'Riveted Mounts' Reconsidered: Horn Composite Combs in Early Medieval Britain, Ireland and France

IAN RIDDLER, NICOLA TRZASKA–NARTOWSKI AND JEAN SOULAT

Riveted bone strips have been described variously as 'riveted mounts' or the components of combs. They are examined here and interpreted as connecting plates from horn composite combs. This comb type came into use during the ninth century and quickly became the most common form of the Late Saxon period, continuing in use until the twelfth century. It is essentially an Anglo–Saxon comb form but examples have been found also in Dublin and across numerous sites in northern France. Connecting plates, made of antler or bone, occur in three basic shapes. Horn composite comb waste assemblages from Norwich, Thetford and Winchester suggest that by the late eleventh century commodity–based manufacture had superseded earlier forms of material–centred production.

INTRODUCTION

Two recent publications dealing with small finds from different sites in Winchester highlight a difficulty that has emerged in the interpretation of a specific Late Saxon object type. Within one of the reports, an assemblage of riveted bone strips is briefly noted (Cool 2011a, 308, 324, fig. 7.30.311 and 314, fig. 7.31.332). They are described as 'a large number of the somewhat enigmatic riveted mounts whose precise function is unknown' (ibid., 308). Yet this is a surprising statement, when a slightly earlier report on small finds from elsewhere in Winchester refers to them as connecting plates from composite horn combs (Rees et al. 2008, 235). Moreover, this earlier report notes the presence of one example (catalogue no. 1616) but fails to recognize that two further strips (catalogue no. 1615) also belong to the same object type. Later in the same report another example is described as 'probably plates from a two-piece knife or tool handle' (ibid., 309, no. 2220). There is clearly some confusion shared by many archaeologists about these objects. This paper aims to resolve this confusion by a consideration of the specific characteristics of the artefacts, including their material and the nature of their riveting, seen alongside their dating and their distribution, both in England and on the Continent.

RIVETED MOUNTS AND HORN COMPOSITE COMBS

Rectangular strips of antler or bone with two or more rivet holes first came to prominence in the archaeological literature in England with the publication of assemblages

from Late Saxon towns. Several examples of tenth- to eleventh-century date from Lincoln were regarded by Mann as bone connecting plates for composite combs (Mann 1982, 7–8). They differed from the other composite combs from the site in terms of their material (utilizing bone rather than antler), their lack of decoration and the relative crudeness of their manufacture. Their crude nature was interpreted as an indication that they were unfinished combs. An undecorated antler connecting plate of D-shaped section with widely spaced rivets and saw marks suggesting the presence of coarse and fine teeth was regarded as part of a double-sided handled comb (ibid., 8). However, MacGregor's publication of a horn composite comb with riveted bone connecting plates from Victoria Street in London strongly suggests that the Lincoln connecting plate also belongs to this class of comb, even though it is made of antler, rather than bone (MacGregor 1985, fig. 52). The Lincoln and London connecting plates share the use of three widely-spaced iron rivets and the presence of saw marks from the cutting of fine teeth on one side of the comb and coarse teeth on the other. They differ only in their choice of material.

The interpretation of these antler and bone strips as connecting plates for horn composite combs was therefore laid out clearly by Arthur MacGregor in his influential monograph of 1985. Yet he was not entirely convinced by the interpretation, noting that the presence of bone connecting plates on a horn comb formed 'a feature which is therefore difficult to explain' (MacGregor 1985, 95). To put it in other words: why would horn combs require relatively crude bone connecting plates? This point was taken up by Martin Biddle in his publication of eleven examples of animal rib composite strips from excavations in Winchester undertaken between 1961 and 1971 (Biddle 1990, 678–90). He suggested that they may have been intended 'to stiffen the horn, to keep it flat, and to prevent it curling, especially if it got wet' (ibid., 678–79). In a near-contemporary publication dealing with a small assemblage of these bone strips from London, Frances Pritchard noted that they 'were presumably added for practical reasons to help stabilize the horn in a flat state' (Pritchard 1991, 199). As an alternative, however, Biddle noted that they may have been provided as skeumorphs of the connecting plates of contemporary antler composite combs, thereby fulfilling a symbolic role, rather than a practical function (Biddle 1990, 679). In later articles, MacGregor was quite disparaging about these animal rib connecting plates, noting that 'later horn combs have no such strengthening strips and it may be that their use here implies a phase when techniques were still far from perfect and when inexpertly flattened horn had to be held in shape with splints' (MacGregor 1989, 112) and 'since they have no connecting function, [they] must have been designed to prevent the comb from warping, a device that no self-respecting medieval horner would have countenanced' (MacGregor 1998, 17).

The small sample of these animal rib strips from Winchester showed some variety in shape and riveting, allowing Biddle to separate them into four types:

A rectangular strips of *c.* 80–90 mm in length, fastened by two iron rivets;
B rectangular strips of *c.* 120–160 mm, fastened by three iron rivets;
C rectangular strips of *c.* 135 mm in length, fastened by two iron rivets;
D decorated strips with a flat baseline and lightly curved opposite face.

Surviving examples of horn composite combs with bone connecting plates from both London and York were invoked in support of this sequence. Even as this typology was published, however, an alternative interpretation of riveted bone strips was presented with the first of a series of volumes describing excavations at Thetford (Rogerson and Dallas 1984). Large quantities of worked bone waste were encountered in the north-western corner of Site 1092, apparently reflecting the manufacture of rectangular strips of animal rib. These were not regarded as combs, however: 'Their short length, the lack of incisions along their long edges, and the fact that they are set so far apart, all suggest that they are not bone comb connecting plates' (Rogerson and Dallas 1984, 167). These continuing doubts about the interpretation of rectangular bone strips as the components of horn composite combs were reiterated by Arthur MacGregor in his publication of forty-five examples from Coppergate at York (MacGregor et al. 1999, 1952–54). This is one of the largest samples of these objects to have been published to date, and it included bone strips fastened with two, three and four iron rivets. MacGregor noted that eight of the mounts had saw marks on one or both edges but, on the other hand, no vestige of horn could be seen on any of them, even when they remained riveted together as pairs of plates. He concluded that 'their function elsewhere is every bit as obscure as it is at Coppergate' (ibid., 1954). He described them as 'riveted mounts', a term that has been used in subsequent reports, as noted above.

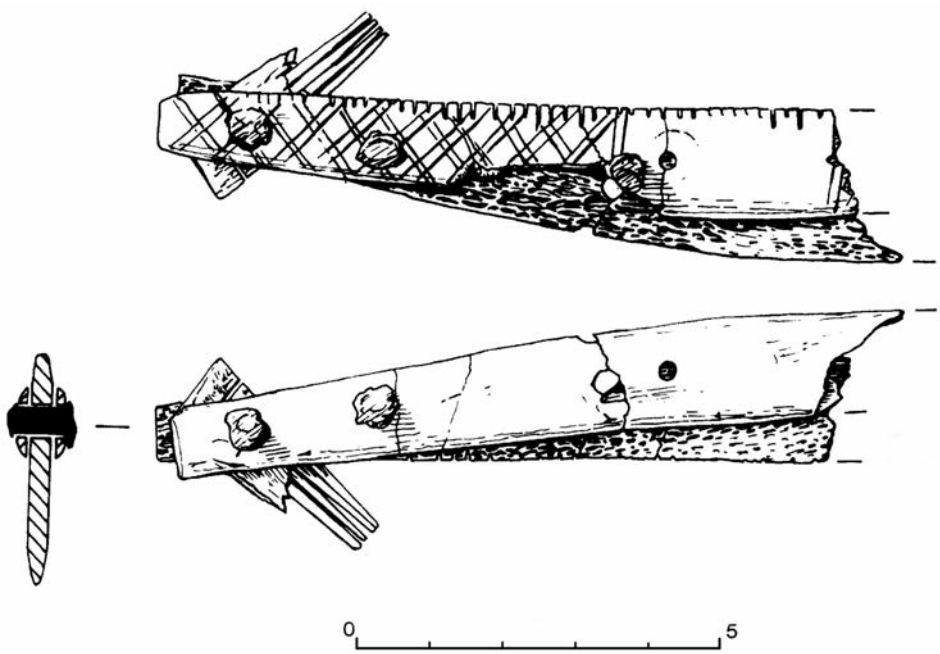
It is easy to see, therefore, why there is a measure of confusion concerning these objects within the series of Winchester small finds volumes. In two of the volumes they are described as combs, in the other they are riveted mounts. Moreover, by no means every example is given the same, consistent interpretation. It is nonetheless possible to decide between these alternatives and to provide a viable interpretation of their use, on the basis of sequences of these objects that are shortly to be published from Dublin and Ipswich (Riddler et al. forthcoming; Riddler and Trzaska-Nartowski forthcoming a). There are just ten of these objects from Dublin, yet they clearly extend the distribution of the object type beyond England, they include some closely dated examples and they come from a settlement where horn waste, horn implements and horn combs have occasionally been found. Ipswich has a large sample of these bone strips from excavations undertaken between 1974 and 1994. The corpus extends to ninety-two examples, occurring in both bone and antler. Although not as well-dated as the Dublin assemblage, this group is significant for its sheer size, as well as the range of forms present.

OBJECTIONS TO THE HORN COMPOSITE COMB

The argument in favour of describing these objects as riveted mounts is, in effect, a reaction to their interpretation as combs and it does not actually provide a different functional interpretation for them. Rather, a healthy scepticism concerning the comb interpretation has led to the use of an alternative, functionally neutral term for them. The objections to the use of rectangular strips of bone or antler as the connecting plates for horn composite combs can be summarized as follows:

1 the lack of incisions along their long edges;
2 the wide spacing between pairs of bone or antler strips and between their rivets;
3 the absence of any traces of horn on the inner faces of the strips;
4 the presence of an additional perforation on two Winchester examples;
5 their crude nature and seemingly inexplicable function.

Each of these objections can be considered in turn. In the first instance, it is certainly true that not all riveted bone strips have incisions along their long edges. Viewed closely, these incisions can be seen to have been cut with the aid of a saw, rather than a knife. Some strips have saw marks on two edges, some on one edge, and some on neither edge. The quantity of each group of marks is set out by percentage in Table 1 for a selection of Late Saxon settlement sites. With the exception of Ipswich, at least 50% of the bone or antler strips from the remaining sites have no saw marks visible on either long edge. Yet this observation itself presupposes that composite combs, of whatever type, *must* include saw marks from the cutting of their teeth. In fact, this is by no means the case. A number of Middle Saxon single and double-sided composite combs, for example, have connecting plates that are decorated on one side and are entirely blank on the other side (Illus. 1). Moreover, on the double-sided horn composite comb from York (Illus. 2) saw marks are present on one edge of one connecting plate, but do not appear at all on the other connecting plate. This indicates that the teeth were cut from one side of the horn sheet only. The absence of saw marks is not,



ILLUS. 1 Middle Saxon antler and bone composite comb from Abbotts Worthy, Hampshire (after Fasham and Whinney 1991, fig. 36) Scale 1:1

therefore, an argument against the identification of bone or antler strips as connecting plates for horn composite combs. Biddle (1990, 682) has rightly noted that where saw marks are absent, it merely means that the cutting of the comb teeth stopped short of the connecting plates. It is also clear that the teeth were cut after the connecting plates had been fastened to the horn at the centre.

Secondly, the wide spacing between pairs of bone or antler strips has also been noted and, for Thetford at least, used as an objection to their interpretation as comb connecting plates. The internal space between strips varies from 4–8 mm, with 5–6 mm forming the most common interval. This is considerably wider than the space

ILLUS. 2 Horn composite comb from York. Courtesy of Yorkshire Museums

TABLE 1 Percentage of saw marks on riveted bone and antler strips from selected sites

	Saw Marks on two edges	Saw Marks on one edge	No Saw marks	Reference
Dublin	0.0	50.0	50.0	Riddler and Trzaska-Nartowski forthcoming
York Coppergate	5.0	7.5	87.5	MacGregor, Mainman and Rogers 1999
Winchester	17.2	17.2	65.6	Biddle 1990; Cool 2011
Thetford	25.0	12.5	62.5	Rogerson and Dallas 1984; Dallas 1993; Riddler 2004
Southampton	33.3	16.7	50.0	Unpublished Archive Reports
Ipswich	54.8	13.1	32.1	Riddler, Trzaska-Nartowski and Hatton forthcoming

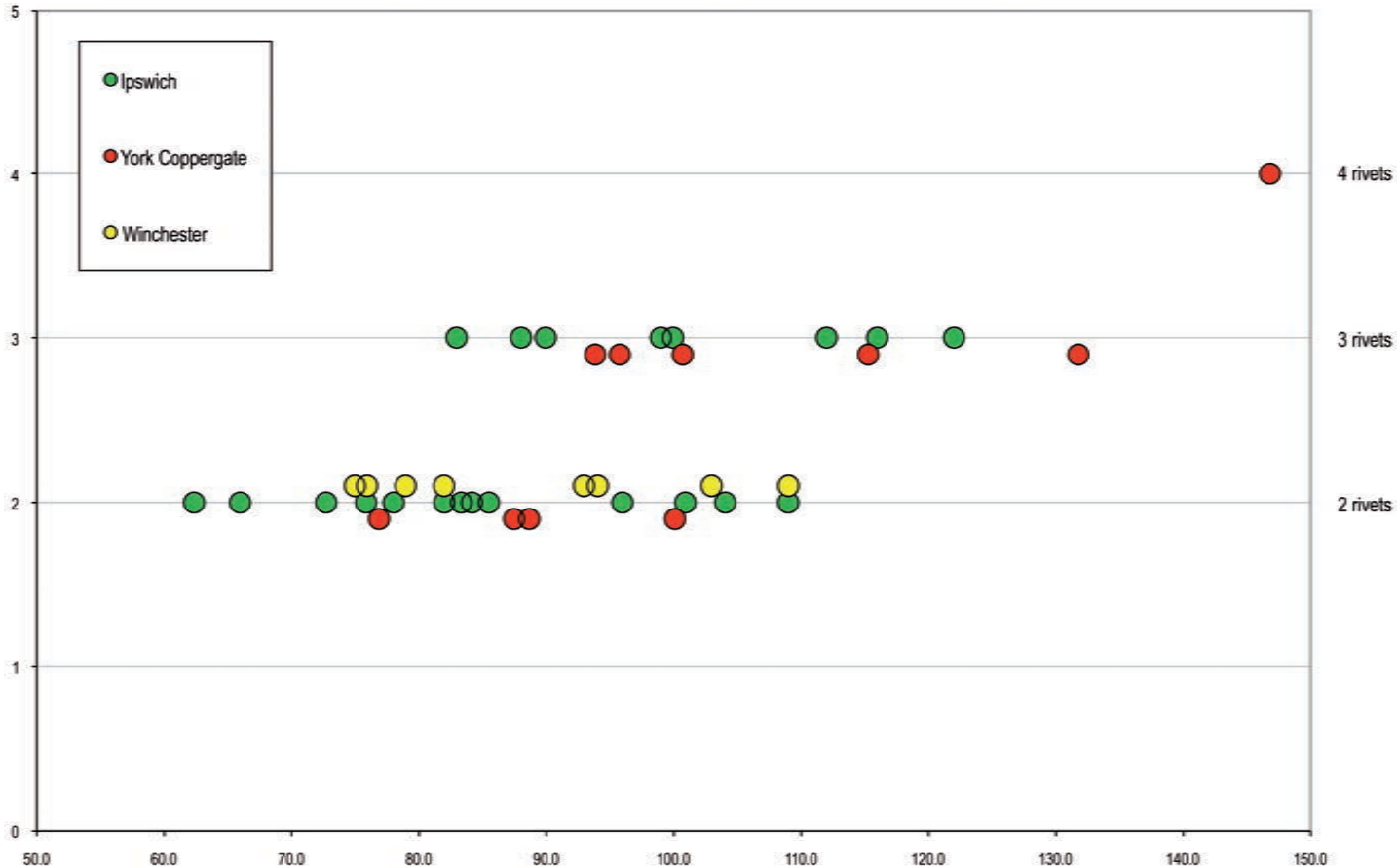
between the connecting plates of antler composite combs, where the tooth segments usually occupy a width of 2–3 mm. A minority of specific Middle Saxon comb types do have wider tooth segments, of 4 mm or more (Riddler 1993a, 116). Moreover, with a few rare exceptions described below, the spacing is based on the thickness of a sheet of horn, rather than the thicknesses of antler tooth segments. A remarkable series of fifteen double-sided simple combs of horn survive from Dublin and these vary from 4 mm to 5 mm in thickness; the horn composite comb from Milk Street in London also includes a sheet of horn around 4 mm in thickness (Riddler and Trzaska-Nartowski forthcoming a; Pritchard 1991, fig. 3.80). The sheets of horn utilized for combs are therefore significantly thicker than antler tooth segments and this forms a simple explanation for the wider spacing between pairs of riveted bone or antler strips. In addition, they would have been significantly longer than antler tooth segments, and they would not have required as many rivets to secure them to the connecting plates.

All of the rivets identified within this object type are made of iron. They are widely spaced along the length of each bone or antler strip, with intervals between them that are much greater than those between the rivets of contemporary antler composite combs. If each pair of strips secured a single sheet of horn, closely spaced rivets would be unnecessary, and they are extremely rare with this object type. One example of closely spaced riveting on antler strips is described below. The Winchester typology was based, in part at least, on the assumption that shorter strips (type A) would require two rivets, and longer strips (type B) would be equipped with three rivets. This was generally — but not entirely — applicable to the small sample of bone strips from London (Pritchard 1991, 199). Using a wider sample of complete or near-complete examples from Ipswich, Winchester and Coppergate at York it is clear that there is an overlap in sizes between plates fastened with two or three rivets (Illus. 3). Pairs of

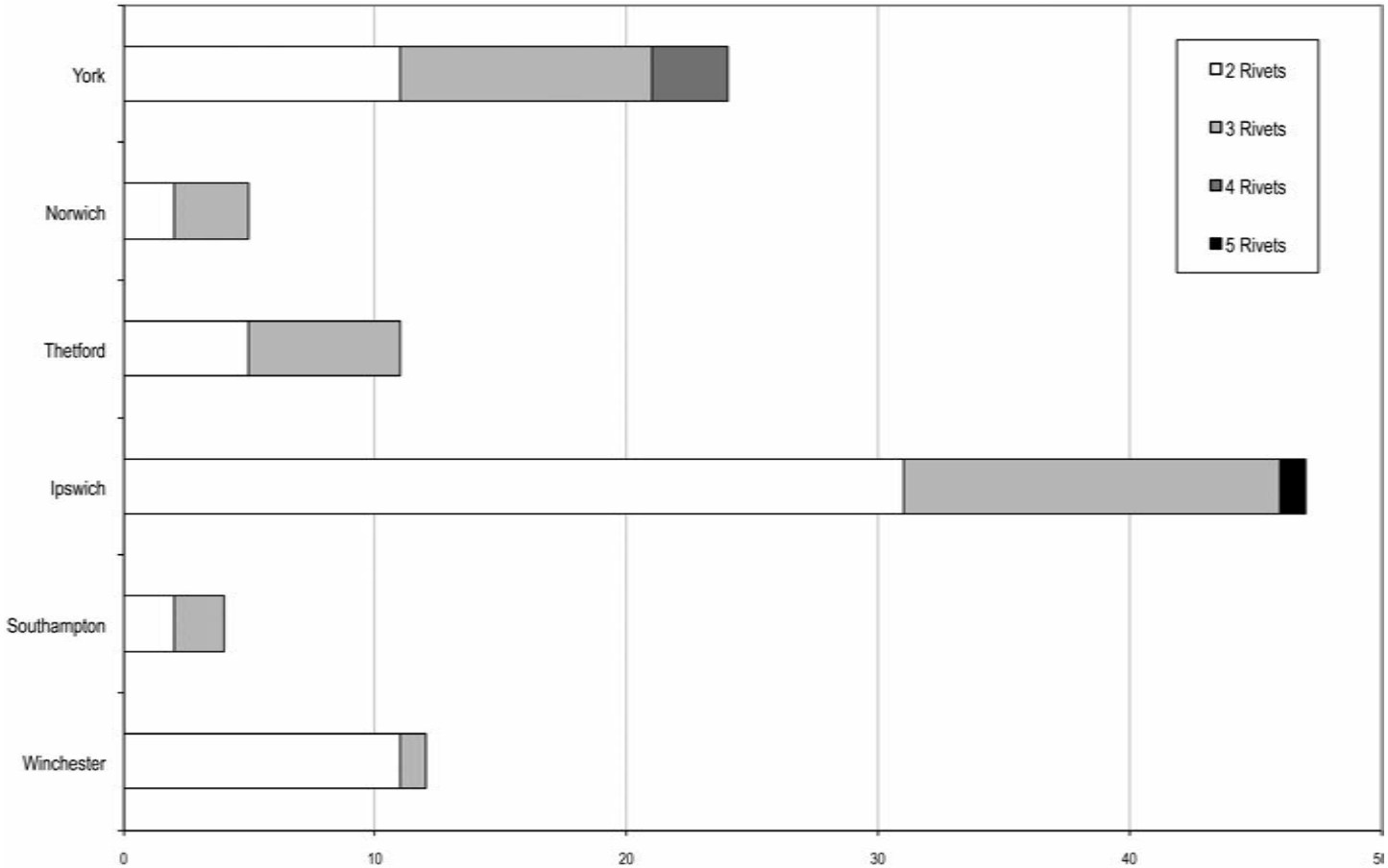
strips fastened with two iron rivets extend from 60–110 mm in length, whilst those with three rivets extend from 80–135 mm. The majority of bone or antler strips from each site are secured with either two or three iron rivets (Illus. 4). At Winchester the preference seems to have been overwhelmingly in favour of two rivets, with eleven examples identified, against just one certain example of a strip with three rivets. Coppergate at York, in contrast, has relatively even quantities of strips with two or three rivets, and includes a small number of strips with four rivets, an arrangement hardly seen anywhere else (MacGregor et al. 1999, fig. 912). An incomplete pair of strips from Ipswich retains traces of five iron rivets, whilst a recently excavated example from Hungate in York has six rivets (Nicky Rogers, pers. comm.). There may be regional distinctions or localized, workshop-based differences in the quantity of rivets utilized but beyond Ipswich, York and Winchester the samples involved are unfortunately relatively small. It can at least be said that two-rivet combs predominate at Winchester, are dominant to a lesser extent at Ipswich and are no more common than three-rivet combs at York.

The third observation is based on the assemblage from York, where a close examination of the strips failed to reveal any traces of horn on their inner surfaces (MacGregor et al. 1999, 1953). Four fragments of horn waste were recovered from Coppergate, but they survived in poor condition (ibid., 1899 and 2047). Horn degrades very easily in the ground and it is rarely found, other than in a mineralized state. In particular, mineralized horn survives on knife handles of the Early Anglo-Saxon period, (Watson 1988; Riddler and Trzaska-Nartowski 2011, 122–23 and fig. 7.2). No traces of horn have been noted on strips from Thetford or Winchester, but they do occur at both Ipswich and Dublin, and not only in mineralized form (Illus 5 and 6). It is important to note also the difference between traces of mineralized horn on knife tangs and its presence on bone or antler strips. In the former case the inner part of the horn is in close contact with the knife tang and becomes mineralized, whereas surviving horn composite combs show that the horn is not as firmly held by the iron rivets or the bone connecting plates, and is only mineralized when in contact with the iron rivets (MacGregor 1985, fig. 52; Pritchard 1991, fig. 2.80; Biddle 1990, fig. 187). Against a background of the very poor and unpredictable survival of horn, arguments based on its absence — rather than its presence — should not be given too much significance. Rather, it should be noted that traces of horn do occur occasionally on the inner surfaces of bone or antler strips, and can be seen on two examples from Ipswich (Illus. 5); and this tends to endorse their identification as the components of horn composite combs. Cool has succinctly noted that 'in such circumstances, it could be argued that the absence of any trace of horn teeth plates cannot be taken as evidence that they [bone or antler strips] were not comb side plates' (Cool 2011b, 83).

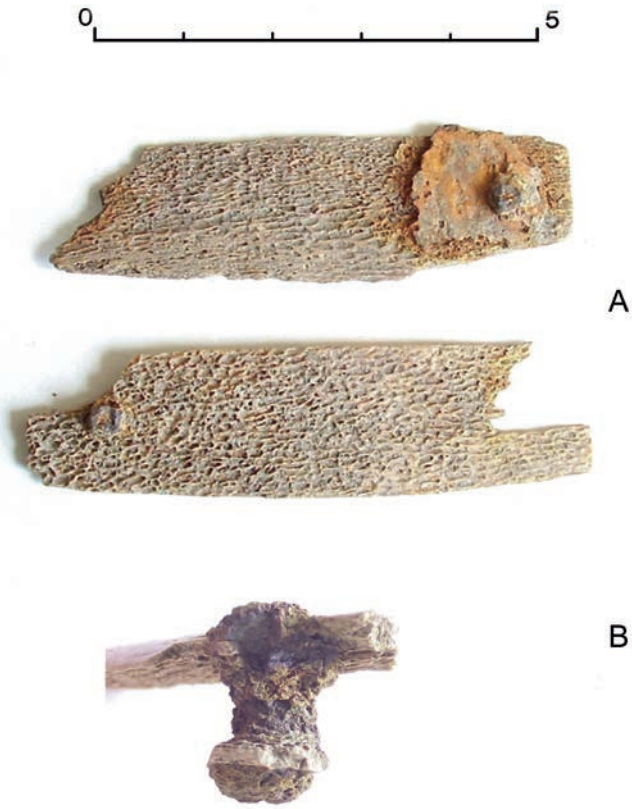
Two bone strips from Winchester include pairs of iron rivets, but also have additional perforations close to one end. Biddle (1990, 680) suggested that one of these examples may derive from a comb case rather than a horn composite comb, on the basis largely of a comparison with comb cases from York, which include suspension holes at their ends (Waterman 1959, pl. XIX. 4 and 7). A second strip from Winchester has an additional perforation but also traces of saw marks on both edges,



ILLUS. 3 Lengths of bone or antler strips in relation to the quantity of rivets



ILLUS. 4 Quantities of rivets fastening bone or antler strips from selected sites

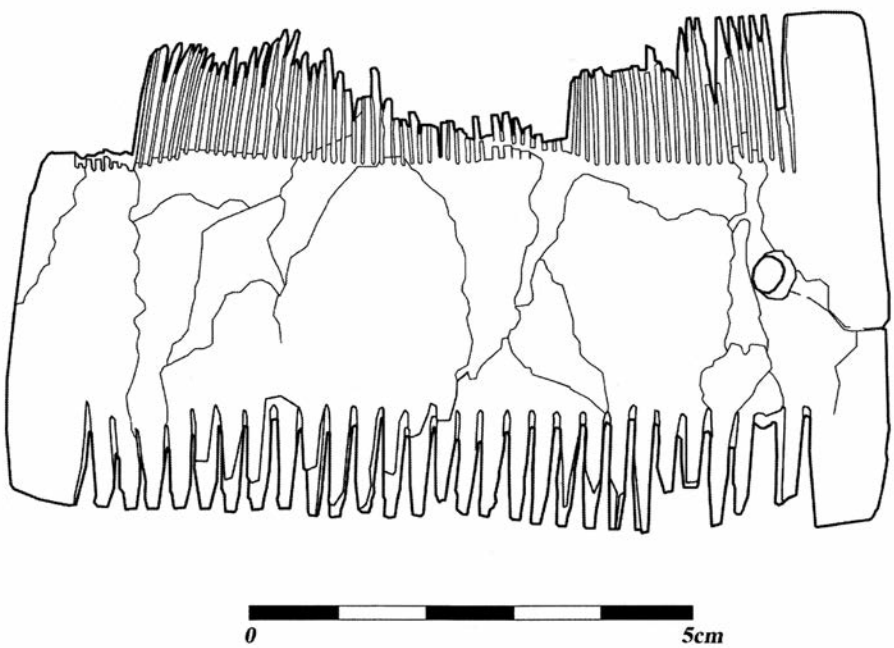


ILLUS. 5 (right) Traces of mineralised horn on a horn composite comb from Ipswich (after Riddler et al. forthcoming). Courtesy of Suffolk County Council Archaeology Service

ILLUS. 6 (below) Fragment of a horn sheet lying between two bone strips on a comb from Dublin (after Riddler and Trzaska-Nartowski forthcoming a). Courtesy of the National Museum of Ireland)

indicating that it is not a comb case. This led Cool to question what the function of the additional perforation might be, noting that 'Now that two examples have shown the additional hole in the same place, it becomes more difficult to interpret it as a misplaced rivet hole' (Cool 2011b, 83). In reality there is a slight confusion here between horn composite combs and antler comb cases, as well as between peg holes for cases and suspension holes for combs. Antler comb cases are comparatively rare across the entire Anglo-Saxon period and seldom extend to more than 5% of any comb assemblage. All of those examined by the authors over the last thirty years are made entirely of antler (aside from their rivets) and there is no single, certain example of a comb case that includes bone connecting plates. In that case, why do these strips include additional rivet holes? The most likely answer is that these are suspension holes, enabling the comb to be worn at the waist, suspended from a belt. It is noticeable that the York horn composite comb includes a suspension hole in the lower corner, beyond the set of coarse teeth (Illus. 2). Three of the horn combs from Dublin also include suspension holes and in two cases they are set towards one side of the central area of the comb, almost precisely in the position where the extra holes on the Winchester horn composite combs would have been placed, in relation to the horn sheet itself (Illus. 7). Although these are double-sided simple combs of horn and not horn composite combs, the suspension holes are set in the same place.

A summary has already been made above of previous attempts to answer the final objection to viewing these bone strips as the connecting plates of horn composite



ILLUS. 7 Horn comb from Dublin High Street (E43:1407) (after Riddler and Trzaska-Nartowski forthcoming). Drawn by Darko Vuksic, © National Museum of Ireland

combs, which is their relatively crude nature. In addition, Ashby (2010, 111–12) has summarized an alternative function proposed for these objects as bone clamps, securing antler tooth segments prior to the cutting of comb teeth but, as noted above, the spacing between the plates is too wide for this purpose, and the presence of a third, central rivet on some examples would make the procedure very difficult. Those strips equipped with four, five or six rivets are even less likely to have been used for this purpose. Why would horn composite combs require such crude connecting plates? A noticeable characteristic of the horn combs from Dublin is their tendency towards a curved section following their deposition, as they return to their original form. The same tendency can be seen on modern horn combs that have not been deposited in the ground, particularly when they are in contact with moisture, and with that in mind the bone or antler connecting plates would undoubtedly have fulfilled a useful function as strengtheners, as argued by Biddle and Pritchard, essentially keeping the sheet of horn as flat as possible. The horn of the York composite comb has curved away from its connecting plates, following its prolonged deposition in the ground, and this emphasizes the requirement for a method of keeping the horn sheet flat. Indeed, it is possible that moisture was a problem with horn composite combs because hair was being combed whilst it was wet. Biddle (1990, 679) suggested that the connecting plates may have been skeumorphs and this should also be considered. With connecting plates attached, these combs resemble earlier and contemporary double-sided composites more closely, and they themselves become composite combs. The addition of connecting plates distinguishes them from double-sided simple combs, which also occur in Late Saxon contexts, if rarely. It aligns them with double-sided composite combs, the specific comb type which they may have directly succeeded.

HORN COMPOSITE COMBS: CHRONOLOGY AND DISTRIBUTION

The five objections listed above can all be refuted and these objects should be regarded as the connecting plates of combs, as suggested in several recent texts (Riddler 2004, 64; Ashby 2007, 2). The term 'connecting plates' is retained here, although it is recognized that the bone strips of horn composite combs do not fulfil the same function as the connecting plates of composite combs. It is argued, therefore, that the term 'riveted mounts' should be abandoned in favour of 'horn composite combs'. This term is preferred to 'horn and bone composite combs' or 'bone-and-horn combs' because the connecting plates can be made of either bone or antler. Nine of the ninety-two examples of horn composite comb connecting plates from Ipswich are made of antler and other examples are known from Lincoln, York and possibly from Norwich (Riddler et al. forthcoming; Mann 1982, fig. 4.29; MacGregor et al. 1999, table 175; Margeson 1993, fig. 33.409). The earliest connecting plates for horn composite combs have been found in contexts of the mid- to late-ninth century and they include four examples from *Hamwic*, three of which were found in the Six Dials area of the settlement, as well as two examples from Dublin (Riddler and Trzaska-Nartowski forthcoming a). One of the Winchester connecting plates came from a context possibly of early ninth-century date, whilst a pair of bone connecting plates

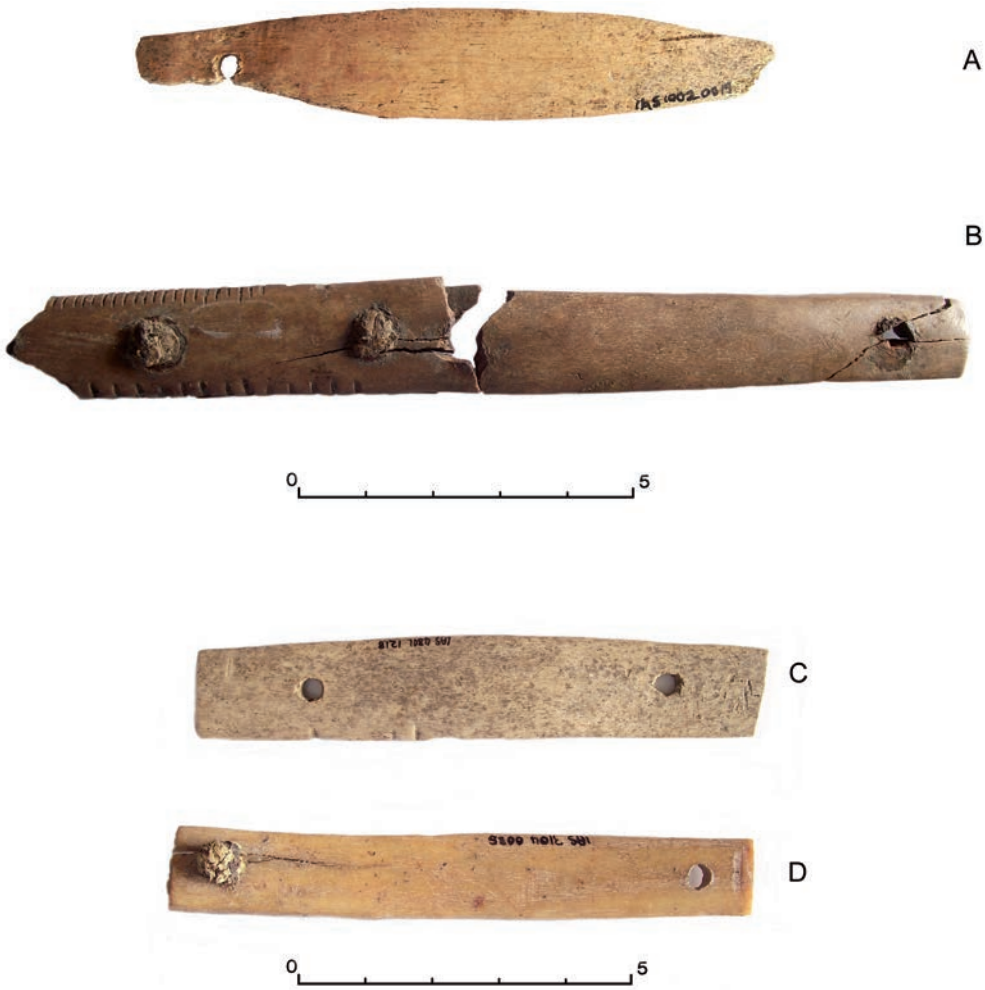
from Coppergate was retrieved from a Period 3 context, of mid-ninth to early tenth-century date (Biddle 1990, 686; MacGregor et al. 2015, table 175 and fig. 912.6917). The majority of examples come from contexts of the mid-tenth to mid-eleventh century, placing them firmly within the Late Saxon period (MacGregor et al. 1999, 1952; Cool 2011b, 83). The latest examples come from contexts of twelfth- to thirteenth-century date at Dover and Winchester (Riddler and Walton Rogers 2006, 263; Biddle 1990, 688, no. 2189F). A possible example from a mid-fourteenth to fifteenth-century context at Norwich Castle is likely to be residual (Huddle 2009a, 147). Seven examples from York came from medieval (Period 6) deposits and ten pieces from Ipswich were also found in medieval contexts that are not closely dated (MacGregor et al. 1999, table 175; Riddler et al. forthcoming). This provides the possibility that the comb type continued into the thirteenth century, although it should be noted that at the majority of sites there are no examples from contexts later than the twelfth century (Margeson 1993, 66).

The animal rib connecting plates of this comb type can be quite irregular in shape, as seen with the York comb (Illus. 2) but it is possible to distinguish three principal forms:

1 rectangular, with either a flat or a lightly curved baseline (Illus 8b and d);
2 crescentic, with a flat baseline and a curved back (Illus. 8c);
3 bow-shaped, with both long edges curved and tapering to either end (Illus. 8a).

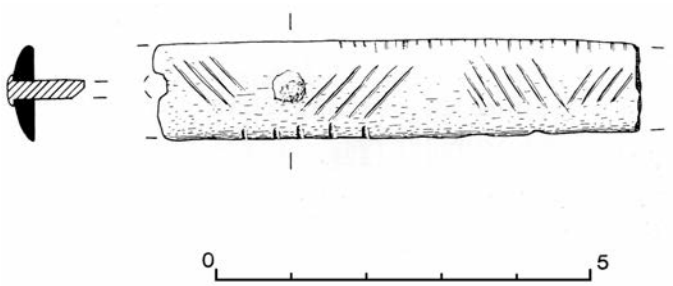
Connecting plates of rectangular shape dominate the assemblages from all of the Late Saxon settlements. Crescentic forms represent 22.5% of the assemblage from Ipswich and can be seen also at Bishopstone and Thetford (Ashby 2010, fig. 6.12.30; Rogerson and Dallas 1984, fig. 188.24 and 26; Riddler 2004, fig. 42.503). Four examples of bow-shaped connecting plates were identified at Ipswich, and they have also been found at Norwich (Huddle 2009a, fig. 4.69.1079). With the benefit of a large sample of these comb connecting plates from Ipswich, it has been possible to examine changes in their design over time. Few changes can actually be seen, however. Antler examples occur in even measure from the ninth century to the twelfth century and there is no preference for them at a particular time. The earlier part of that period has been portrayed as a 'Golden Age' for antler working (MacGregor 1985, 48; Riddler and Trzaska-Nartowski 2011, 125–26), when red deer antler was widely available as a raw material, which would explain its occasional use for this comb type. The three forms of connecting plate identified above also occur across the entire time period. The one area where a slight change can be observed lies in the tooth values (i.e. number of teeth per centimetre) of these combs.

As noted above, saw marks from the cutting of teeth in the horn sheet can be seen on a number of these connecting plates, either on one or both long edges. In the case of the Bishopstone comb, where both fine and coarse saw marks occur on a single edge, it has been suggested that the comb itself could have been single-sided (Ashby 2010, 112). This remains a possibility, but it is a little more likely that the comb was double-sided. The York comb shows how some of the connecting plates retain saw marks on one edge alone, even though the comb is double-sided. Moreover, the sequence of fifteen horn combs from Dublin includes just one single-sided example,



ILLUS. 8 Connecting plates for horn composite combs from Ipswich (after Riddler et al. forthcoming). Courtesy of Suffolk County Council Archaeology Service

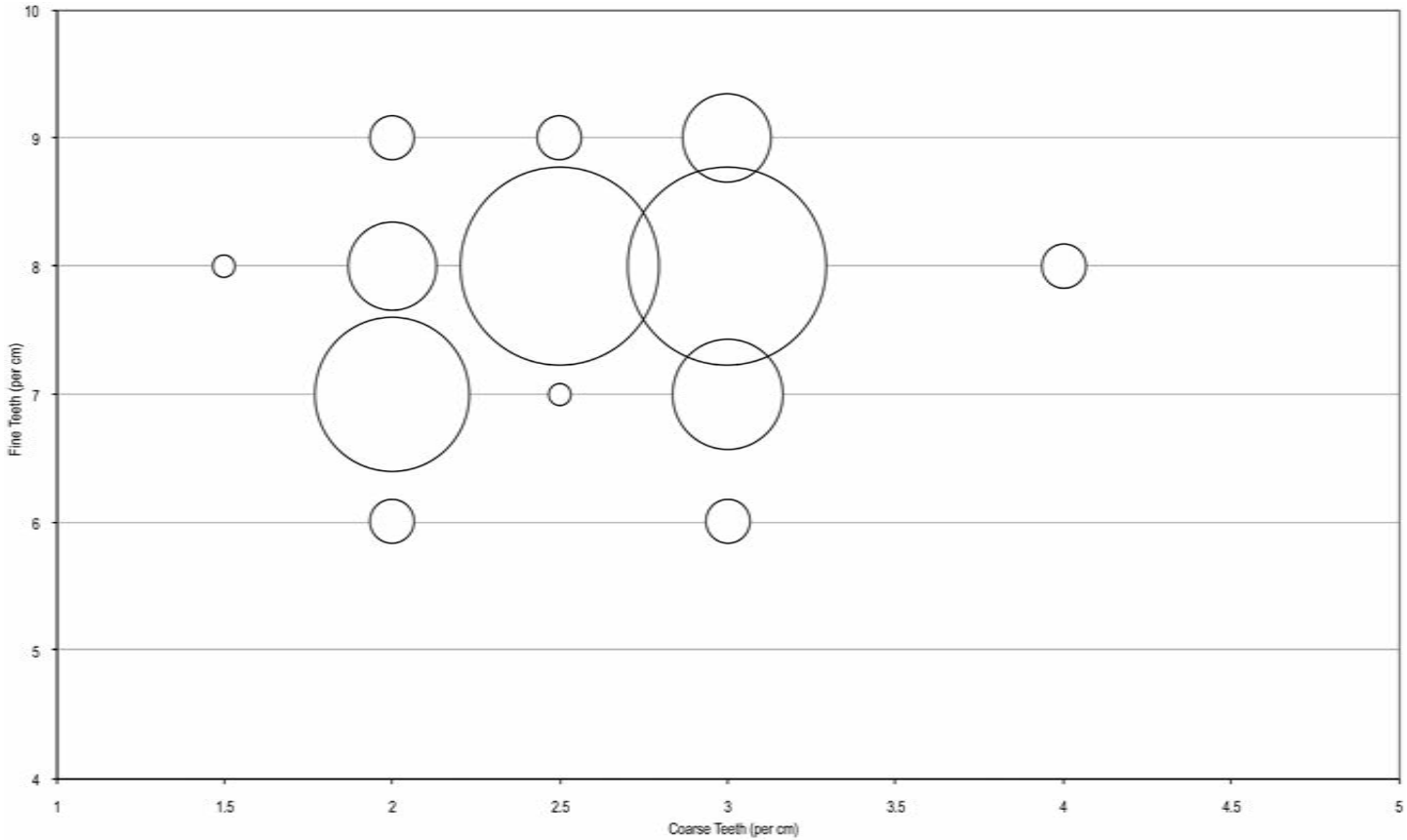
and that is of post-medieval date; and the three surviving English examples of horn composite combs that retain their sheets of horn are all double-sided as well (Riddler and Trzaska-Nartowski forthcoming a). It should also be noted that the technology of these combs involved the cutting and flattening of a single sheet of horn, which was secured between the connecting plates, and it is rhomboidal-shaped sheets that have survived as combs and are echoed in the sawn horn cores and other waste products of Late Saxon England. In effect, the form of the horn sheet dictated the shape of the comb itself. Thus, although it is possible that some horn composite combs were



ILLUS. 9 Horn composite comb from Bishopsgate, Norwich (after Margeson 1993)

produced in a single-sided form, there is no conclusive evidence for this as yet. Post-medieval single-sided simple combs of horn were made in that form but early medieval composite examples have yet to be conclusively identified. The Bishopstone comb is significant, however, for the presence of both fine and coarse saw marks on one long edge, providing tooth values of four and eight teeth per centimetre (Ashby 2010, 113). Few other horn composite combs show this feature, although the manner in which the fine saw marks stop at the midway point along a decorated connecting plate from Norwich (Illus. 9) suggests that the other half of this comb, most of which does not survive, may have been designed in a similar way (Margeson 1993, fig. 33.409). A close parallel is also provided by a horn composite comb from Portchester (Cunliffe 1975, fig. 117.104). The tooth values of the saw marks have seldom been recorded on combs of this class, in part perhaps because of the confusion over the nature of the object type. They have often been noted, but have seldom been measured. With the exception of the Bishopstone and Portchester combs, where they are present they indicate the cutting of coarse teeth on one side of the comb, and fine teeth on the other. Within the sample that has been measured, the coarse teeth vary from two to four per centimetre, and the fine teeth from six to nine (Illus. 10). A study of the Ipswich assemblage suggested that the fine teeth became coarser over time, with eight teeth per centimetre common in late ninth to tenth century contexts, supplanted by six to seven teeth per centimetre in contexts of the eleventh century or later (Riddler et al. forthcoming). At Ipswich, combs with three rivets are as common as those with two rivets in the earlier period, but from the eleventh century onwards most of the horn composite combs have connecting plates fastened with just two rivets (Table 2).

The third characteristic that may change over time is the length of the connecting plates. Within the Ipswich sample, the connecting plates of horn composite combs have an average length of 103.8 mm across the ninth and tenth centuries, but that figure drops to 83.8 mm for the eleventh to twelfth centuries. It is difficult to see any overt reduction in connecting plate lengths across the Winchester and York assemblages, but the possibility remains that connecting plates of the later combs were shorter in length. Taking these two characteristics together, it appears that horn composite combs may have been produced to a shorter and smaller design from the



ILLUS. 10 Tooth values for horn composite combs. Diameter of each circle represents number of examples from one to nine

TABLE 2 Quantities of rivets for Ipswich horn composite combs by period

	Numbers of Rivets:		
Dating:	Two	Three	Five
ELS: Later 9th to mid-10th century	5	3	1
MLS: Mid-10th century to *c.* 1000	4	7	
EMED: 11th and 12th century	17	3	
MED: 12th to 15th century	1	1	
Undated	4	1	

eleventh century onwards, with fewer teeth per centimetre cut on the fine side of each comb, and with two rivets securing the connecting plates, rather than three.

The majority of the connecting plates from horn composite combs are undecorated. Just five examples from Ipswich are decorated, representing 5.4% of the sample. The decoration follows a restricted range of linear designs and consists either of single saltires, continuous saltire patterns or continuous chevrons formed from paired diagonal lines. The patterns are generally unbounded. Similar decoration can also be seen on horn composite combs from London and Thetford (Pritchard 1991, fig. 3.81.221; Rogerson and Dallas 1984, fig. 188.26; Biddle 1990, 679 note 5). The connecting plates of horn composite combs can, therefore, be readily identified and distinguished from animal rib strips used as casket mounts, which can be of a similar size, and sometimes include iron rivets. The latter are decorated in a much wider range of patterns, including ring-and-dot designs, lattice mesh, continuous diagonals and decorative perforations (MacGregor et al. 1999, 1954–60; Vanhaeke 1997; Legoux 2012, 103 and figs 122–23). Ring-and-dot patterns, in particular, occur frequently on casket mounts but have yet to be identified on horn composite comb connecting plates. In general, there is an abhorrence towards undecorated space on casket mounts, whilst the reverse is true for the connecting plates of horn composite combs.

Horn composite combs have a relatively crude appearance, in comparison with the elegant sequences of composite combs that preceded them (MacGregor 1985, figs 49 and 51). Most of them were made from domestic animal bone and horn, commodities that were less suitable for comb manufacture than antler (MacGregor 1985, 25–29); but these were readily available materials. Horn composites are analogous to handled combs, produced from the early eighth century onwards, many of which are made of bone, rather than antler. In this case the choice of bone may have reflected a shortage of antler supply coupled, as here, with a huge and abundant supply of the skeletal remains of domesticates (Riddler and Trzaska-Nartowski forthcoming b). It is also conceivable that both handled combs and horn composite combs represented a lower level of comb product, below composite combs of antler, with ivory combs forming the top level of demand.

WASTE ASSEMBLAGES

Most of the comb assemblages noted above have come from Late Saxon towns and it has rightly been noted by Ashby (2010, 112) that it is unusual to find horn composite combs in rural contexts. This still remains the case, although they are not entirely absent from the countryside, or from sites outside of towns. One example is known from a medieval context at the monastery of Wearmouth (Riddler 2006, 273), whilst another was recovered from a Late Saxon context at Steyning in Sussex (Riddler 1993b, 52–53). Waste assemblages from the manufacture of horn composite combs, however, are confined to towns. They include an assemblage of 589 fragments of worked cattle-sized mammal rib from Property SE 3 at Snitheling Street, Winchester, found in the same pit as 'appreciable quantities' of horn cores, mainly of cattle (Ford and Teague 2011, 155, 206–7 and 356–57). The fills of the pit date to the Anglo-Norman period, *c.* AD 1050–1225. The property lay immediately adjacent to a contemporary stone chapel. An assemblage of more than 600 fragments of animal rib came from several layers lying over a ditch forming a part of the town defences, located in the north-western corner of Site 1092 at Thetford (Rogerson and Dallas 1984, 57, 167, 192, 199 and pl XXII). They included twenty-eight examples with perforations of 1.9 to 3.4 mm in diameter. A smaller assemblage of 202 fragments was found at Norwich Castle, the waste largely stemming from the fills of two refuse pits of Period 2.1 (*c.* AD 1067–1094) located within the south bailey (Huddle 2009b, 348). One of the pits also included an assemblage of twelve cattle horn cores.

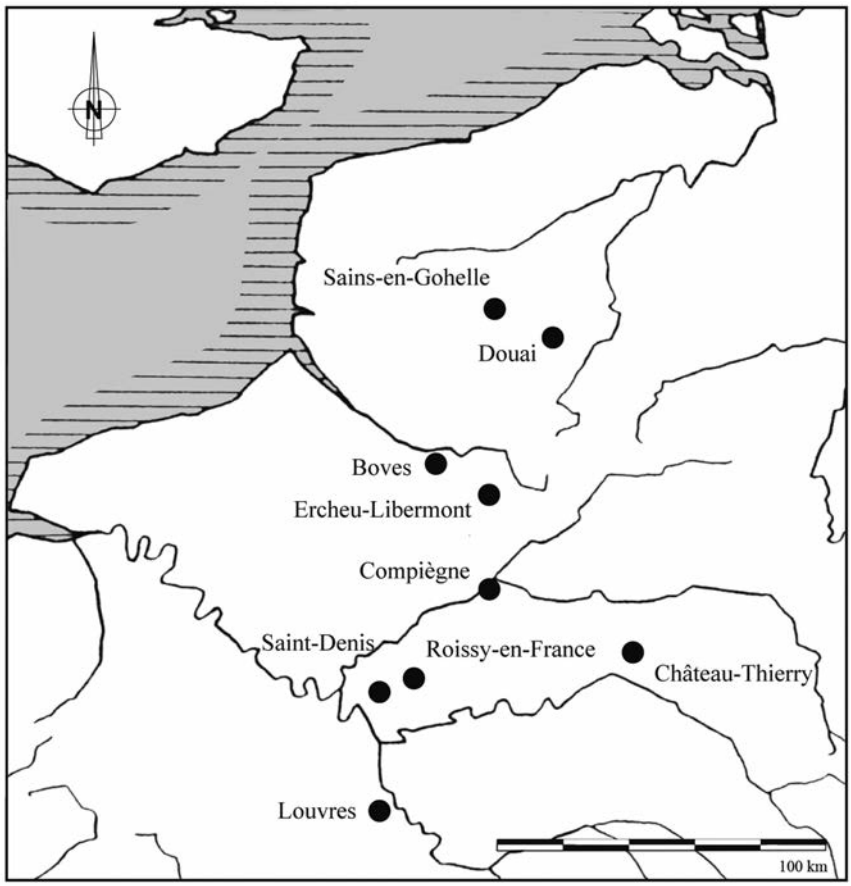
All three assemblages are of an appreciable size and include several hundred fragments of shaped animal ribs, some of which had fractured in the course of being perforated, and had been discarded. In two cases the animal ribs were accompanied by horn cores, mostly of cattle. The presence of waste confined entirely to cattle-sized animal ribs, found alongside horn cores in the same context, links the two materials together and suggests that the worked animal ribs were connected with horn working. MacGregor has suggested that horn working was almost exclusively an urban craft, because of the volume of raw material that was required (MacGregor 1989, 119). However, he has noted that concentrations of horn cores can also be linked to tanning, rather than horn working. The major distinction to be noted in waste assemblages is that tanning waste usually includes quantities of metapodia and phalanges alongside the horn cores, indicating that the skins were acquired with the foot bones still on them, a practice that was retained in Europe until comparatively recently (MacGregor 1998, 14). The foot bones could be detached and boiled in order to produce neatsfoot oil, a valuable leather dressing (Serjeantson 1989, 141). In some cases the horn cores have been crudely perforated, to enable them to be hung on hooks to make the handling of the skins easier (MacGregor 1989, 119; Albarella et al. 2009, 1030). It has also been pointed out, however, that in any case the horns retained on skins intended for tanning may still have made their way to the horn worker in the course of processing (MacGregor 1998, 21; Serjeantson 1989, 139). Assemblages of waste stemming from the production of horn composite combs have rightly been identified from the presence of worked animal ribs, accompanied in some cases by quantities of horn cores, but without the presence of significant numbers of foot bones.

HORN COMPOSITE COMBS IN NORTHERN EUROPE

The horn composite comb seems to be essentially, but not entirely, an Anglo-Saxon object. In previous texts it has been stated that its distribution is confined to England or the British Isles (Riddler 2004, 64; Ashby 2010, 112) but this statement needs to be amended (cf. Ashby 2011). Ten examples are known from Dublin, currently the only site in Ireland where they have been found (Riddler and Trzaska-Nartowski forthcoming a) where they span the period from the ninth to the twelfth century. They represent less than 1% of the total number of combs from the National Museum's excavations in Dublin. It is unlikely that horn composite combs (or indeed any form of Anglo-Saxon composite comb) were traded or exchanged on any scale. Combs appear to have been made locally in numerous workshops and regional preferences can be identified across the Anglo-Saxon period (Riddler and Trzaska-Nartowski 2011, 130 and 133–36; Riddler and Trzaska-Nartowski forthcoming b). Horn composite combs may therefore provide an index of identity, indicating the presence of Anglo-Saxons in the Viking-period town. More recently, they have also been found in northern France.

In France, studies have been undertaken of bone and horn objects found recently at the sites of Château-Thierry (Aisne), Saint-Denis (Île-de-France) and Boves (Somme) (Goret 1997; 2004; Chandeveau 2002; 2012, 121–60). These analyses have identified and described horn composite combs, as well as providing a dating framework for them (Chaoui-Derieux and Goret 2009, 270; Chandeveau 2012, 107–17). The distribution of this type of comb in France (Illus. 11) shows its association with different kinds of settlements: urban sites such as Saint-Denis and Douai (Nord) (Chaoui-Derieux and Goret 2009, 270), rural settlements such as Sains-en-Gohelle (Pas-de-Calais) (T. Oueslati, pers. comm.), Roissy-en-France, Louvres (Val-d'Oise) and Ercheu-Libermont (Somme) (Chaoui-Derieux and Goret 2009, 269; Gentili 2000, 126; Soulat 2011) but also aristocratic sites such as Château-Thierry, Boves, Compiègne and Blois (Loir-et-Cher) (Goret 1997, 122–26; Chandeveau 2002, 45–47; Petitjean and Jabukowski 1997, 301–02; Aubourg and Josset 2003, 192–93). Thus the apparent restriction of such combs mainly to urban settlements in England and Ireland is not repeated in France. The chronology of these finds covers the period between the ninth and the eleventh century, a slightly shorter time span than that suggested for England (Petitjean and Jabukowski 1997, 301; Chaoui-Derieux and Goret 2009, 269–70). French examples are of a similar size to the English series, not exceeding 120–135 mm in length, and the same can be said for the small series of these objects from Dublin (Chaoui-Derieux and Goret 2009, 269; Riddler and Trzaska-Nartowski forthcoming a). Horn composite combs with two or three rivets dominate the French sample, as in England. A search for horn composite combs beyond Ireland and France in published literature has so far failed to reveal any further examples.

The quantity of horn composite combs from these sites, alongside the sheer range of contexts and settlement types in which they have been found, suggests that they are not necessarily a straightforward index of Anglo-Saxon presence in northern France, although strong Anglo-Saxon influence is likely. The situation is relatively simple in Ireland but could be a little more complicated on the Continent, where these combs



ILLUS. 11 Distribution of horn composite combs in northern France

are more common. At Compiègne, for example, two of the six comb fragments are horn composites, and at Château-Thierry the figure is similar, with four horn composites against seven combs of antler or bone (Petitjean and Jabukowski 1997, fig. 10b; Goret 1997, 122–26, figs 6.3, 6.5 and 14). If they are relatively common in northern France, they are abundant also in Late Saxon England. This is not quite so apparent at Coppergate in York, where forty-five horn composite combs can be set alongside 136 fragments of antler or bone composite combs, the latter figure excluding individual tooth segments found separately from other comb elements. Horn composite combs provide roughly 40% of the comb assemblage. It should be noted that they can be readily distinguished from antler composite combs, even where the horn composites have antler connecting plates. Beyond the use of fine teeth (which is not seen on antler composite combs at this time), the shape of the connecting plates and the very wide spacing of the iron rivets allows them to be recognized. At other sites, horn composite combs represent over 50% of the comb sample for the Late Saxon period.

At Winchester, a combined total of thirty horn composite combs can be compared with twenty-five fragments of antler or bone composites (55%), whilst for Ipswich the figures are ninety horn composites, against seventy-three combs of antler or bone (55%). By the Late Saxon period, therefore, horn composite combs were as common in some settlements as combs made of other materials.

MacGregor has viewed horn workers as separate artisans from antler or bone workers, a viewpoint sustained, in part, by their subsequent medieval history. Thus, horners and cutlers obtained their own guilds; antler and bone workers did not (MacGregor 1998, 20–21). Horn composite combs represent a rare example of an early medieval composite object that utilizes three separate materials: horn, bone (or antler) and iron. They are conceivably the products of horners, but recent work has shown that the antler worker, the bone worker and the horn worker could be the same person, particularly in the Middle Saxon period. Waste assemblages from *Hamwic* include offcuts of antler and bone, as well as sawn sections of horn core, in the same context, indicating that all three materials were being worked in unison. The same situation prevails with at least some of the waste assemblages from *Lundenwic* (Riddler and Trzaska-Nartowski 2011, 124–25 and 129; Haslam et al. forthcoming; Riddler and Trzaska-Nartowski forthcoming b). The immediate background to the advent of the horn composite comb is therefore one of sedentary workshops within urban environments producing a wide range of implements of bone, antler and horn, and sometimes mixing these materials together (Riddler and Trzaska-Nartowski 2011, fig. 7.5). At this period the horn worker is clearly not a separate individual. This situation continues into the earlier part of the Late Saxon period at least and can be emphasized by examining two unusual combs, one coming from Ipswich and the other from York.

A comb from a late ninth- to mid-tenth-century context at Franciscan Way in Ipswich has been included in the survey of horn composite combs because it has antler connecting plates of cylindrical form and at one end its rivets are widely spaced, with no saw marks present (Illus. 8b). Yet the other end of this comb is quite different. It includes traces of four closely-spaced iron rivets and saw marks indicating that one side of the comb included three teeth per centimetre, and the other had seven teeth per centimetre. The wide internal spacing of the two connecting plates, which are 6 mm apart, suggests that a single sheet of horn was placed between them, but only half of the comb includes saw marks, and only half of the comb has closely-spaced rivets. A horn sheet may have been secured by the connecting plates, but the nature of one half of the comb is a little uncertain. Closely spaced riveting is more redolent of antler composite combs and it is possible that this example utilized a small horn sheet across half of the comb and antler tooth segments across the other half. If this seems a little strange, it can be compared with a comb from York, where precisely this arrangement occurs (Illus. 12). The comb includes antler tooth segments along half of its length and widely spaced rivets enclosing a sheet of horn across the other half, with no saw marks present there. The comb is an old discovery, not published by Waterman (1959), and currently curated in the Yorkshire Museum. On typological grounds, it can be dated broadly to *c.* AD 950–1050. Widely spaced riveting occurs also on half of a comb from Lund, with closely spaced riveting across the remainder, and this may well be another example of an admixture of materials, and not a question of a comb repair or

ILLUS. 12 Antler and horn composite comb from York, with detail of horn sheet. Courtesy of Yorkshire Museums

modification (Persson 1976, 319–21 and fig. 289.12A). It is possible that this comb was made in York and not at Lund; it is an unusual form for Scandinavia (Riddler and Trzaska-Nartowski forthcoming a). A different admixture occurs on a comb from Hungate in York, where antler tooth segments and closely spaced rivets occupy one half of the comb, and the other half is blank, with widely spaced rivets. Analysis of the comb suggests that the section which no longer retains any tooth segments includes traces of wood on its rivets (Sonia O'Connor and Nicky Rogers, pers. comm.). These combs clearly indicate that the horn worker could also be the antler comb maker, and that wood could also be used with composite combs of antler.

By the later eleventh century, material-based crafts were being transformed into product-based manufacturing, which could encompass a number of materials. A good example of this transition is provided by an assemblage of sawn cattle metatarsals from a late eleventh or early twelfth-century pit at Wood Street in London, which represents part of the waste material from the manufacture of rings, produced both in bone and in shale (Pritchard 1991, 154–55, 156 and 175). The entire assemblage is based on the production of a single object type, and the same can be said also of the three urban waste assemblages described above from Norwich, Thetford and Winchester. In each case, these appear to be assemblages of several materials geared towards the production of a single object type. The horn composite comb may have begun, therefore, as a commodity produced by an antler, bone and horn worker, but by the late eleventh century it was manufactured by a horner, who was conceivably a specialist dealing exclusively with combs. This change in working behaviour may lie behind the subtle differences noted at Ipswich, with the design of the connecting plates becoming more formalized, with two rivets representing the standard riveting pattern and with fewer teeth per centimetre on the fine side of a comb that was probably a little smaller in size. It may also be a consequence of changes in raw material supply. MacGregor (1985, 32; 1989, 113–14) has argued that supplies of antler may have been restricted, at least in part, by dramatic changes in the protection of red deer after the Norman Conquest. Those changes can be seen also in the post-cranial record for red deer, as noted by Sykes (2007, 66–75). The other side of the coin is seen in the urban environment, where horn and bone were becoming available in ever-increasing quantities (MacGregor 1998, 20). In a situation where red deer antlers were no longer readily available as a raw material, and where antler, bone and horn working may have become more of an urban activity, a transformation in working practices towards commodity-based specialists may have begun after the Norman Conquest (MacGregor 1989, 114; Riddler and Trzaska-Nartowski 2011, 132). The relatively subtle changes in the form of horn composite combs over time may also therefore reflect significant changes in their production circumstances.

CONCLUSION

The horn composite comb came into use in England and France, as well as in Dublin, during the ninth century. It was a double-sided composite comb designed with a set of coarse teeth and a set of fine teeth, and with connecting plates at the centre intended to keep the comb flat, particularly when the horn sheet was in contact with

moisture. The fine teeth extend from six to nine per centimetre (Illus. 10). Within the contemporary series of antler single-sided composite combs, examples with six teeth per centimetre are common, whilst those with eight or nine per centimetre are not. The horn composite seems to represent a radical transformation of comb design occurring at the end of the Middle Saxon period, effectively providing combs with fine teeth in a simpler and more rudimentary format. The appearance of double-sided composite combs with nine or more teeth per centimetre in Middle Saxon England may itself have been a response to an increased density of settlement, which led to problems with head lice and nits (Riddler and Trzaska-Nartowski 2011, 137 and fig. 7.6). Combs with five or six teeth per centimetre are not fine enough to deal with hair hygiene. The horn composite may well have been intended as a successor to Middle Saxon fine-toothed double-sided composites. The quantity of horn composite combs increases markedly across the Late Saxon period, whilst the number of double-sided composite combs drops sharply. At the same time, it is worth noting that the finest teeth on horn composite combs reach only nine per centimetre, whilst the Middle Saxon double-sided composite combs can include as many as fourteen teeth per centimetre. In effect, therefore, a whole range of combs with ten to fourteen teeth per centimetre disappear from the archaeological record by the late ninth century, as horn composite combs come into use. Equally, with separate sets of coarse and fine teeth on the same comb, horn composites both revisit and revitalize a format that occurs sporadically from the fourth century onwards in England. Thereafter, the format was retained, both with antler double-sided composite combs of twelfth century and later date, as seen with an example from Southampton published recently (Grant et al. 2011, 216–17 and fig. 5.51.6), and with double-sided simple combs, produced from the twelfth century onwards in a variety of materials.

It is clear also that a wealth of information about combs and comb making is still to be found in old collections, even when these assemblages have been published. Waterman (1959, 87–90) described a number of combs from earlier excavations in York but failed to publish them all, missing (amongst others) the comb described and illustrated here (Illus. 12), and further combs from subsequent work in the city also remain unreported. Old discoveries can be set within modern typological frameworks and — more importantly — they extend the range of forms present and provide valuable information about the technology of comb making.

Assemblages of waste material from the production of horn composite combs have been found in late eleventh to twelfth-century contexts at Norwich, Thetford and Winchester. They consist of fragments of animal rib, deposited alongside horn cores, and are therefore quite distinctive in nature. As yet, no earlier waste, of the Late Saxon period, can be securely attributed to horn composite comb manufacture, notwithstanding the number of combs of this period recovered from excavations. Viewed in a broader context, Late Saxon antler, bone and horn waste remains a scarce commodity, and material that can be attributed specifically to horn composite comb manufacture is harder to distinguish within assemblages that also include antler and bone waste stemming from the manufacture of other object types (Riddler and Trzaska-Nartowski 2011, 125–26). Each of the eleventh- to twelfth-century waste assemblages identified above includes several hundred fragments of animal rib, whilst

the quantity of horn cores also present is not generally known. This is unfortunate, because it may have been possible to calculate what the waste actually represents, in terms of the quantity of combs manufactured. At its simplest, each horn core could have provided a comb. Once the horn had been removed from the sheath and flattened, it was relatively easy to produce the comb itself, and each comb would have taken no more than a day to construct. At Norwich Castle, the only site for which sufficient data has been provided (Huddle 2009b, 347–48 and table 5.14), a pit containing 158 animal rib strips also included eleven horn cores of cattle and one of goat, providing a minimum estimate of twelve combs. Yet the number of fragments of animal rib, five of which were perforated, suggests that a much larger quantity of combs were made. Some Middle Saxon waste assemblages of antler, bone and horn appear to represent seasonal episodes of production, extending through the spring and summer, with composite combs forming the principal object type to be manufactured (Riddler and Trzaska-Nartowski forthcoming b). In the Anglo-Saxon period horn composite combs would initially have been made during these seasonal episodes, alongside other items. The transition to product-centred manufacture in the latter part of the eleventh century may well have extended the length of the working season, as well as the scale and intensity of production, but as yet there is not enough evidence to confirm this suggestion. The horn composite comb was a radical departure from earlier forms of comb making in Anglo-Saxon England and it endured for three centuries, effectively setting a template for comb design that continued throughout the medieval period.

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Ian Riddler and Nicola Trzaska-Nartowski
Email: trzaska@lineone.net
Jean Soulat, 7, rue due 11 novembre, 77920 Samois-sur-Seine, France
Email: jean.soulat@gmail.com