 46a-271	FR	GrA-44419	CR	1615	35	356-542	AS	ASSP2	B,D,L		Lanting and Van der Plicht 2010, 142; Knol 2008, 153 (fig.)
		GrN-16726	CC	1565	40	405-577					
5. Beetgum-Besseburen 46a-999	FR	GrA-43425	CR	1530	35	427-601	AS	ASSP2	A,D,F,I,L		Knol 1993, 62 (GrN-16726); Lanting and Van der Plicht 2010, 142 and fig. 15.19 (after Knol 1993, fig. 13)
6. Beetgum-Besseburen 46a-1000	FR	GrA-44420	CR	1595	35	394-545	AS	ASSP1	A,F,K,M		Lanting and Van der Plicht 2010, 142; Knol 1993, fig. 75.1
7. Beetgum-Besseburen 46a-1001	FR	GrA-44422	CR	1650	30	264-533	AS	-	A,E,K,M		Lanting and Van der Plicht 2010, 142; Knol 1993, fig. 75.5
8. Bloodmoor Hill V7	BI	GrA-25923	PC	1400	35	584-674	HS	HS		D	Lucy et al. 2009, tab 6.1 and fig. 4.31
9. Bloodmoor Hill V15	BI	OxA-13728	PC	1579	29	412-546	AS	-	F		Lucy et al. 2009, tab 6.1 and fig. 4.31
10. Bloodmoor Hill V20	BI	OxA-13883	PC	1559	26	424-557	AS	-	F		Lucy et al. 2009, tab 6.1 and fig. 4.32
11. Bloodmoor Hill V45	BI	OxA-13967	PC	1510	26	431-618	HS	HS		D	Lucy et al. 2009, tab 6.1 and fig. 4.35
12. Bloodmoor Hill V77	BI	OxA-13707	PC	1398	25	605-665	HS	HS		D	Lucy et al. 2009, tab 6.1 and fig. 4.36
		GrA-25590	PC	1425	35	570-661					
13. Bloodmoor Hill V89	BI	OxA-14019	PC	1559	24	425-554	AS	ASSP4	H		Lucy et al. 2009, tab 6.1 and fig. 4.37
14. Bloodmoor Hill V99	BI	OxA-13752	PC	1502	27	434-632	HS	HS		D	Lucy et al. 2009, tab 6.1 and fig. 4.38
15. Bloodmoor Hill V114	BI	OxA-13709	PC	1459	29	555-648	HS	HS		D	Lucy et al. 2009, tab 6.1 and fig. 4.39
		GrA-25592	PC	1440	35	561-656					
16. Bloodmoor Hill V125	BI	OxA-13966	PC	1425	27	583-658	HS	HS		A	Lucy et al. 2009, tab 6.1 and fig. 4.39
		OxA-13726	PC	1509	27	430-622					
17. Bloodmoor Hill V128	BI	GrA-25589	PC	1385	35	595-686	HS	HS		D	Lucy et al. 2009, tab 6.1 and fig. 4.40
18. Bloodmoor Hill V131	BI	OxA-14017	PC	1697	26	256-407	UD	G7			Lucy et al. 2009, tab 6.1 and fig. 4.40
19. Bloodmoor Hill V143	BI	GrA-25950	PC	1710	50	172-428	UD	G7			Lucy et al. 2009, tab 6.1 and fig. 4.41
20. Broechem-Nierlenders 377/1455	BE	RICH-23297	CR	1622	30	356-538	UD	G7			Annaert et al., in prep.
21. Den Haag-Solleveld V1010	ZH	GrA-44418	CR	1550	35	420-585	HS	HS		B	Lanting and van der Plicht 2010, 149; Waasdorp and Eimermann 2008, fig. 5.7
		GrN-8825	CP	1570	50	395-595					
22. Eursinge 16 (/17)	DR	GrA-44318	CP	1590	30	406-542	AS,-	-	F		Lanting 1977, fig. 13; Lanting and van der Plicht 2010, 136
23. Eursinge 19 (/20)	DR	GrN-8826	OP	1545	30	425-579	AS,UD	G7*,ASSP1*,SCHA*	A,B		Lanting 1977, fig. 13; Lanting and Van der Plicht 2010, 136
		GrN-7499	CS	1460	50	432-662					
24. Eursinge 26 (/24)	DR	GrA-44317	CS	1590	30	406-542	HS	HS		D	Lanting 1977, 242 and fig. 13(GrN-7499); Lanting and van der Plicht 2010, 136
25. Ferwerd-Burmania II 101bis-1941	FR	GrA-43426	CR	1570	35	410-564	AS	ASSP2	A,E,G,L		Lanting and van der Plicht 2010, 142; Nieuwhof 2015; Knol 1993, fig. 10.6
26. Flögeln-Voßbarg 27	GE	Poz-69387	CR	1795	30	132-328	UD	G7			NiHK Wilhelmshaven;Schön 1988, fig. 7
27. Flögeln-Voßbarg 46	GE	Poz-69383	CR	1840	50	65-326	AS	SCHA*	A,J		NiHK Wilhelmshaven; Schön 1988, fig. 8
28. Flögeln-Voßbarg 58	GE	Poz-69388	CR	1675	30	258-425	AS,HS	SCHA*,HS	A,J	A	NiHK Wilhelmshaven; Schön 1988, fig. 9
29. Flögeln-Voßbarg 106	GE	Poz-69386	CR	1740	30	236-386	AS	ASSP1	A,B,J		NiHK Wilhelmshaven; Schön 1988, fig. 16
30. Flögeln-Voßbarg 151	GE	Poz-69385	CR	1785	30	135-332	AS	-	B,J,M		NiHK Wilhelmshaven; Schön 1988, fig. 21
31. Friens 172-31	FR	GrN-16727	CC	1320	50	615-859	HS	HS		C	Knol 1993, 63; Lanting and Van der Plicht 2010, fig. 17.13 (after drawing E. Knol)
32. Helpman	GR	GrA-44146	CR	1560	35	415-575	AS	ASSP2	A,G		Van Es 1978/8 fig. 2; Lanting and van der Plicht 2010, 142
33. Hogebeintum 28-158	FR	GrN-16076	CC	1500	35	430-642	HS	HS		B	Knol 1993, tab. 4; Lanting and Van der Plicht 2010 fig. 17.8 (after drawing E. Knol)
		GrN-16721	CC	1730	60	136-419					
34. Hogebeintum 28-159	FR	GrA-23454	CR	1540	45	416-608	HS	HS		C	Knol 1993, tab. 4 (GrN-16721), fig. 13; Lanting and Van der Plicht 2010, 147; Nieuwhof 2015, 240
35. Hogebeintum 28-299	FR	GrN-16722	CC	1900	70	49 BC-321	HS	HS		C	

		GrA-23455	CR	1515	45	427-630					Knol 1993, tab. 4 (GrN-16722), fig. 13; Lanting and Van der Plicht 2010, 147
36. Hogebeintum 28-328	FR	GrN-16540	CC	1505	40	429-640	HS	HS		B	Knol 1993, tab. 4; Lanting and Van der Plicht 2010, fig. 17.7 (after drawing E. Knol)
37. Hogebeintum 28-333	FR	GrN-16723	CC	1470	50	430-659	HS	HSd		C	Knol 1993, tab. 4; Lanting and Van der Plicht 2010, fig. 17.9 (after drawing E. Knol)
		GrN-16724	CC	1450	45	474-665					
38. Hogebeintum 28-373a	FR	GrA-43431	CR	1625	35	347-538	AS	ASSP1	A,B,J		Knol 1993, tab. 4 (GrN-16724), fig. 13; Lanting and Van der Plicht 2010, 142; Nieuwhof 2015, 240
		GrN-16078	CC	1645	25	337-530					
		GrA-44840	CR	1705	35	249-405					
39. Hogebeintum 28-422	FR	GrA-43255	CR	1855	30	82-234	AS	ASSP1	A,B,J		Knol 1993, tab. 4 (GrN-16078); Lanting and Van der Plicht 2010, 142; Nieuwhof 2015, 240
40. Hogebeintum 28-430	FR	GrN-16541	CC	1280	50	655-875	HS	HSd		B	Knol 1993, tab. 4; Lanting and Van der Plicht 2010, fig. 17.16 (after drawing E. Knol)
41. Hogebeintum 28-458	FR	GrN-16079	CC	1325	45	625-775	HS	HS		-	Knol 1993, tab. 4 and fig. 13.11
		GrN-16080	CC	1750	35	176-390					
42. Hogebeintum 28-459	FR	GrA-23456	CR	1575	40	400-567	AS	ASSP2	A,E,G,K		Knol 1993, tab. 4 (GrN-16080), fig. 13; Lanting and Van der Plicht 2010, 142; Nieuwhof 2015, 240
43. Hogebeintum 28-463	FR	GrN-16725	CC	1285	40	655-863	HS	HS		C	Knol 1993, tab. 4; Lanting and Van der Plicht 2010, 17.15 (after drawing E. Knol)
44. Hogebeintum 28-469	FR	GrN-16542	CC	1335	40	639-770	HS	HS		D	Knol 1993, tab. 4; Lanting and Van der Plicht 2010, fig. 17.12 (under wrong number, after drawing E. Knol)
45. Hogebeintum 28-499	FR	GrN-16081	CC	1475	35	474-652	HS	HSd		B	Knol 1993, tab. 4; Lanting and Van der Plicht 2010, fig. 17.11 (under wrong number, after drawing E. Knol)
46. Hogebeintum 28-508	FR	GrN-16082	CC	1550	40	418-594	HS	HS		B	Knol 1993, tab. 4; Lanting and Van der Plicht 2010, fig. 17.1 (after drawing E. Knol)
47. Hogebeintum 28-525	FR	GrN-16544	CC	1270	40	662-868	HS	HS		C	Knol 1993, tab. 4; Lanting and Van der Plicht 2010, fig. 17.17 (after drawing E. Knol)
48. Hogebeintum 28-527	FR	GrN-16545	CC	1300	40	648-800	HS	HSd		C	Knol 1993, tab. 4; Lanting and Van der Plicht 2010, fig. 17.14 (after drawing E. Knol)
49. Hogebeintum 28-809	FR	GrN-16083	CC	1510	25	431-615	HS	HS		C	Knol 1993, 62; Lanting and Van der Plicht 2010, fig. 17.6 (after drawing E. Knol)
50. Hogebeintum 28-811	FR	GrN-16547	CC	1515	45	427-630	HS	HS		C	Knol 1993, tab. 4; Lanting and Van der Plicht 2010, fig. 17.4 (after drawing E. Knol)
51. Leermens 1968/VI.131	GR	GrA-43693	CR	1525	30	428-604	HS	HSd		B	Lanting and van der Plicht 2010, 142 and fig. 15.13 (after drawing E. Knol)
52. Marssum V853-2	FR	GrA-61791	PC	1684	42	242-505	UD	G7			Hielkema 2015, tab 6.2 and fig. 7.27b
53. Marum 1975-III-2	GR	GrA-32130	CR	1310	25	658-768	HS/EG	HS/EG			Groenendijk and Knol 2007, 100; Lanting and Van der Plicht 2010, fig. 17.20 (after Groenendijk and Knol 2007, fig. 2)
54. Middels Osterloog 2411/6:124.1	GE	Poz-68799	PC	1325	30	650-768	HS/EG	HS/EG			NiHK Wilhelmshaven; Bärenfänger and Schwarz 1999, fig. 3
55. Middels Osterloog 2411/6:124.3	GE	Poz-68798	PC	1910	80	94 BC-326	HS	HS		A	NiHK Wilhelmshaven; Bärenfänger and Schwarz 1999, fig. 3
56. Midlaren 1856/IV.2	DR	GrA-43415	CR	1720	35	242-396	AS	ASSP1	A,C,D,J,M		Lanting and van der Plicht 2010, 142; Nieuwhof 2013, fig. 12.1 (after drawing Ypey)
57. Midlaren 1856/IV.3	DR	GrA-43416	CR	1690	35	253-419	AS	ASSP1	A,B,C,J,M		Lanting and van der Plicht 2010, 142; Nieuwhof 2013, fig. 12.7 (after drawing Ypey)
58. Midlaren 1856/IV.4	DR	GrA-43418	CR	1615	35	356-542	AS	ASSP2	A,E,G,K		Lanting and van der Plicht 2010, 142; Nieuwhof 2013 fig. 12.6 (after drawing Ypey)
59. Midlaren 1856/IV.5	DR	GrA-43419	CR	1620	35	350-540	AS	ASSP1	A,B		Lanting and van der Plicht 2010, 142; Nieuwhof 2013, fig. 12.2 (after drawing Ypey)
60. Midlaren 1856/IV.8	DR	GrA-43689	CR	1590	30	406-542	AS	ASSP1	A,J		Lanting and van der Plicht 2010, 142; Nieuwhof 2013, fig. 12.3 (after drawing Ypey)
61. Midlaren 1856/IV.10	DR	GrA-45176	CR	1625	35	347-538	AS	ASSP1	A,E,G,K		Lanting and van der Plicht 2010, 142; Nieuwhof 2013, fig. 13.12 (after drawing Ypey)
		GrA-28354	CR	1745	35	180-394					
62. Midlaren de Bloemert 88A-79-2582	DR	GrA-32125	CR	1760	35	143-384	AS	SCHA*	A,C,K,M		Tuin 2008, tab. 26.3; Nieuwhof 2008, fig. 14.12
63. Monster h1956/7.9	ZH	GrA-44831	CR	1540	30	426-588	AS	ASSP2	A,G,L		Lanting and van der Plicht 2010, 145; Waasdorp and Eimermann 2008, fig. 5.10 (after Braat 1956, fig. 22.9)
64. Monster VIII	ZH	GrA-44414	CR	1560	30	420-565	AS	-	A,G,L		Lanting and van der Plicht 2010, 145; Waasdorp and Eimermann 2008, fig. 5.9 (after Braat 1956, fig. 21)
65. Odoorn 100	DR	GrN-10943	CS	1495	35	432-644	AS	-	F		Waterbolk and Lanting 2002, 569; Lanting and Van der Plicht 2010, 136 and fig. 11
66. Odoorn 158	DR	GrN-10944	OP	1490	30	436-644	AS,HS	HSd, SCHA*	A	D	Waterbolk and Lanting 2002, 569; Lanting and Van der Plicht 2010, 136 and fig. 11
67. Odoorn 165	DR	GrN-10945	OP	1665	50	249-535	AS	ASSP3	A,G,L		

		GrN-32041	OP	1600	30	399-539					Waterbolk and Lanting 2002, 569 (GrN-10945); Lanting and Van der Plicht 2010, 136 and fig. 11
68. Odoorn 1966:171	DR	GrN-6624	CP	1645	30	332-534	UD	G7			Waterbolk 1973, 37; Lanting and van der Plicht 2010, 136; Van Es 1979, figs. 4 and 10
69. Odoorn 1966:230	DR	GrN-6625	CS	1310	25	658-768	HS	HS		-	Waterbolk 1973, 37; Van Es 1979, fig. 6
70. Oosterbeintum grave 140	FR	GrA-48239	CR	1490	40	430-648	HS	HS		D	Lanting and Van der Plicht 2012, 288; Knol et al. 1997, 378 (fig.)
		GrA-48240	CR	1725	40	230-405					
71. Oosterbeintum grave 160	FR	GrA-49923	CR	1675	40	250-527	AS	ASSP1	A,J		average: Lanting and Van der Plicht 2012, 288; Knol et al. 1997, 382 (fig.); Nieuwhof 2015, 240; values for seperate dates provided by CIO Groningen
72. Oosterbeintum grave 241	FR	GrA-48831	HU	1355	30	625-764	HS	HS		D	Lanting and Van der Plicht 2012, 288; Knol et al. 1997, 384 (fig.)
73. Oosterbeintum grave 420	FR	GrA-48837	HU	1235	30	686-880	HS/EG	HS/EG			Lanting and Van der Plicht 2012, 288; Knol et al. 1997, 396 (fig.)
74. Oosterbeintum grave 438	FR	GrN-19448	CC	1385	40	577-761	HS/EG	HS/EG			Knol et al. 1997, tab. 1, 400 (fig.) and 403
75. Oosterbeintum grave 483	FR	GrN-16341	CC	1545	35	423-589	HS	HS		C	Knol et al. 1997, tab. 1, 402 (fig.) and 404
76. Oosterbeintum grave 515	FR	GrA-48234	CR	1475	40	434-653	HS	HSd		C	Lanting and Van der Plicht 2012, 302; Knol et al. 1997, 406 (fig.)
		GrA-48237	CR	1425	40	560-665					
77. Oosterbeintum grave 521	FR	GrA-50053	CR	1440	40	550-659	AS	ASSP3	F,I,L		average: Lanting and Van der Plicht 2012, 302; Knol et al. 1997, 406 (fig.); values for seperate dates provided by CIO Groningen
78. Oosterbeintum grave 583	FR	GrA-48242	CR	1380	30	606-680	HS	HS		C	Lanting and Van der Plicht 2012, 302; Knol et al. 1997, 408 (fig.)
79. Oosterbeintum grave C	FR	GrA-48233	CR	1310	40	651-772	HS	HS		C	Lanting and Van der Plicht 2012, 302; Knol et al. 1997, 374 (fig.)
80. Rijnsburg h1913/11.77	ZH	GrA-45517	CR	1560	60	385-623	AS	ASSP3	A,B,L		Lanting and van der Plicht 2010, 145 and fig. 15.29 (after drawing M. Dijkstra)
81. Rijnsburg h1913/11.80	ZH	GrA-44834	CR	1535	35	426-598	HS	HS		B	Lanting and van der Plicht 2010, 149 and fig. 17.24 (after drawing M. Dijkstra)
82. Rijnsburg h1913/11.81	ZH	GrA-44835	CR	1495	35	432-644	HS	HS		C	Lanting and van der Plicht 2010, 149 and fig. 17.25 (after drawing M. Dijkstra)
83. Rijnsburg h1921/10.1	ZH	GrA-45518	CR	1510	45	428-637	AS	ASSP4	H,L		Lanting and van der Plicht 2010, 145 and fig. 15.28 (after drawing M. Dijkstra)
84. Rijnsburg h1925/2.14	ZH	GrA-44836	CR	1510	35	428-634	AS	ASSP3	F		Lanting and van der Plicht 2010, 145 and fig. 15.27 (after drawing M. Dijkstra)
85. Saksenoord 442/518/519	FR	Poz-81078	WO	1540	30	426-588	UD,HS	G7*,HS*		A	GIA (T. Varwijk)
86. Southampton 5114	BI	GU-9323	CC	1420	45	553-670	AS	ASSP4	H,L		Birbeck et al. 2005, tab. 1 and fig. 10 © Wessex Archaeology
87. Tynaarlo Westeres 1970-IX-2	DR	GrA-43675	CR	1570	30	416-557	AS	ASSP2	A,D,E,F,L		Lanting and van der Plicht 2010, 142; Van Vilsteren 1993, fig. 4
88. Tynaarlo Westeres 1986-II-25	DR	GrA-43677	CR	1570	35	410-564	AS,-	-	A,G,L		Lanting and van der Plicht 2010, 142; Van Vilsteren 1993, fig. 4
89. Ulrum-De Capel 1	GR	GrA-44423	CR	1255	30	672-868	HS/EG	HS/EG			Knol 1995, fig. 2; Lanting and Van der Plicht 2010, 147
90. Ulrum-De Capel 2	GR	GrA-44594	CR	1405	35	580-670	HS/EG	HS/EG			Knol 1995, fig. 2; Lanting and Van der Plicht 2010, 147
91. Wageningen 1928/3.8	GL	GrA-45521	CR	1500	45	428-644	AS	ASSP2	A,E,G,L		Lanting and van der Plicht 2010, 142; Van Es 1964, fig. 94.5
92. Wasperton cremation 3	BI	OxA-15962	CR	1609	32	389-540	AS	-	F		Carver et al. 2009, tab. 4.1, 344 (fig.)
93. Wasperton cremation 14	BI	GrA-32242	CR	1550	30	423-574	AS	ASSP2	F,J		Carver et al. 2009, tab. 4.1, 348 (fig.)
94. Wasperton cremation 20	BI	OxA-15964	CR	1735	55	139-411	AS	ASSP1	A,F,J		Carver et al. 2009, tab. 4.1, 351 (fig.)
		GrN-29174	SW	1310	20	660-767					
95. Wierum well 2-2	GR	GrN-29175	TW	1340	25	646-764	HS	HS		-	Nieuwhof 2006, tab. 3.3 and fig. 4.2
		GrA-44595	CR	1780	35	134-339					
96. Wijnaldum-Tjitsma 4840/95b	FR	GrA-45845	CR	1795	35	130-332	AS	ASSP1	A,B,D,L,M		Lanting and Van der Plicht 2010, 142 and fig. 15.23 (after drawing J. de Koning)
97. Wijnaldum-Tjitsma 6438/6451	FR	GrA-1531	PC,OP	1470	30	545-645	UD,HS	HS*,HSd*,G7*		A*,D*	Gerrets and De Koning 1999, 97; Taayke, forthcoming (drawing J. de Koning)
98. Wijster grave VII	DR	GrA-23496	CR	1750	50	138-394	UD	G7			Lanting and van der Plicht 2010, 147; Van Es 1967, fig. 272
		GrA-13369	CR	1600	40	383-557					
99. Wijster-Looveen 1926/IV.221	DR	GrA-24189	CR	1610	40	351-546	AS	ASSP2	E,F,L		average: Lanting and van der Plicht 2010, 142; Van Es 1967, fig. 278.1; values for seperate dates provided by CIO Groningen
		GrA-23497	CR	1650	50	257-539					
100. Zeyen-Rhee 1937/VIII.134	DR	GrA-45178	CR	1550	35	420-585	AS	-	A,F,L		Lanting and van der Plicht 2010, 142; Van Es 1967, fig. 160.17

THE CHRONOLOGY OF ANGLO-SAXON STYLE POTTERY IN RADIOCARBON DATES: IMPROVING THE TYPO-CHRONOLOGY

RADIOCARBON DATES ANGLO-SAXON STYLE POTTERY

Krol, T.N., Dee, M. and Nieuwhof, A.

SUPPLEMENTAL MATERIAL

TABLES

Table 3. The unused dates, in alphabetical order. Region: see table 1. Category and type: see table 2. Sample type: CC = charcoal from cremation; CH = charcoal; CP = charcoal from pit; CR = cremation remains; CW = construction wood well; G = charred grain; HA = charred hazelnut; HU = bone from inhumation; PC = pottery crust; SW = sap wood from construction well; TW = twig from construction well. Reason for deselection: CW = construction wood; IN = indeterminable pottery; NC = not categorisable; PU = context with prolonged use; UW = unclear which pot was dates; SW = sapwood; TO = too old (calibrated dates BC); UC = unclear context; US = unreliable sample (insufficient pre-treatment). Calibrated dates: OxCal v4.3.2 Bronk Ramsey (2017); r.5 IntCal13 atmospheric curve (Reimer et al. 2013)

Site and no.	Region	Lab No.	Sample Type	Age (yr BP)	Uncertainty	Calibrated date (95.4% confidence)	Category	Type	ASSP decorations	HS Form Type	Reason For Deselection	Reference
Bloodmoor Hill V28	BI	GrA-25925	PC	1305	40	648-775 AD	-				NC	Lucy et al. 2009, tab. 6.1, fig. 4.33
Bloodmoor Hill V28	BI	OxA-13710	PC	1316	25	656-768 AD	-				NC	Lucy et al. 2009, tab. 6.1, fig. 4.33
Bloodmoor Hill V119	BI	OxA-14007	PC	1614	33	383-541 AD	-				IN	Lucy et al. 2009, tab. 6.1, fig. 4.39
Brinkum	GE	Poz-68797	PC	1420	30	582-661 AD	-				NC	Lucy et al. 2009, tab. 6.1, fig. 4.39
Esens ES#3 2311/6	GE	Poz-68795	PC	1315	30	655-768 AD	HS			-	UW	NiHK Wilhelmshaven; Bärenfänger 2001, fig. 47
Esens ES#4 2311/6	GE	Poz-68796	PC	1310	30	656-769 AD	HS			-	UW	NiHK Wilhelmshaven; Bärenfänger 2001, fig. 47
Eursinge 15/40/25 (/29)	DR	GrN-32043	SW	1560	60	385-623 AD	AS,-	-	-		NC,UC,SW,PU	Lating 1977, afb. 13; Lanting and van der Plicht 2010, 136
Groningen Rode Weeshuis	GR	GrA-48679	TW	1620	35	350-540 AD	AS	ASSP3	A,D,E		UC,PU	Lanting and Van de Plicht 2012, 306 and fig. 1 (drawing courtesy of G.L.G.A. Kortekaas)
Groningen Rode Weeshuis	GR	GrA-48869	TW	1590	35	397-548 AD	AS	ASSP3	A,D,E		UC,PU	Lanting and Van de Plicht 2012, 306 and fig. 1 (drawing courtesy of G.L.G.A. Kortekaas)
Groningen Rode Weeshuis	GR	GrA-48823	TW	1575	30	413-551 AD	AS	ASSP3	A,D,E		UC,PU	Lanting and Van de Plicht 2012, 306 and fig. 1 (drawing courtesy of G.L.G.A. Kortekaas)
Groß Fredenbeck 193	GE	KI-4208	CH	1700	65	140-534 AD	AS,-	-	-		NC, UC	Cott 2008, tab. 53 and tab. 14 (fig.)
Groß Fredenbeck 212	GE	KIA-3311	CS	1720	30	248-391	AS,-	-	-		NC	Cott 2008, tab. 53 and tab. 15 (fig.)
Groß Fredenbeck 383	GE	KI-4211	CW	1680	35	254-425 AD	HS,-	HS		D,-	CW,UC,PU	Cott 2008, tab. 53 and tab. 21 (fig.)
Groß Fredenbeck 528	GE	KI-4210	CP	1760	40	141-384 AD	-				NC	Cott 2008, tab. 53 and tab. 52 (fig.)
Marssum V235-1	FR	GrA-61746	PC	1609	35	383-544 AD	-				IN	Hielkema 2015, tab. 6.2 and fig. 7.25
Marssum V687-1	FR	GrA-61793	PC	1571	36	407-565 AD	UD				NC,UC,PU	Hielkema 2015, tab. 6.2 and fig. 7.72a
Marssum V687-2	FR	GrA-61792	PC	1596	36	392-547 AD	AS	SCHA	-		UC,PU	Hielkema 2015, tab. 6.2 and fig. 7.72a
56. Middels Osterloog 2411/6:124.2	GE	Poz-68801	PC	1815	30	126-322	AS	-	-		NC	NiHK Wilhelmshaven; Bärenfänger and Schwarz 1999, fig. 3
Oosterbeintum grave 66	FR	GrN-19441	CC	1690	50	231-532 AD	-				US	Knol et al. 1997, tab. 1 and 376 (fig.)
Oosterbeintum 28bis-190	FR	GrA-48232	CR	3345	40	1741-1527 BC	AS	ASSP2	E,L		TO	Lanting and Van der Plicht 2012, 302; Boeles 1927, tab. XXX and 1951, tab. XXXVI (fig.)
Oosterbeintum 28bis-190	FR	GrA-50052	CR	2825	40	1115-860 BC	AS	ASSP2	E,L		TO	Lanting and Van der Plicht 2012, 302; Boeles 1927, tab. XXX and 1951, tab. XXXVI (fig.)
Oosterbeintum grave 131	FR	GrN-19443	CC	1580	110	231-660 AD	HS	HS		C	US	Knol et al. 1997, tab. 1 and 378 (fig.)
Oosterbeintum grave 398	FR	GrA-48836	HU	1595	30	401-540	UD	-			NC	Lanting and Van der Plicht 2012, 302; Nieuwhof 2015, 238; Knol et al. 1997, 394 (fig.)
Oosterbeintum grave 421	FR	GrN-19447	CC	1590	70	262-614 AD	HS	HS		C	US	Knol et al. 1997, tab. 1 and 396 (fig.)

Oosterbeintum grave 527	FR	GrN-19449	CC	1510	50	427-638 AD	HS,-	HS		-	US	Knol et al. 1997, tab. 1 and 406 (fig.)
Pesse 'Hilgensteen'	DR	GrA-43676	CR	2480	35	775-431 BC	AS	ASSP1	A,E,G,L		TO	Lanting and Van de Plicht 2010, 314; Pleyte 1882, tab. LXXVIII (fig.)
Pesse 'Hilgensteen'	DR	GrA-44320	CC	2270	30	400-210 BC	AS	ASSP1	A,E,G,L		TO	Lanting and Van de Plicht 2010, 314; Pleyte 1882, tab. LXXVIII (fig.)
Southampton 5106	BI	GU-9324	CC	1305	40	648-775 AD	-				IN	Birbeck et al. 2005, tab. 1 (no fig.)
Southampton 5134	BI	GrA-18294	CR	1540	45	416-608 AD	-				IN	Birbeck et al. 2005, tab. 1 (no fig.)
Southampton 7138	BI	GU-9322	CC	1245	40	675-881 AD	-				IN	Birbeck et al. 2005, tab. 1 (no fig.)
Southampton 7138	BI	GrA-18295	CR	1510	45	428-637 AD	-				IN	Birbeck et al. 2005, tab. 1 (no fig.)
Southampton 7380	BI	NZA-14941	HU	1247	70	653-952 AD	-				IN	Birbeck et al. 2005, tab. 1 (no fig.)
Wageningen 1928/3.7	GL	GrA-44839	CR	1600	35	391-544 AD	-				NC	Lanting and van der Plicht 2010, 326; Van Es 1964, fig. 95.2
Warendorf-Milte F3	GE	GrA-50209	G	1535	35	426-598 AD	AS	-	-		UW	Lanting and Van der Plicht 2012, 290 (not fig. site is published by Grünewald 2010, without figs. of specific pots)
Warendorf-Milte F30	GE	GrA-50210	HA	1500	35	430-642 AD	AS	-	-		UW	(see above)
Warendorf-Milte F78D	GE	GrA-50211	G	1545	35	423-589 AD	AS	-	-		UW	(see above)
Wasperton cremation 1a	BI	GrA-32135	CR	1570	35	410-564 AD	-				IN	Carver et al. 2009, tab. 4.1, 343 (fig.)
Wasperton cremation 6	BI	GrA-32136	CR	1595	35	394-545 AD	-				IN	Carver et al. 2009, tab. 4.1, 345 (fig.)
Wasperton cremation 10	BI	OxA-15963	CR	1565	29	420-558 AD	-				IN	Carver et al. 2009, tab. 4.1, 347 (fig.)
Wasperton cremation 12	BI	GrA-32241	CR	2370	30	540-388 BC	-				IN,TO	Carver et al. 2009, tab. 4.1, 348 (fig.)
Wasperton cremation 22	BI	OxA-15965	CR	1566	30	418-559 AD	-				IN	Carver et al. 2009, tab. 4.1, 352 (fig.)
Wasperton cremation 26	BI	OxA-15985	CR	1687	28	257-416 AD	-				NC	Carver et al. 2009, tab. 4.1, 354 (fig.)

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Table 4. OxCal Order Results for General Type, with the number of dates included in the model shown in brackets next to the name of the General Type and the probabilities of the chronological ordering (column before row) given as percentages. The table should be read as follows: for type ASSP 1, 17 dates were available and there is a 24% chance this style is older than G7, whilst there is a 94% chance it is older than ASSP 2 and a 97% chance it is older than ASSP 3 and so on.

	G7 (7)	ASSP 1 (17)	ASSP 2 (14)	ASSP 3 (6)	ASSP 4 (4)	HS (40)	HS Decorated (8)	HS or EG (6)
G7 (7)		76%	99%	99%	99%	100%	100%	100%
ASSP 1 (17)	24%		94%	97%	97%	100%	100%	100%
ASSP 2 (14)	1%	6%		84%	81%	98%	99%	100%
ASSP 3 (6)	1%	3%	16%		50%	70%	86%	97%
ASSP 4 (4)	1%	3%	19%	50%		69%	85%	97%
HS (40)	0%	0%	2%	30%	31%		74%	92%
HS Decorated (8)	0%	0%	1%	14%	15%	26%		70%
HS or EG (6)	0%	0%	0%	3%	3%	8%	30%	

Table 5. OxCal Order Results for ASSP Decoration, with the number of dates included in the model shown in brackets next to the name of the ASSP Decoration and the probabilities of the chronological ordering (column before row) given as percentages. As in Table 4, the table should be read as follows: ASSP Decoration B has a 61% chance of being older than A but only a 30% chance of being older than C, and so on.

	C (4)	M (9)	J (16)	B (14)	K (8)	D (7)	A (41)	E (10)	G (12)	F (19)	L (22)	H (4)	I (4)
C (4)		69%	81%	70%	91%	77%	83%	98%	99%	100%	99%	100%	100%
M (9)	31%		68%	60%	81%	68%	73%	92%	95%	98%	98%	99%	100%
J (16)	19%	32%		48%	64%	57%	62%	79%	84%	92%	94%	97%	98%
B (14)	30%	40%	52%		62%	57%	61%	73%	77%	85%	89%	94%	96%
K (8)	9%	19%	36%	38%		47%	51%	67%	74%	86%	90%	94%	97%
D (7)	23%	32%	43%	43%	53%		54%	64%	69%	82%	87%	93%	95%
A (41)	17%	27%	39%	39%	49%	46%		61%	66%	79%	85%	91%	95%
E (10)	2%	8%	21%	27%	33%	36%	39%		58%	78%	85%	91%	95%
G (12)	1%	5%	16%	23%	26%	31%	34%	42%		73%	82%	90%	94%
F (19)	0%	2%	8%	15%	14%	18%	21%	22%	27%		64%	79%	86%
L (22)	1%	2%	6%	11%	10%	13%	15%	15%	18%	36%		68%	76%
H (4)	0%	1%	3%	6%	6%	7%	9%	9%	10%	21%	32%		56%
I (4)	0%	0%	2%	4%	3%	5%	5%	5%	6%	14%	24%	44%	

Table 6. OxCal Order Results for HS Types, with the number of dates included in the model shown in brackets next to the name of the HS Type and the probabilities of the chronological ordering (column before row) given as percentages. As with Tables 4 and 5, this table should be read as follows: HS B has an 18% probability of being before HS A, but a 57% probability of being older than C, and so on.

	HS A (5)	HS D (13)	HS B (10)	HS C (15)
HS A (5)		67%	82%	93%
HS D (13)	33%		74%	89%
HS B (10)	18%	26%		57%

HS C (16)	7%	11%	43%	

CODE FOR MAIN OXCAL MODELS

Once the main models had run, the posterior outputs from the Sum functions ("Average ...etc") were extracted and interrogated using Order function.

<u>All by General Type Model</u>

```
Plot()
{
Outlier_Model("SL",T(5),U(0,4),"t");
Outlier_Model("IA",Prior("Charcoal_Pl
us"),U(0,3),"t");
Sequence("G7")
{
Boundary("Start G7")
{
color= "Darkgreen";
};
Phase("All Dates G7")
{
R_Date("Poz-69387", 1795, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-23496", 1750, 50)
{
Outlier("IA", 1);
};
R_Date("GrA-25950", 1710, 50)
{
Outlier("SL", 0.05);
};
R_Date("OxA-14017", 1697, 26)
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Outlier("SL", 0.05);
};
R_Date("GrA-61791", 1684, 42)
{
Outlier("SL", 0.05);
};
R_Date("GrN-6624", 1645, 30)
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Outlier("IA", 1);
};
R_Date("RICH-23297", 1622, 30)
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Outlier("IA", 1);
};
Sum("Average G7 (7)")
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color="Red";
};
Interval("Duration G7");
};
Boundary("End G7")
{
color="Darkgreen";
};
};
Sequence("ASSP 1")
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Boundary("Start ASSP 1")
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color= "Darkgreen";
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Phase("All Dates ASSP 1")
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R_Date("GrA-45845", 1795, 35)
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R_Date("Poz-69386", 1740, 30)
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R_Date("OxA-15964", 1735, 55)
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R_Date("GrA-43419", 1620, 35)
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{
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};
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};
Interval("Duration ASSP 1");
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Boundary("End ASSP 1")
{
color="Darkgreen";
};
};
Sequence("ASSP 2")
{
Boundary("Start ASSP 2")
{
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Phase("All Dates ASSP 2")
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Interval("Duration ASSP 2");
};
Boundary("End ASSP 2")
{
color="Darkgreen";
};
};
Sequence("ASSP 3")
{
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color= "Darkgreen";
};
Phase("All Dates ASSP 3")
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R_Date("GrN-32041", 1600, 30)
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Outlier("IA", 1);
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R_Date("GrA-45517", 1560, 60)
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Outlier("IA", 1);
};
R_Date("GrA-44836", 1510, 35)
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};
R_Date("GrA-50053", 1440, 40)
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Outlier("IA", 1);
};
R_Date("GrA-48237", 1425, 40)
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Outlier("IA", 1);
};
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};
Interval("Duration ASSP 3");
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Boundary("End ASSP 3")
{
color="Darkgreen";
};
};
Sequence("ASSP 4")
{
Boundary("Start ASSP 4")
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color= "Darkgreen";
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Phase("All Dates ASSP 4")
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};
R_Date("OxA-14019", 1559, 24)
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Outlier("SL", 0.05);
};
R_Date("GrA-25590", 1425, 35)
{
Outlier("SL", 0.05);
};
R_Date("GU-9323", 1420, 45)
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Outlier("IA", 1);
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color="Red";
};
Interval("Duration ASSP 4");
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Boundary("End ASSP 4")
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};
Sequence("HS")
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Boundary("Start HS")
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color= "Darkgreen";
};
Phase("All Dates HS")
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Outlier("IA", 1);
};
R_Date("GrN-16082", 1550, 40)
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R_Date("GrA-23454", 1540, 45)
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R_Date("GrA-44834", 1535, 35)
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R_Date("GrN-16547", 1515, 45)
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};
R_Date("GrA-25589", 1385, 35)
{
Outlier("SL", 0.05);
};
R_Date("GrA-48242", 1380, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-44824", 1380, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-48831", 1355, 30)
{
Outlier("SL", 0.05);
};
R_Date("GrN-16542", 1335, 40)
{
Outlier("IA", 1);
};
R_Date("GrN-16079", 1325, 45)
{
Outlier("IA", 1);
};
R_Date("GrN-16727", 1320, 50)
{
Outlier("IA", 1);
};
R_Date("GrN-6625", 1310, 25)
{
Outlier("IA", 1);
};
R_Date("GrA-48233", 1310, 40)
{
Outlier("IA", 1);
};
R_Date("GrN-29175", 1340, 25)
{
Outlier("SL", 0.05);
};
R_Date("GrN-29174", 1310, 20)
{
Outlier("IA", 1);
};
R_Date("GrN-16725", 1285, 40)
{
Outlier("IA", 1);
};
R_Date("GrN-16544", 1270, 40)
{
Outlier("IA", 1);
};
```

```
R_Date("GrN-16721", 1730, 60)
{
Outlier("IA", 1);
};
R_Date("GrN-16722", 1900, 70)
{
Outlier("IA", 1);
};
R_Date("Poz-68798", 1910, 80)
{
Outlier("SL", 0.05);
};
R_Date("Poz-69388", 1675, 30)
{
Outlier("IA", 1);
};
Sum("Average HS (40)")
{
color="Red";
};
Interval("Duration HS");
};
Boundary("End HS")
{
color="Darkgreen";
};
};
Sequence("HS Decorated")
{
Boundary("Start HS Decorated")
{
color= "Darkgreen";
};
Phase("All Dates HS Decorated")
{
R_Date("GrA-43693", 1525, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-10944", 1490, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-16081", 1475, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-48234", 1475, 40)
{
Outlier("IA", 1);
};
R_Date("GrN-16723", 1470, 50)
{
Outlier("IA", 1);
};
R_Date("GrN-16545", 1300, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-44825", 1290, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-16541", 1280, 50)
{
Outlier("IA", 1);
};
Sum("Average HS Decorated (8)")
{
color="Red";
};
Interval("Duration HS Decorated");
};
Boundary("End HS Decorated")
{
color="Darkgreen";
};
};
Sequence("HS/EG")
{
Boundary("Start HS/EG")
{
color= "Darkgreen";
};
Phase("All Dates HS/EG")
{
R_Date("GrA-44594", 1405, 35)
{
Outlier("IA", 1);
};
R_Date("GrN-19448", 1385, 40)
{
Outlier("IA", 1);
};
R_Date("Poz-68799", 1325, 30)
{
Outlier("SL", 0.05);
};
R_Date("GrA-32130", 1310, 25)
{
Outlier("IA", 1);
};
R_Date("GrA-44423", 1255, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-48837", 1235, 30)
{
Outlier("SL", 0.05);
};
Sum("Average HS/EG (6)")
{
color="Red";
};
Interval("Duration HS/EG");
};
Boundary("End HS/EG")
{
color="Darkgreen";
};
};
};
```

The ASSPs By Decoration Model was run in three separate components (A, B-I, J- M)

ASSPs By Decoration Model A

```
Plot()
{
Outlier_Model("IA",Prior("Charcoal_Plus"),U(0,3),"t");
Sequence("A")
{
Boundary("Start A")
{
color= "Darkgreen";
};
Phase("All Dates A")
{
R_Date("Poz-69383", 1840, 50)
{
Outlier("IA", 1);
};
R_Date("GrA-45845", 1795, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44595", 1780, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-32125", 1760, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-28354", 1745, 35)
{
Outlier("IA", 1);
};
R_Date("Poz-69386", 1740, 30)
{
Outlier("IA", 1);
};
R_Date("OxA-15964", 1735, 55)
{
Outlier("IA", 1);
};
R_Date("GrA-43415", 1720, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43416", 1690, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-48240", 1725, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-49923", 1675, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-44422", 1650, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-44840", 1705, 35)
{
Outlier("IA", 1);
};
R_Date("GrN-16078", 1645, 25)
{
Outlier("IA", 1);
};
R_Date("GrA-45176", 1625, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43419", 1620, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43418", 1615, 35)
{
Outlier("IA", 1);
};
R_Date("GrN-10945", 1665, 50)
{
Outlier("IA", 1);
};
R_Date("GrN-32041", 1600, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-44420", 1595, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43689", 1590, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-23456", 1575, 40)
```

```
{
Outlier("IA", 1);
};
R_Date("GrA-43677 ", 1570, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43426", 1570, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43675 ", 1570, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-45517", 1560, 60)
{
Outlier("IA", 1);
};
R_Date("GrA-44414", 1560, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-44146", 1560, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-23497", 1650, 50)
{
Outlier("IA", 1);
};
R_Date("GrA-45178", 1550, 35)
{
Outlier("IA", 1);
};
R_Date("GrN-8826 ", 1545, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-44831", 1540, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-16726", 1565, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-43425", 1530, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-45521", 1500, 45)
{
Outlier("IA", 1);
};
R_Date("GrN-10944", 1490, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-16724", 1450, 45)
{
Outlier("IA", 1);
};
R_Date("GrA-43431", 1625, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43255", 1855, 30)
{
Outlier("IA", 1);
};
R_Date(" GrN-16080", 1750, 35)
{
Outlier("IA", 1);
};
R_Date("Poz-69388", 1675, 30)
{
Outlier("IA", 1);
};
Sum("Average A (41)")
{
color="Red";
};
Interval("Duration A");
};
Boundary("End A")
{
color="Darkgreen";
};
};
};
```

<u>ASSPs By Decoration Model (B-I)</u>

```
Plot()
{
Outlier_Model("SL",T(5),U(0,4),"t");
Outlier_Model("IA",Prior("Charcoal_Plus"),U(0,3),"t");
Sequence("B")
{
Boundary("Start B")
{
color= "Darkgreen";
};
Phase("All Dates B")
{
R_Date("Poz-69385", 1785, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-45845", 1795, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44595", 1780, 35)
{
Outlier("IA", 1);
};
R_Date("Poz-69386", 1740, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-43416", 1690, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44840", 1705, 35)
{
Outlier("IA", 1);
};
R_Date("GrN-16078", 1645, 25)
{
Outlier("IA", 1);
};
R_Date("GrA-43419", 1620, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44419", 1615, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-45517", 1560, 60)
{
Outlier("IA", 1);
};
R_Date("GrN-8826 ", 1545, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-16724", 1450, 45)
{
Outlier("IA", 1);
};
R_Date("GrA-43431", 1625, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43255", 1855, 30)
{
Outlier("IA", 1);
};
Sum("Average B (14)")
{
color="Red";
};
Interval("Duration B");
};
Boundary("End B")
{
color="Darkgreen";
};
};
Sequence("C")
{
Boundary("Start C")
{
color= "Darkgreen";
};
Phase("All Dates C")
{
R_Date("GrA-32125", 1760, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-28354", 1745, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43415", 1720, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43416", 1690, 35)
{
Outlier("IA", 1);
};
Sum("Average C (4)")
{
color="Red";
};
Interval("Duration C");
};
Boundary("End C")
{
color="Darkgreen";
};
};
Sequence("D")
{
Outlier("IA", 1);
Boundary("Start D")
{
color= "Darkgreen";
};
Phase("All Dates D")
{
R_Date("GrA-45845", 1795, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44595", 1780, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43415", 1720, 35)
{
```

```
Outlier("IA", 1);
};
R_Date("GrA-44419", 1615, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43675 ", 1570, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-16726", 1565, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-43425", 1530, 35)
{
Outlier("IA", 1);
};
Sum("Average D (7)")
{
color="Red";
};
Interval("Duration D");
};
Boundary("End D")
{
color="Darkgreen";
};
};
Sequence("E")
{
Boundary("Start E")
{
color= "Darkgreen";
};
Phase("All Dates E")
{
R_Date("GrA-44422", 1650, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-45176", 1625, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43418", 1615, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-24189", 1610, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-13369", 1600, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-23456", 1575, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-43426", 1570, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43675 ", 1570, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-45521", 1500, 45)
{
Outlier("IA", 1);
};
R_Date(" GrN-16080", 1750, 35)
{
Outlier("IA", 1);
};
Sum("Average E (10)")
{
color="Red";
};
Interval("Duration E");
};
Boundary("End E")
{
color="Darkgreen";
};
};
Sequence("F")
{
Boundary("Start F")
{
color= "Darkgreen";
};
Phase("All Dates F")
{
R_Date("OxA-15964", 1735, 55)
{
Outlier("IA", 1);
};
R_Date("OxA-15962", 1609, 32)
{
Outlier("IA", 1);
};
R_Date("GrA-24189", 1610, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-13369", 1600, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-44420", 1595, 35)
{
Outlier("IA", 1);
};
R_Date("OxA-13728", 1579, 29)
{
Outlier("SL", 0.05);
};
R_Date("GrA-44318", 1590, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-8825", 1570, 50)
{
Outlier("IA", 1);
};
R_Date("GrA-43675 ", 1570, 30)
{
Outlier("IA", 1);
};
R_Date("OxA-13883", 1559, 26)
{
Outlier("SL", 0.05);
};
R_Date("GrA-23497", 1650, 50)
{
Outlier("IA", 1);
};
R_Date("GrA-45178", 1550, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-32242", 1550, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-16726", 1565, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-43425", 1530, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44836", 1510, 35)
{
Outlier("IA", 1);
};
R_Date("GrN-10943", 1495, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-50053", 1440, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-48237", 1425, 40)
{
Outlier("IA", 1);
};
Sum("Average F (19)")
{
color="Red";
};
Interval("Duration F");
};
Boundary("End F")
{
color="Darkgreen";
};
};
Sequence("G")
{
Boundary("Start G")
{
color= "Darkgreen";
};
Phase("All Dates G")
{
R_Date("GrA-45176", 1625, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43418", 1615, 35)
{
Outlier("IA", 1);
};
R_Date("GrN-10945", 1665, 50)
{
Outlier("IA", 1);
};
R_Date("GrN-32041", 1600, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-23456", 1575, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-43426", 1570, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43677 ", 1570, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44146", 1560, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44414", 1560, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-44831", 1540, 30)
```

```
{
Outlier("IA", 1);
};
R_Date("GrA-45521", 1500, 45)
{
Outlier("IA", 1);
};
R_Date(" GrN-16080", 1750, 35)
{
Outlier("IA", 1);
};
Sum("Average G (12)")
{
color="Red";
};
Interval("Duration G");
};
Boundary("End G")
{
color="Darkgreen";
};
};
Sequence("H")
{
Boundary("Start H")
{
color= "Darkgreen";
};
Phase("All Dates H")
{
R_Date("GrA-45518", 1510, 45)
{
Outlier("IA", 1);
};
R_Date("OxA-14019", 1559, 24)
{
Outlier("SL", 0.05);
};
R_Date("GrA-25590", 1425, 35)
{
Outlier("SL", 0.05);
};
R_Date("GU-9323", 1420, 45)
{
Outlier("IA", 1);
};
Sum("Average H (4)")
{
color="Red";
};
Interval("Duration H");
};
Boundary("End H")
{
color="Darkgreen";
};
};
Sequence("I")
{
Boundary("Start I")
{
color= "Darkgreen";
};
Phase("All Dates I")
{
R_Date("GrN-16726", 1565, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-43425", 1530, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-50053", 1440, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-48237", 1425, 40)
{
Outlier("IA", 1);
};
Sum("Average I (4)")
{
color="Red";
};
Interval("Duration I");
};
Boundary("End I")
{
color="Darkgreen";
};
};
};
```

ASSPs By Decoration Model (J-M)

```
Plot()
{
Outlier_Model("IA",Prior("Charcoal_Pl
us"),U(0,3),"t");
Sequence("J")
{
Boundary("Start J")
{
color= "Darkgreen";
};
Phase("All Dates J")
{
R_Date("Poz-69383", 1840, 50)
{
Outlier("IA", 1);
};
R_Date("Poz-69385", 1785, 30)
{
Outlier("IA", 1);
};
R_Date("Poz-69386", 1740, 30)
{
Outlier("IA", 1);
};
R_Date("OxA-15964", 1735, 55)
{
Outlier("IA", 1);
};
R_Date("GrA-43415", 1720, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43416", 1690, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-48240", 1725, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-49923", 1675, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-44840", 1705, 35)
{
Outlier("IA", 1);
};
R_Date("GrN-16078", 1645, 25)
{
Outlier("IA", 1);
};
R_Date("GrA-43689", 1590, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-32242", 1550, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-16724", 1450, 45)
{
Outlier("IA", 1);
};
R_Date("GrA-43431", 1625, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43255", 1855, 30)
{
Outlier("IA", 1);
};
R_Date("Poz-69388", 1675, 30)
{
Outlier("IA", 1);
};
Sum("Average J (16)")
{
color="Red";
};
Interval("Duration J");
};
Boundary("End J")
{
color="Darkgreen";
};
};
Sequence("K")
{
Boundary("Start K")
{
color= "Darkgreen";
};
Phase("All Dates K")
{
R_Date("GrA-32125", 1760, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-28354", 1745, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44422", 1650, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-45176", 1625, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43418", 1615, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44420", 1595, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-23456", 1575, 40)
{
Outlier("IA", 1);
};
R_Date(" GrN-16080", 1750, 35)
{
Outlier("IA", 1);
};
Sum("Average K (8)")
{
color="Red";
};
Interval("Duration K");
};
```

```
Boundary("End K")
{
color="Darkgreen";
};
};
Sequence("L")
{
Boundary("Start L")
{
color= "Darkgreen";
};
Phase("All Dates L")
{
R_Date("GrA-45845", 1795, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44595", 1780, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44419", 1615, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-24189", 1610, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-13369", 1600, 40)
{
Outlier("IA", 1);
};
R_Date("GrN-10945", 1665, 50)
{
Outlier("IA", 1);
};
R_Date("GrN-32041", 1600, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-43426", 1570, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43677 ", 1570, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43675 ", 1570, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-44414", 1560, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-45517", 1560, 60)
{
Outlier("IA", 1);
};
R_Date("GrA-23497", 1650, 50)
{
Outlier("IA", 1);
};
R_Date("GrA-45178", 1550, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44831", 1540, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-16726", 1565, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-43425", 1530, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-45518", 1510, 45)
{
Outlier("IA", 1);
};
R_Date("GrA-45521", 1500, 45)
{
Outlier("IA", 1);
};
R_Date("GrA-50053", 1440, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-48237", 1425, 40)
{
Outlier("IA", 1);
};
R_Date("GU-9323", 1420, 45)
{
Outlier("IA", 1);
};
Sum("Average L (22)")
{
color="Red";
};
Interval("Duration L");
};
Boundary("End L")
{
color="Darkgreen";
};
};
Sequence("M")
{
Boundary("Start M")
{
color= "Darkgreen";
};
Phase("All Dates M")
{
R_Date("Poz-69385", 1785, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-45845", 1795, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44595", 1780, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-32125", 1760, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-28354", 1745, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43415", 1720, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43416", 1690, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44422", 1650, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-44420", 1595, 35)
{
Outlier("IA", 1);
};
Sum("Average M (9)")
{
color="Red";
};
Interval("Duration M");
};
Boundary("End M")
{
color="Darkgreen";
};
};
};
```

HS by Form Type Model

```
Plot()
{
Outlier_Model("SL",T(5),U(0,4),"t");
Outlier_Model("IA",Prior("Charcoal_Pl
us"),U(0,3),"t");
Sequence("HS A")
{
Boundary("Start HS A")
{
color= "Darkgreen";
};
Phase("All Dates HS A")
{
R_Date("GrA-25592", 1440, 35)
{
Outlier("SL", 0.05);
};
R_Date("OxA-13966", 1425, 27)
{
Outlier("SL", 0.05);
};
R_Date("Poz-68798", 1910, 80)
{
Outlier("IA", 1);
};
R_Date("Poz-69388", 1675, 30)
{
Outlier("IA", 1);
};
R_Date("Poz-81078", 1540, 30)
{
Outlier("IA", 1);
};
Sum("Average HS A (5)")
{
color="Red";
};
Interval("Duration HS A");
};
Boundary("End HS A")
{
color="Darkgreen";
};
};
Sequence("HS B")
{
Boundary("Start HS B")
{
color= "Darkgreen";
};
Phase("All Dates HS B")
{
R_Date("GrA-44418", 1550, 35)
{
Outlier("IA", 1);
};
```

```
R_Date("GrN-16082", 1550, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-44834", 1535, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-43693", 1525, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-16540", 1505, 40)
{
Outlier("IA", 1);
};
R_Date("GrN-16076", 1500, 35)
{
Outlier("IA", 1);
};
R_Date("GrN-16081", 1475, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44824", 1380, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-44825", 1290, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-16541", 1280, 50)
{
Outlier("IA", 1);
};
Sum("Average HS B (10)")
{
color="Red";
};
Interval("Duration HS B");
};
Boundary("End HS B")
{
color="Darkgreen";
};
};
Sequence("HS C")
{
Boundary("Start HS C")
{
color= "Darkgreen";
};
Phase("All Dates HS C")
{
R_Date("GrN-16341", 1545, 35)
{
Outlier("IA", 1);
};
R_Date("GrN-16547", 1515, 45)
{
Outlier("IA", 1);
};
R_Date("GrN-16083", 1510, 25)
{
Outlier("IA", 1);
};
R_Date("GrA-44835", 1495, 35)
{
Outlier("IA", 1);
};
R_Date("GrA-48234", 1475, 40)
{
Outlier("IA", 1);
};
R_Date("GrN-16727", 1320, 50)
{
Outlier("IA", 1);
};
R_Date("GrA-48233", 1310, 40)
{
Outlier("IA", 1);
};
R_Date("GrN-16545", 1300, 40)
{
Outlier("IA", 1);
};
R_Date("GrN-16725", 1285, 40)
{
Outlier("IA", 1);
};
R_Date("GrN-16544", 1270, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-48242", 1380, 30)
{
Outlier("IA", 1);
};
R_Date("GrA-23454", 1540, 45)
{
Outlier("IA", 1);
};
R_Date("GrA-23455", 1515, 45)
{
Outlier("IA", 1);
};
R_Date("GrN-16723", 1470, 50)
{
Outlier("IA", 1);
};
R_Date("GrN-16721", 1730, 60)
{
Outlier("IA", 1);
};
R_Date("GrN-16722", 1900, 70)
{
Outlier("IA", 1);
};
Sum("Average HS C (15)")
{
color="Red";
};
Interval("Duration HS C");
};
Boundary("End HS C")
{
color="Darkgreen";
};
};
Sequence("HS D")
{
Boundary("Start HS D")
{
color= "Darkgreen";
};
Phase("All Dates HS D")
{
R_Date("OxA-13967", 1510, 26)
{
Outlier("SL", 0.05);
};
R_Date("OxA-13752", 1502, 27)
{
Outlier("SL", 0.05);
};
R_Date("GrA-48239", 1490, 40)
{
Outlier("IA", 1);
};
R_Date("GrN-10944", 1490, 30)
{
Outlier("IA", 1);
};
R_Date("OxA-13707", 1398, 25)
{
Outlier("SL", 0.05);
};
R_Date("GrA-48831", 1355, 30)
{
Outlier("SL", 0.05);
};
R_Date("GrN-16542", 1335, 40)
{
Outlier("IA", 1);
};
R_Date("GrA-44317", 1590, 30)
{
Outlier("IA", 1);
};
R_Date("GrN-7499", 1460, 50)
{
Outlier("IA", 1);
};
R_Date("OxA-13709", 1459, 29)
{
Outlier("SL", 0.05);
};
R_Date("GrA-25923", 1400, 35)
{
Outlier("SL", 0.05);
};
R_Date("OxA-13726", 1509, 27)
{
Outlier("SL", 0.05);
};
R_Date("GrA-25589", 1385, 35)
{
Outlier("SL", 0.05);
};
Sum("Average HS D (13)")
{
color="Red";
};
Interval("Duration HS D");
};
Boundary("End HS D")
{
color="Darkgreen";
};
};
};
---------------------------------------
```