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Investigating and interpreting an early-to-mid sixth-century Frankish style helmet

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Summary In 2004 the Isle of Wight Metal-Detecting Club reported the discovery of fragmentary early Anglo-Saxon artefacts and associated grave goods at a site to the west of the island near Shorwell. The depth and scattered nature of the finds suggested that the graves in which the objects had originally been interred had been destroyed by plough-related subsoiling. Following a coroner's inquest, the finds were declared Treasure and acquired by the British Museum in 2006.

During a controlled excavation of the site a single remaining grave was identified that contained objects which suggested it represented a high status male 'warrior' burial of the sixth century. Among the assemblage was what was initially thought to be a very fragmentary iron 'vessel', but cleaning, consolidation and reconstruction of the pieces confirmed that the object was a helmet. Examination of its construction, aided by X-radiography and three-dimensional scanning, showed that the helmet was of composite construction and originally comprised eight separate plates riveted together. An encircling brow band had been riveted to a brow-to-nape band and two separate lateral bands, with the gaps left by this cruciform 'framework' backed by four sub-triangular infill plates. Examination of the associated mineral-preserved organic remains showed that stems of flax plants (*Linum usitatissimum*), Poaceae (grass family) stem fragments and shavings of Scots Pine wood (*Pinus sylvestris*) had been used as a grave lining and/or covering and that five different types of textile were in contact with the surface of the helmet. The inclusion of at least two textiles with fine and possibly complex weave patterns serves as a rare reminder that biodegradable objects as well as metals can feature in high status burial assemblages.

Only four other more or less complete helmets are known from the Anglo-Saxon period and these are all of a Nordic-influenced crested type. Parallels suggest that the Shorwell find not only predates these examples, but is unique as the only known example of a *bandhelm* found in the British Isles that is from Francia, or styled on the helmets of that region.

INTRODUCTION

Discovery

During 2004–2005 the Isle of Wight Metal-Detecting Club reported the discovery of fragmentary early Anglo-Saxon grave goods to their local Finds Liaison Officer as part of the UK Treasure process [1]. Following a coroner's inquest, the finds were acquired by the British Museum in 2006 and registered as items 2006,0305.1–2006,0305.73, with further finds from the site acquired subsequently. The graves must have been relatively shallow, since all but one (grave No. 69) had been severely disturbed by plough-related subsoiling.

When the single identifiable grave was excavated by members of the Isle of Wight Archaeology and Historic Environment Service in November 2004 it was found to contain what was provisionally identified as a fragmentary iron 'vessel' (2006,0305.67), an iron pattern-welded sword blade (missing its hilt), a silver pyramidal-shaped pommel (from the topsoil above the grave), part of a gilded copper alloy scabbard mouthpiece [2, 3],[1] the socket from a broken spearhead, a shield-boss with extended grip, a copper alloy buckle (perhaps from a sword belt), a clear, fluted glass vessel, the remains of a Celtic copper alloy hanging bowl with bird-shaped mounts and two pieces of flint that may have been worked, Figure 1. A square gold mount of Mediterranean origin inlaid with garnet and glass was found sufficiently close to the grave to be likely plough scatter

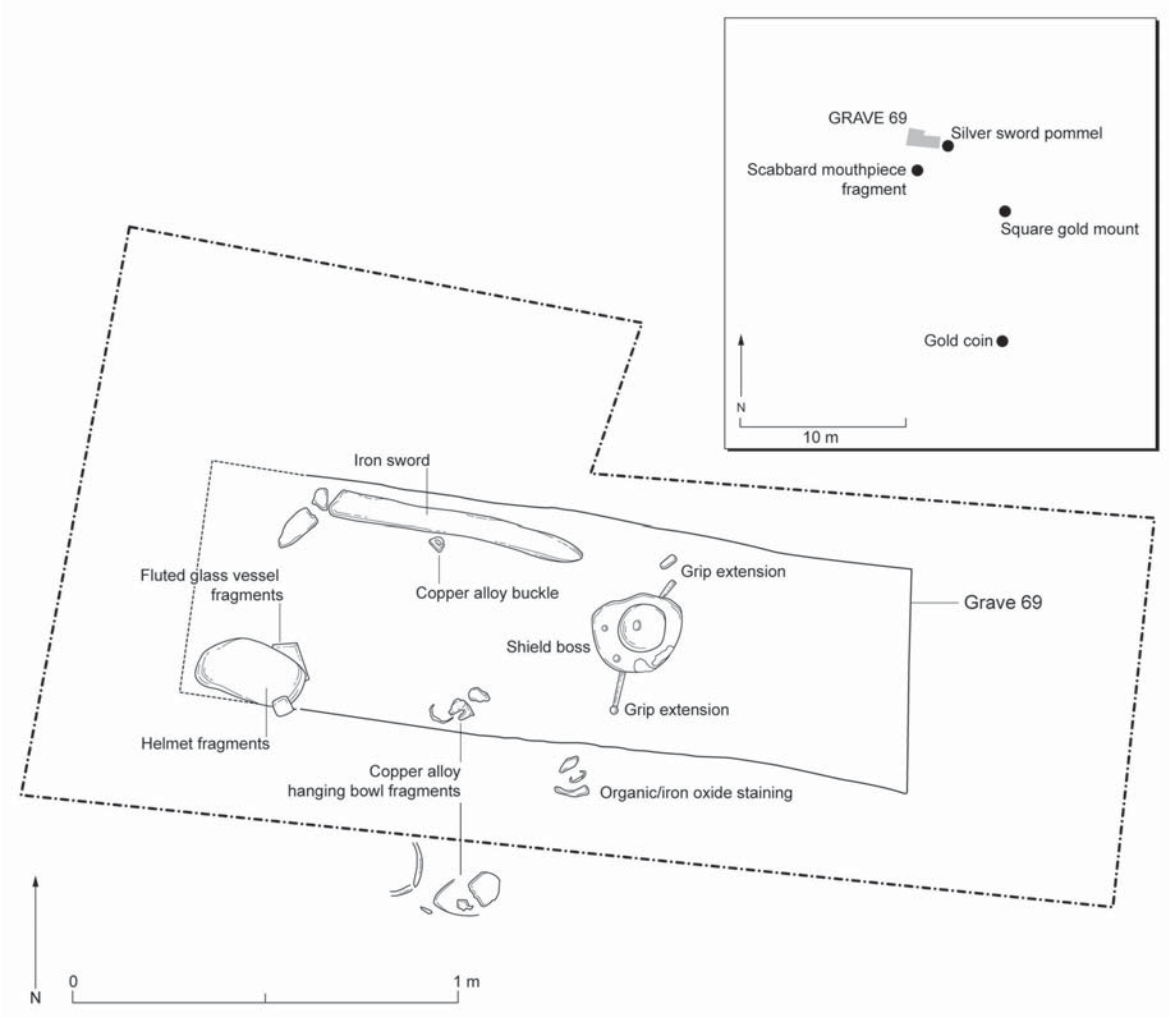

FIGURE 1. Grave plan with dissociated objects found out of context but in the immediate area plotted by Global Positioning System in the inset map. Drawing: Craig Williams after Rachel Salter.

from it. In 2007 a Merovingian or possibly Burgundian gold copy of a solidus of Anastasius I (reigned 491–518) was also found close by and is therefore probably similarly associated; it may be connected with the continental burial rite of 'Charon's obol', in which a coin is placed in or on the mouth of the deceased before burial [4].[2] The finds began to suggest that the grave contained an important, high status male 'warrior' burial of the late fifth or sixth century, possibly that of a Frank serving in the retinue of the local ruler. Since the fragmentary iron 'vessel' was located towards the head end of the grave, where a helmet might be placed, it was reconstructed in an attempt to confirm its identity.

Examination, investigative conservation and reconstruction

During excavation of the grave the iron 'vessel' was so fragmentary, with no clear relation or co-location of the pieces, that the excavation team lifted the fragments individually or in small groups where a correlation was obvious, rather than block-lifting the entire assemblage.

X-radiography, initially carried out by English Heritage and later at the British Museum once the objects had been acquired, was used as a means of sorting the fragments by density and curvature. An approach of minimal cleaning was adopted for each of the approximately 400 fragments in order to retain any mineral-preserved organic remains that might be better interpreted after reconstruction, Figure 2. It was clear that extensive corrosion, as well as some distortion, had occurred in the ground, which made establishing the co-location of fragments and their reconstruction into a three-dimensional object particularly complex. In some cases joins had to be made between delaminated layers of the same fragment as well as along the break edges. This was achieved using a cellulose nitrate-based adhesive, while consolidation was carried out with a 3–5% solution of Paraloid B72 (ethyl methacrylate copolymer) in acetone, applied with a micropipette and soft brushes. The break edges were supported by adding nylon gossamer tabs secured with adhesive and fills were made with fine, amorphous silica microballoons mixed with differing percentages of Paraloid B72 in acetone depending on the specific working properties required.

FIGURE 2. Some of the more than 400 fragments laid out in trays after being cleaned of burial deposits, but prior to reconstruction

DESCRIPTION OF THE HELMET

Construction

Once the majority of the pieces had been reconstructed it could be confirmed that the object was a helmet with a domed shape and composite construction, Figure 3. Only about two-thirds could be reassembled and while not all the fragments were incorporated, it was clear that the remainder were insufficient to make up the rest of the helmet. No deliberate damage was noted, such as that found on the seventh-century helmet from Wollaston, Northamptonshire, where the nasal had been forced inwards to render the helmet unusable after deposition [5; p. 39]. Nor were there obvious signs of damage caused by agricultural equipment, but the disturbance of other objects from the grave, such as the broken spearhead, missing sword tang and disassociation of the pommel, strongly suggests that the rest of the helmet may have been disturbed by plough-related subsoiling.

Although only part of the dome-shaped helmet survives, following reconstruction and careful examination it is possible to suggest with some certainty how it was made and once appeared. Given that other surviving helmets of the period are constructed in a symmetrical manner, the proportions of this example from Shorwell could be deduced from the surviving section. From the overlaps of the existing plate edges it can be surmised that the skull was made from eight separate plates of iron riveted together. The 'frame' of the skull is formed by an encircling brow band to which are attached a brow-to-nape band and two lateral bands, see Figure 4. The lateral bands are connected to the main brow-to-nape band at the crown and to the sides of the brow band. Four sub-triangular shaped infill plates fit under the gaps left by the bands. The bands and infill plates are fixed together with iron rivets that are flush with the outer surface but are visible on the inside of the helmet where their heads were domed over.

Dimensions and illustrative reconstruction

In order to support a digital reconstruction and the preparation of the illustration shown in Figure 4, exact measurements of the individual plates were taken where possible and approximated elsewhere, Table 1. The encircling brow band is suggested to have been 620 mm long and appears to have been worked from a single piece of metal. Where the ends meet at the medial line they overlap by 12 mm and are connected by three iron rivets; this produces an approximate interior circumference of 608 mm at the base of the skull. Given that a Frankish influence or connection is inferred by the evidence of ritual and from the objects found within and around the grave, the suggested circumference of the Shorwell helmet was compared to the cranium size of males from a sixth-century cemetery site in northern France, which averaged 535.3 mm [6; p. 494]. While the circumference of the Shorwell helmet is around 73 mm larger than this average cranium size, allowance

FIGURE 3. The helmet after reconstruction, with distortion of the metal clearly evident

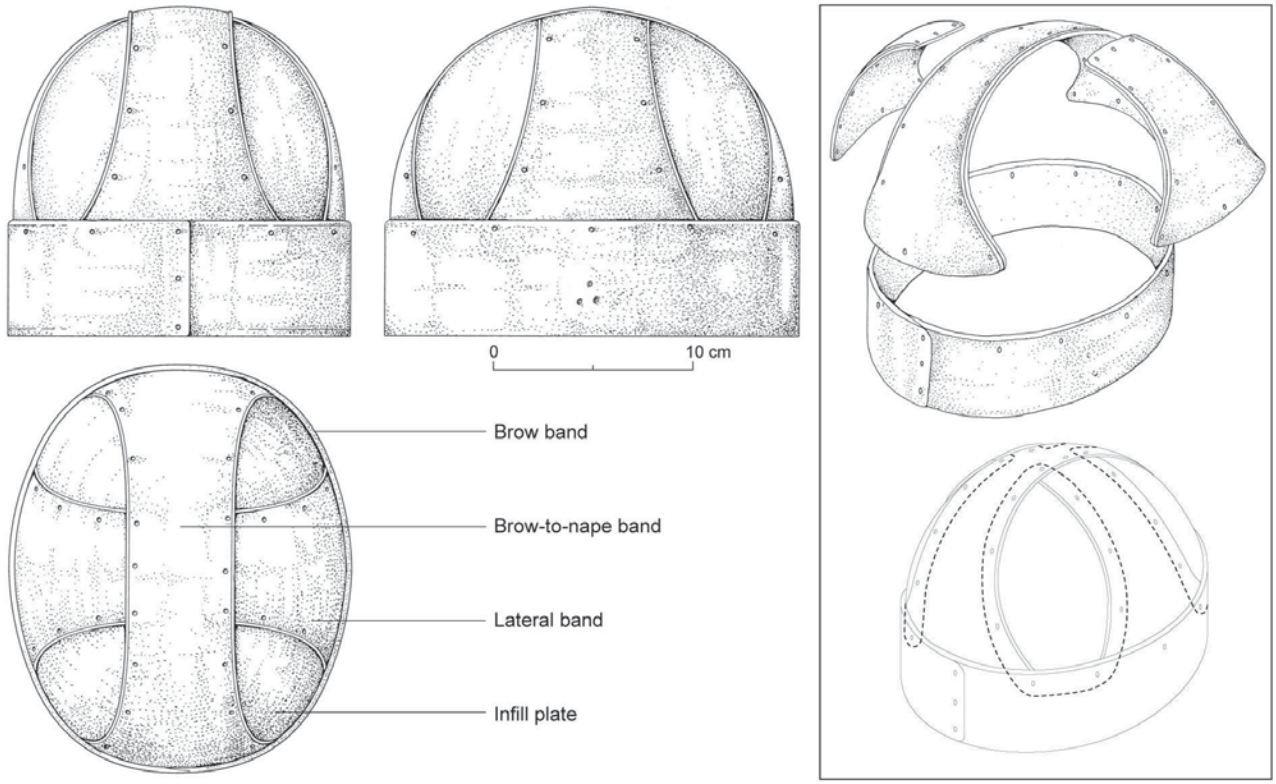

FIGURE 4. Reconstruction drawings of the helmet based on measurement of the surviving fragments. Drawing: Craig Williams

needs to be made for interior padding. When compared to the circumferences proposed for the Sutton Hoo helmet (*c.*741 mm [7; p. 152]) or the mid-to-late eighth-century helmet from Coppergate, York (*c.*618 mm at the brow [8; Figures 493–496]), it is smaller or far more closely fitting. The width of the brow band of the Shorwell helmet appears to have varied from 57 to 63 mm, but this unusual irregularity may be due to the severity of corrosion along the lower edge. Expansion and delamination of the metal make it particularly difficult to determine an accurate thickness for the band but it is suggested that it is likely to measure *c.*2.2 mm. The join was probably at the back of the helmet, indicating that what would have been the front is now lost. While it is possible that the front might have had a nasal, this feature is not usually associated with simpler 'iron cap' helmets of the Early Medieval period. The skull is also too shallow for the brow band to have required curved cut outs for the eyes. In the X-radiographs of the side of the brow band, points of higher density were identified as three rivets arranged in a triangle 19 mm from the base of the skull, Figure 5a. On the outside of the helmet this feature is hidden beneath a layer of mineralized organic material but on the inside three copper alloy rivets are visible. The use of copper alloy rivets in a non-structural capacity, as opposed to the iron rivets used to connect the various plates, may indicate that they were intended to be easier to remove or decorative in nature, see below.

The brow-to-nape band does not survive in entirety, but was almost certainly worked from a single piece of metal. It was probably *c.*340 mm long and varies in width from 52 wood mm at the crown apex to 150 mm at its widest point. The one surviving end passes behind the brow band, where a 20 mm overlap is secured by three iron rivets. It is likely that this manner of construction was mirrored in the missing front part of the helmet. The edges of the brow-to-nape band are decorated with ridges 2–3 mm thick. From the cross-section of the ridge it is apparent that it was made by hammering to condense the metal and create a

TABLE 1. Summary of the approximate dimensions of the individual surviving components of the helmet

Plate	Dimensions (mm)			
	Length	Width at narrowest	Width at widest	Thickness
Brow band	620	57–63 (variable due to corrosion)		2.2
Brow-to-nape band	340	52	150	2.1
Lateral band (right)	159	40	118	2.0
Sub-triangular infill plates		n/a (variable shape)		2.0

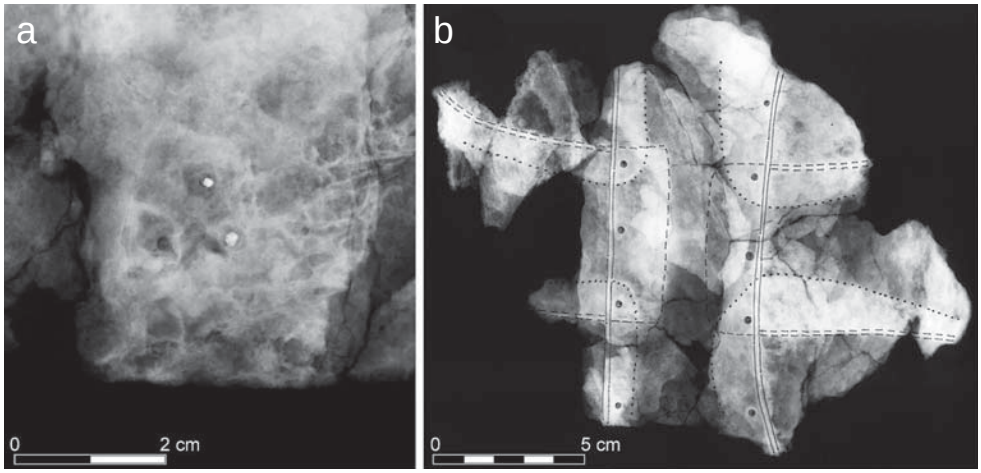

FIGURE 5. X-radiographs of parts of the helmet after reconstruction: (a) detail from the side of brow band where three copper alloy rivets are surrounded by a trapezoidal feature that might be a skin product; and (b) the crown apex where the brow-to-nape band (solid lines), lateral bands (dashed lines) and infill plates (dotted lines) meet and overlap and are secured together with rivets (black circles). X-radiograph exposure: operating at 3 mA, 110 kV for 3.5 minutes

thickened edge with a semicircular section. It is likely that definition was then added with a file, as fine parallel striations are evident on the outer surface of the brow-to-nape band next to the raised edge. While only one of the lateral bands survives in entirety, the upper ends of both are visible at the crown apex, where they are riveted under the brow-to-nape band. This is one of the best-preserved areas of the helmet, presumably because, as was intended, it is the strongest part, Figure 5b. The surviving lateral band also features thickened edges; it is 159 mm long and varies in width from 40 mm at the crown apex to 118 mm where it is overlapped by the brow band. The shape of the curved edge on the lateral bands is similar to, but not exactly the same as, those on the brow-to-nape band, as the former bands are shorter and more compact. Although they vary slightly in size, the four infill plates all have a sub-triangular shape and, at 2 mm, are marginally thinner than the bands.

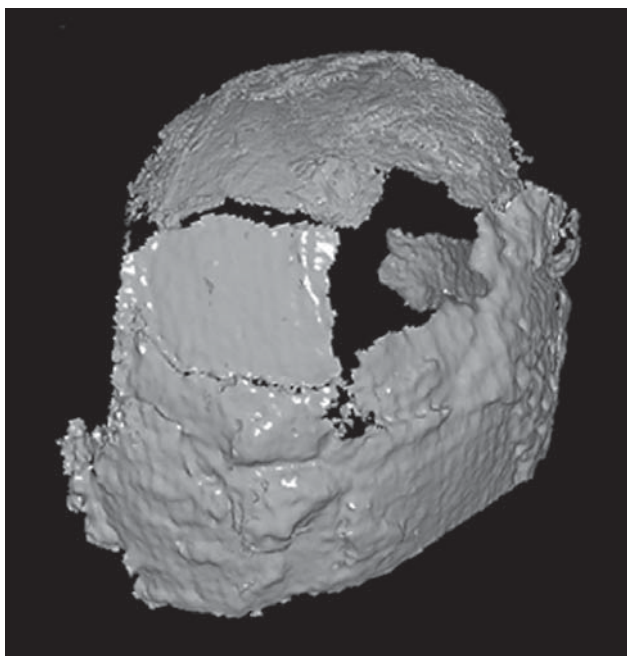

FIGURE 6. Image derived from three-dimensional laser scanning of the back right side of the helmet (compare with Figure 3). Image: Craig Williams

A digitally reconstructed model of the Shorwell helmet was made by processing a combination of X-radiographs and three-dimensional laser scans, supported by approximate or average measurements of the most intact and undamaged areas. The results of the three-dimensional laser scans from the Shorwell helmet were particularly useful in showing the overall shape and curvature of the fragments in their entirety, Figure 6. However, the extreme distortion of the fragments prevented the creation of an accurate three-dimensional digital model and line drawings of the three main views, supported by an exploded isometric view of the constituent parts, provide the most effective portrayal of the original shape and construction of the helmet, Figure 4.

MINERAL-PRESERVED ORGANIC REMAINS

Some areas on the surface of the helmet were found to have organic material that was preserved as pseudomorphs and casts in close proximity to the metal. This preservation process occurs after burial when corrosion products from the metal impregnate organic material with which it is in contact. Metal salts that are produced as iron or copper alloys corrode initially act as a biocide, preventing the attack of those micro-organisms that break down organic matter. As deterioration of both the metal and organic material progresses, the metal corrosion products that are deposited at their interface create 'replacements' that preserve the shape but not the composition of the organic material [9, 10; p. 101, 11].

TABLE 2. Summary of the observations on the 11 separate areas of textile or areas showing impressions of mineral-preserved textiles

Textile fragment (TF)	Location on helmet	Size of fragment (mm)	Thread count (per centimetre)[a]		Thread diameter (mm)	Spin direction	Distinguishing features[c]	Notes
			System 1[b]	System 2				
TF 1	Lower edge of brow band	10 × 10	8 (4 in 5 mm)	N/D	N/D	N/D	None	It is unclear if this is the underside or face of the cloth
TF 2	Crown of helmet	36 × 29	10	N/D	<1	None visible	None, but visually finer than TF1	Possibly multiple layers. Alignment of the cloth is across the helmet. An indistinct area with a 'fuzzy' surface suggesting a raised nap, possibly a complex twill, but not showing any regularity to the weave pattern that could be reconstructed
TF 3	Crown of helmet	25 × 22 (5 thick)	N/D	N/D	N/D	N/D	None	Visual impression of layers of fine weave
TF 4	Crown of helmet	26 x 22	8 (4 in 5 mm)		1.2	z-spun (?)	Faced weave. Only a loose z-spin visible, possible presence of plied threads with un-spun Z-ply. In area where thread interrelationships were visible, a single thread was counted going under four threads in system 1, possibly in a twill pattern	Appears to be from a more utilitarian cloth than the other fragments
TF 5	Crown of helmet	25 × 22 (5 thick)	N/D	N/D	N/D	N/D	None	Fragment underlies TF 4 in contact with iron, possibly part of TFs 7 and 6
TF 6	Crown of helmet	20 × 28	N/D	N/D	N/D	N/D	None	Probably detached part of TF 7, directly in contact with the iron rib of the helmet
TF 7	Crown of helmet	85 × 30	10 (5 in 5 mm)	Not visible	N/D	z/s-spun (?)	Wool. This cloth is strongly ribbed in system 1, with system 2 not visible, suggesting a repp plain weave. It is closely woven with a very regular weave pattern. Where visible, only z-spin was seen. Intermittent and finer s-spun wool threads across system 2, possibly additional to ground weave	It was unclear if this was a single layer or was folded back diagonally on itself to present both face and underside, presenting as TFs 5 and 6. The weave identification was complicated by the presence of the ends of threads rather than the length of the threads in some areas
TF 8	Crown of helmet	22 × 12	15	Not visible	Variable	Tightly z -spun	None	Overlies TF 7, similar to TF 2
TF 9	Crown of helmet	N/D	N/D	N/D	N/D	N/D	None	Associated with the area of plant remains, probably the same cloth as TF 2 and TF 8
TF 10	Unknown – detached from helmet	18 × 29	12	N/D	N/D	N/D	Plain weave	As the fragment could not be relocated onto the helmet it does not assist in determining whether the whole helmet was covered by cloth
TF 11 (Figure 7)	Unknown – detached from helmet	N/D	N/D	N/D	<1	N/D	Wool, fine weave	As the fragment could not be relocated onto the helmet it does not assist in determining whether the whole helmet was covered by cloth

Notes
a. The terms 'System 1' and 'System 2' are used here, as it was unclear which was the warp and which the weft. '(N/D)', or not distinguishable, indicates that there was insufficient evidence or that the state of preservation was particularly poor.
b. Figures in brackets indicate the number of threads counted in that distance, from which the number of threads per centimetre is then calculated.
c. 'Z-ply' denotes that the spun threads are plied together in a z-direction.

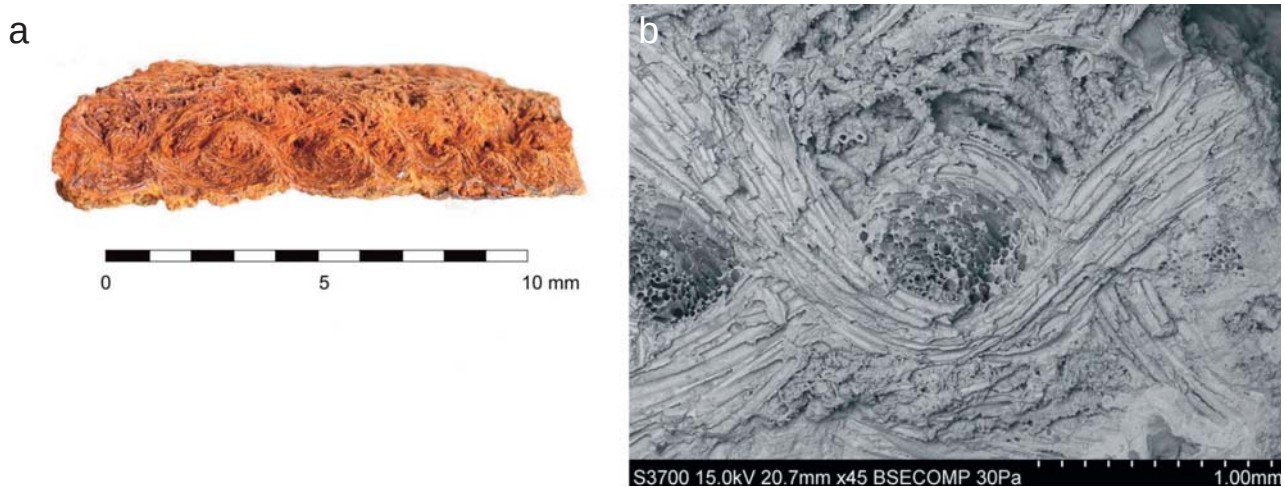

FIGURE 7. Detached fragment of textile from the helmet: (a) in cross-section; and (b) VP-SEM image, showing both thread systems in detail (see Table 2, TF11)

The condition of the mineral-preserved organic remains was extremely variable and ranged from examples that provided excellent analytical potential to areas where the extent of degradation provided few or no discernable diagnostic features. In this study, the preliminary examination of the remains serves mainly to support a discussion of the construction, intended use and deposition of the helmet rather than the grave assemblage as a whole.

Textile remains

Five types of textile were found to be present when 11 separate areas were examined (nine areas on the surface of the helmet and two detached fragments). These textiles are not interpreted as being directly associated with the helmet as a bag or as an internal or external covering. The relatively large surface area of the iron in this case seems to have contributed to the preservation of what are almost certainly soft furnishings placed in the grave, Table 2 and Figure 7. From the orientations and interrelationships of the textiles it would appear that the helmet was lying at an angle with the crown against a pile of cloths and this contributed to the visibility of the thread ends. This pile consisted of a coarse cloth, associated with textile fragment (TF) 1, which lay beneath plant remains, an area of black organic residue that could not be characterized readily by Fourier transform infrared spectroscopy or gas chromatography-mass spectrometry [12], and the other textiles (represented by TFs 2, 4, 7 and 8), with TF7 forming the top part of the pile. From such small areas it is not possible to reconstruct the form and purpose of each textile, but the presence of a cloth similar to TF7 on the shield grip, found some distance away from the helmet on the other side of the body, indicates a wide deployment of visually striking materials. The position of TF7 suggests it was adjacent to the helmet and may, therefore, have been associated with a cushioned headrest, as evidence for pillows has been found in comparable Kentish burials.

It is possible that when the spearhead socket and sword scabbard are further cleaned additional textile fragments may be found that clarify matters, but the one system of threads (either the warp or weft) found on the latter to date ran across the sword, suggesting a careful alignment of these burial components. The shield grip fragments have provided another extremely promising area of mineral-preserved textile, with threads showing a surface with a raised nap similar to a cloth (TF2) from the helmet, suggesting a covering over the body (but below the shield) rather than clothing.

In most cases, the better-preserved fibres featured a surface scale pattern characteristic of an animal origin, although further examination may yet produce plant-based fibres. Despite the significant quantities of metalwork preserved in the cemeteries of the Isle of Wight, there are frustratingly few extant textile fragments and none that are clearly associated with a male grave. Textiles found on unassociated iron artefacts held in the British Museum from the Chessell Down cemetery site (located around 7 km to the north west of Shorwell) exhibit similar visual characteristics to those adhering to the Shorwell helmet; most have a plain weave with a relatively high count of 14–18 threads per centimetre in each direction, while one iron rove (usually associated with female burials: 1869,1011.88) has a plain weave with 30/14 threads per centimetre [13]. Another comparable feature is that, in common with the examples from Shorwell, this cloth is closely woven and of good quality. The spearhead socket from Chessell Down (1869,1011.20), which belongs to Swanton's 'Group H3' type [14; pp. 110–114], is associated with a broken diamond twill 2/2 with s/z-spun threads that is coarser, with a thread count of 8/9 threads per centimetre, while a knife (1869,1011.62) that might come from an inhumation of a male 'warrior' (inhumation No. 59) shows a closely woven, possibly complex twill with a thread count of 18/18. From this small corpus of data from Shorwell and Chessell Down, augmented by the

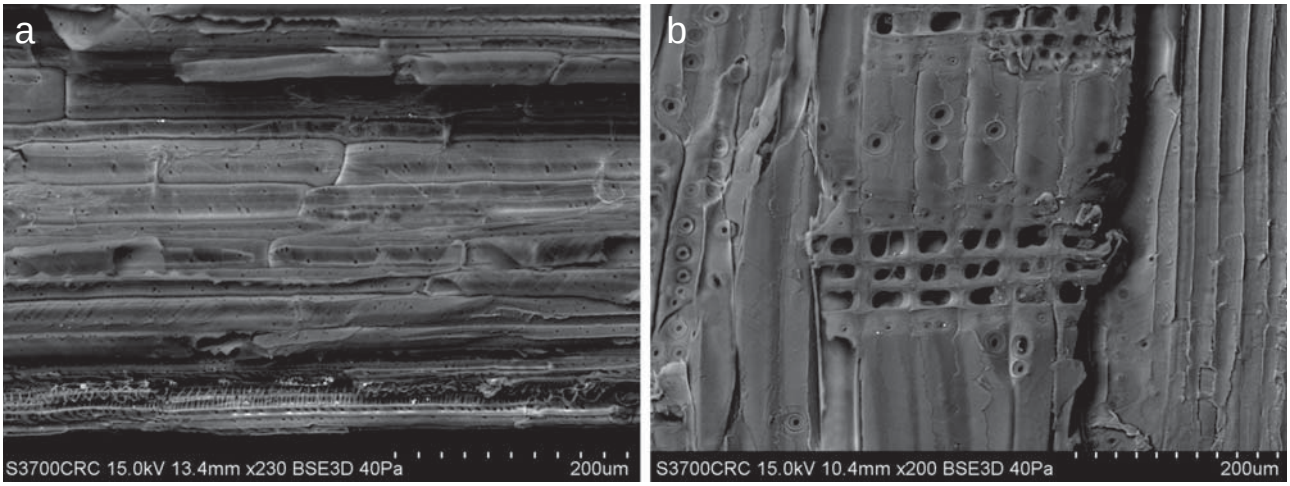

FIGURE 8. VP-SEM images of plant remains: (a) split but otherwise unprocessed flax stem (*Linum usitatissimum*); and (b) pine wood shavings (*Pinus sylvestris*) viewed in radial longitudinal section

records from copper alloy artefacts associated with females recorded by Bender Jørgensen [15], it can be seen that the Isle of Wight textiles were, at the very least, of comparable quality and diversity to those from contemporary Kentish contexts.

Based on the evidence for the type, distribution and arrangement of the textiles preserved in the Shorwell grave, the closest insular comparison is probably represented by an adult male grave (inhumation No. 81) dated to the mid-to-late sixth century from Mill Hill, Deal, Kent [16]. Microstratigraphic analysis of this grave identified a twill cloak laid out together with non-costume textiles that related to a down-filled pillow or upholstered object and a plain weave textile (present on the surface of the sword), which suggested the presence of a burial covering. The five types of textile found in Kent were of fine quality and included diamond twills with a preponderance of z/s-spun threads, reflecting the high status of the other artefacts associated with that burial.

Possible evidence for skin product

An amorphous deposit is preserved in some areas on the inside of the helmet. While no definite diagnostic features were present, such as hair shafts, grain pattern, three-dimensional weave or surface decoration [17, 18], one possible interpretation is that it is a lining based on an extremely degraded skin product.[3] It is not clear from the Shorwell helmet how, or if, a full lining or lining band – to which a padded lining web or cap could have been sewn – might have been secured in place, as the iron rivets all appear to be used to join plates. For comfort and protection against blows any lining was probably also padded, although this may have taken the form of a separate, padded arming cap of coif form, similar to later Medieval examples.

Evidence for linings in late Roman helmets is rare and while some examples have close-set holes around the base of the skull that are likely to have served for the attachment of a liner, as in the case of two fourth to early fifth-century examples from Berkasovo (Serbia) that are recorded as having surviving traces of 'leather' linings stitched in place [19; pp. 7 and 21–23], most do not. Roman troops are recorded as wearing a *pilleus* (cap) under their helmets by the fourth-century scholar Ammianus Marcellinus [20]. Although descriptions of this separate liner are vague, a loose inner cap of skin product was preserved within a four segmented, multi-plate construction helmet that probably dates to the late third century AD from an Egyptian Roman context [21; pp. 164–165, 22; pp. 115, 131 and Figure 20]. However, other evidence suggests that the *pilleus* may not always have been made from the same material, as a conical wool cap with side flaps, which has been identified as a specific form of 'arming cap' for wear under a helmet with cheek pieces, was found with other elements of Roman military equipment at Dura Europos (a city in modern-day Syria abandoned after its conquest by the Sassanid Persian Empire in AD 256–257) [23; p. 101 and Figure 51]. Apart from a single example of an early sixth-century *Spangenhelm* (a conical helmet made up of multiple plates arranged in a radiating framework) from Planig, Germany, in which traces of what was interpreted as a leather lining were found, evidence from early Medieval Europe is particularly scant [24; p. 87]. While no identifiable evidence survives on any of the other helmets from the Anglo-Saxon period, the presence of a lining, although not necessarily made from skin product, in the helmets from Sutton Hoo [7; pp. 146, 179, 185–186, 203 and 231, 25; p. 31] and Wollaston [5; p. 40] is inferred by anomalies in the corrosion layer and the presence of degraded material of an organic nature.

On the inside of the brow band of the Shorwell helmet is a piece of what may be skin product that is found around and over the three copper alloy rivets arranged in a triangle. The fragment is 2 mm thick, has a fibrous quality and is visible in the X-radiographs as a trapezoidal shape, Figure 5a. It is

possible that this feature represents the remains of an attachment point for a skin product strap or cheek flap that has not been preserved. An empty rivet hole is also present on the side of the brow band of a Frankish helmet from Trivières, Belgium (discussed below) and, while attachment straps were a characteristic feature of late Roman helmets of similar skull cap form [26; Plates 8.1–8.2], iron cheek pieces are commonly found on helmets of the period. Metal would have undoubtedly offered the best degree of protection but a thick material, such as hardened *cuir bouilli* (a skin product treated with oil, hot wax or hot water), would have been a suitable substitute. The cheek pieces of the helmets from Wollaston and Coppergate are attached with metal hinges, but while this offered the most secure attachment method it may have limited their flexibility. The attachment of cheek pieces with skin product hinges would provide greater manoeuvrability, which might lie behind the cheek piece and neck guard arrangement (with skin product hinges) that has been suggested for the Sutton Hoo helmet [7; pp. 185–186].

Plant remains

In addition to the textile remains, an area of layered plant remains was preserved on what would have been the right side of the helmet, adding weight to the theory that the helmet was placed in the grave on its side.

Examination of the plant remains with a variable pressure scanning electron microscope (VP-SEM) revealed that most of the material is mineral-replaced or mineral-preserved to the extent of having only part of the inner or outer cell walls surviving as negative impressions. The bulk of these were identified to family level only (for example as Poaceae for grasses) as insufficient features survived for attribution at genus or species level. However, the VP-SEM revealed that there were some plant stems and wood shavings that retained sufficient diagnostic features and cellular structure to permit both generic and specific identifications. Figure 8a, for example, shows the characteristic features of a split but otherwise unprocessed flax stem (*Linum usitatissimum*). Flax stems are naturally thin: *c*.25 mm at the root end, *c*.18 mm mid-stem and *c*.0.5 mm at the seed head. From root to tip each stem is around 1.5 m long and is fairly brittle when dry, so it is likely that if flax stems were laid down as a grave lining they would have fragmented naturally into shorter lengths, perhaps of around 25 cm. The split flax stem in Figure 8a is far more likely to reflect accidental breakage rather than a deliberate splitting of an already very thin stalk. It is not possible to quantify the number of flax stems in this deposit because of the variable nature of preservation of the material, but it is important to note that as there appear to be no linen textiles in this assemblage, the flax (a native species in the British Isles) may be inferred to be simply part of the surrounding vegetation.

The presence of unprocessed flax stems in such a deposit is highly unusual, as plant grave linings habitually utilize heather and bracken [27] or grasses; the last material, although only identified to the Poaceae family, is well represented on the helmet. Also highly unusual is the presence of pine wood shavings (*Pinus sylvestris*), Figure 8b. The SEM image in Figure 8b shows unequivocally the key diagnostic characteristics for pine viewed in radial longitudinal section, i.e. the cross-field area where the parenchyma cells intersect with tracheids containing large window-like pits, dentate ray tracheids, uniseriate tracheid pits and heterocellular rays. The presence of pine at Shorwell is not surprising, as *Pinus sylvestris* was present widely but locally in southern England from as long ago as 7000 BC [28, 29].

No plant material was noted on the sword or shield boss from the grave. While this could indicate that this material was specifically related to deposition of the helmet, it is more probably due to a lack of preservation, since it is likely that the layer represents a grave lining and/or covering that would have extended over the whole grave; a widespread practice in the Early Medieval period, both in England [30; p. 97], as well as continental Europe. A parallel for the practice of using plant material as a grave lining or covering has been interpreted recently from material preserved on objects from graves at the late fifth to late seventh-century cemetery site near Tranmer House, Bromeswell, Suffolk, situated 500 m to the north of the Sutton Hoo ship burial and barrow cemetery [27, 31].

DISCUSSION

Purpose

Unlike the majority of surviving Early Medieval helmets, the example from Shorwell appears to have been sparsely decorated and utilitarian in nature, indicating that it probably represents a serviceable 'fighting helmet'. Its simple but effective design achieves maximum strength within the limitations of the relatively small plates from which it is made. The wide, flared ends of the brow-to-nape and lateral bands optimize the potential of the multi-plate construction by creating large overlaps with the brow band. The almost symmetrical ellipses left by the gaps between the brow-to-nape and lateral band framework, which are backed by the infill plates, show a high degree of foresight on the part of the smith and suggest the helmet was designed and made by a specific craft specialist, possibly an armourer. A further indication of functional details may be the thickened edges of the brow-to-nape and lateral bands; although these may have been intended to be decorative, they could also have served as 'stop-ribs' (a feature usually associated with late fourteenth- and fifteenth-century plate armour) to prevent blows from edged weapons glancing down onto the shoulders or, in the absence of a nasal, the face.

FIGURE 9. Sixth century *bandhelm* from a Frankish grave at Trivières, Belgium. Image: © Musée royal de Mariemont, Belgium

Parallels and dating

The multiple plate, segmented arrangement of the Shorwell helmet is typical of types of head defence prevalent throughout Europe during the Early Medieval period. This type of helmet has its origins in Asian (and perhaps most closely Mesopotamian-Iranian) armour design. The wider adoption and subsequent development of this form in Europe probably arose initially from necessity since, with the notable exception of the Sutton Hoo helmet,[4] the art of raising and shaping helmet bowls from a single sheet of copper alloy or iron, which was known to the cultures of Classical Greece and Imperial Rome, appears to have been lost by *c.*AD 500 [32; pp. 112–114, 33].

Based on the typology of Early Medieval segmented helmets proposed by Rudolph Henning and Ortwin Gamber, the dome-shaped, multiple-band construction of the Shorwell helmet makes it a typical example of a *bandhelm* [32; p. 113, 34–36]. Although helmets of *bandhelm* form were worn throughout Europe, regionally distinct sub-types can often be identified, arising from variations in construction and the use of culturally specific forms of decoration. This means that the closest parallels for both the form and construction of the Shorwell helmet lie not with the well-known Anglo-Saxon examples from Sutton Hoo, Suffolk (late sixth to mid-seventh century [7; pp. 138–231 and Figures 103–107, 16; Figures 8, 13, 15 and 25]), Benty Grange, East Yorkshire (mid-seventh century [37]), Wollaston, Northamptonshire (seventh century [5]) or Coppergate, York (mid-to-late eighth century [8]), which all belong to the Nordic-influenced crested type, but with an earlier, simpler, domed type known from Frankish graves at Trivières, Belgium [38], Bretzenheim bei Mainz, Germany [39],[5] and less certainly from a fragmentary helmet from Endrebacke, Gotland [40].[6]

Comparisons with the helmets from Trivières (dated to the sixth century) and Bretzenheim (*c.*AD 500–550) combined with the dating of grave goods associated with the Shorwell helmet indicate that it is datable to a period from around AD 500 into the first half of the sixth century.

The overall shape and features, such as the flared crown-to-nape and lateral bands, and the decorative groove encircling the base of the skull, make the helmet from Trivières (Musée royal de Mariemont, No. Tr.493: Figure 9) the closest known comparison to the find from Shorwell. There are, however, subtle differences in construction; the Shorwell helmet consists of a cap of four segments riveted to two lateral bands joining a brow band to a single brow-to-nape band, while other surviving examples of continental type helmets have two continuous bands crossing at right angles over a cap comprising only two segments. This difference indicates the possibility of regional variation, with the Shorwell helmet representing a more complex, if potentially weaker, manner of design or construction.[7]

Like the crested helmets, this small group appears to be influenced by late Roman parade helmets and is more distantly related to two Early Medieval domed helmets of unknown provenance in the Römisch-Germanisches Zentralmuseum, Mainz, Germany that are also each made from two segments riveted to a crown band, but without a lateral band [41]. None of these domed *bandhelme* from central and western Europe show any applied decoration or curved cut outs in the brow band for the eyes or ears. While band edges decorated with separate strips of edge binding or roll moulding are commonly found on helmets of the Early Medieval period (e.g. Sutton Hoo and Coppergate in Britain or Vendel and Valsgärde in Sweden), ferrous bands with incised, thickened or rolled edges do not appear to have been common. The thickened edges found on the Shorwell helmet are perhaps most similar to the indented groove encircling the lower edge of the brow band on the example from Trivières. It is also suggested here that the expanded ends of the brow-to-nape and lateral bands on the Shorwell helmet, as well as those on the examples from Trivières and Bretzenheim, may reflect an interpretation of the curved 'straps' of inverted T-shape that make up the characteristic radiating conical-shaped framework of the roughly contemporary, but stylistically distinct, continental *spangenhelm* [39].

Although the Shorwell helmet appears to have had little in the way of decoration, it has been suggested that Frankish helmets could have been covered with skin product and the find from Trivières has been cited as a possible example [38; p. 539]. If a skin product was used in this way on the Shorwell helmet, no evidence of its presence can be identified due to the deterioration of the metal and the layers of textile and plant remains that obscure the outer surface. Anglo-Saxon leatherwork prior to the eighth century tended to follow the late Roman tradition and used extremely thin pieces of skin product, making it even more difficult to establish with certainty what may have been directly next to the surface of the metal [42; p. 54]. Skin product could have been adhered to, or shrunk onto, the surface [42; p. 53], but there appear to be no stitching holes or rivets on the Shorwell helmet that could have allowed its physical attachment. While a skin

product covering would have obscured the thickened edges of the brow-to-nape and lateral bands they would still have shown through, if less pronounced, in a similar way to the patterns created by leather-covered, string-lined ('foundation moulded') decoration on Germanic sword scabbards of the period [3; pp. 5 and 35–36].

CONCLUSIONS

By reconstructing what was once thought to be a fragmentary iron vessel it has been possible to identify a rare early-to-mid sixth-century (*c.*AD 500–550) helmet. The suggested date means the Shorwell helmet represents a bridge in the chronological sequence of evidence for the wearing of helmets within the British Isles between examples deriving from a Roman context (i.e. from before *c.*AD 410) and the four helmets known from the Anglo-Saxon period, which stem from the late sixth to the late eighth century.[8] Significantly, however, parallels suggest that the Shorwell helmet is of a different sub-type from these four insular examples and represents either the first known Frankish import from the Continent to be found in the British Isles or a locally made example that illustrates the wider influence of armour design throughout early Medieval Europe. Therefore, while the geographical distribution of the four other helmets known from Anglo-Saxon England reflects the direct and indirect influence of helmets from Scandinavia, the probable Frankish origin of the Shorwell helmet clearly shows the close relationship the Isle of Wight enjoyed with Francia as well as with the British mainland.

While the Shorwell helmet appears to have been plain and apparently utilitarian in nature, the wide, expanded ends of the brow-to-nape and lateral bands offer an aesthetic element that also optimizes the defensive potential of the multi-plate construction by creating large overlaps with the brow band. This indicates that the Shorwell helmet's primary function was for defence rather than display, unlike the majority of surviving Early Medieval examples known from throughout Europe, which are usually highly decorative and may have primarily served either the latter, or both, functions.

At a date when graves were relatively sparsely furnished, the Shorwell helmet's size and composition provided excellent potential for mineral preservation of organic material. This has afforded a rare opportunity to examine fragments of five different types of textile from within the grave environment, including some of the finest examples known from the Isle of Wight. As well as the more familiar use of grasses, the presence of highly unusual plant materials such as unprocessed flax stems and pine wood shavings (which are likely to represent a grave lining and/or covering and, in the absence of a coffin, act as a barrier layer between body and soil backfill), may also lend further weight to the exceptional nature of this deposit.

The extreme rarity of helmets from the period accords with the view that only royalty and those nobles nearest to the king were likely to have owned them [8; pp. 1169–1170]; this suggests that the individual buried in Shorwell grave No. 69 was of high social status. While the helmet may conceivably have been made locally, acquired through trade or the exchange of gifts, or have belonged to a local man who left the island to serve in the Frankish army, the strong Frankish influence indicated by the form of the helmet itself, by the cloisonné belt plaque and the putative 'Charon's obol', suggests that the owner may have been a Frankish warrior serving in the retinue of a local leader.

EXPERIMENTAL APPENDIX

Microscopy

Mineral-preserved organic remains were examined using a binocular microscope with fibre optic illumination at magnifications ranging from ×10 to 45, with a Dino-Lite Pro digital microscope at magnifications between ×20 and 50 and using a Leica MZ 12.5 microscope at magnifications up to ×100.

Variable pressure scanning electron microscopy

Examination, identification and imaging of the plant remains, wood shavings and some textile fragments were undertaken in a VP-SEM (Hitachi S-3700N) using the backscatter detector at 15 kV with a working distance of *c.*10–22 mm. The SEM chamber was only partially evacuated (30 or 40 Pa). The 3D mode (rather than Compositional) was selected to maximize the opportunity to reveal the diagnostic features of the plant and wood cells.

X-radiography

X-radiographs were made with a Torrex™ (TRX5200) X-ray cabinet system.

Three-dimensional laser scanning

Laser scanning was carried out with a 'David Laserscanner' system[9] comprising a line laser, webcam and software programme. The object was placed on two boards set at 90° to each other that contain calibration points allowing an accurate three-dimensional model to be built up during several scans of the object's surface. The scans provided a three-dimensional image that could be measured, digitally manipulated and viewed from every aspect.

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MATERIALS AND SUPPLIERS

- Paraloid B72, HMG (cellulose nitrate based adhesive) and microballoons (GB03 – amorphous silica): Conservation Resources (UK) Ltd, Unit 2, Ashville Way, Off Wellington Road, Cowley, Oxford OX4 6TU, UK.
- Acetone (GPR grade): VWR International Ltd, Hunter Boulevard, Magna Park, Lutterworth, Leicestershire LE17 4XN, UK.
- Nylon Gossamer: Preservation Equipment Ltd., Vinces Road, Diss, Norfolk IP22 4HQ, UK.

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NOTES

1. The scabbard mouthpiece belongs to Menghin's relatively large and well-defined 'Kempston-Mitcham' type that features characteristic transverse grooves and ridges. In addition to those known from sixth-century contexts throughout south east England, six 'Kempston-Mitcham' type scabbard fittings have been found in Scandinavia, three in Germany and one in Belgium. [2, 3; pp. 42–43 and Figures 22–23].
2. Further small finds in the plough soil immediately around the assemblage in grave No. 69 include fragments of a ewer handle, but this was found midway between this grave and another cluster of objects situated to the south east that are probably related to a female grave and further detailed research is needed to try to establish meaningful associations between the ewer fragments and other finds from the surrounding area.
3. For accuracy, the term 'skin product' is used throughout the text to describe material derived from animal hide when it has not been possible to determine the exact nature of the material and any subsequent processing, for example tanning.
4. It has been suggested that the Sutton Hoo helmet featured a one-piece iron bowl, but the extreme deterioration of the fragments has not allowed this to be confirmed beyond doubt [7; pp. 150–152].
5. Böhner has suggested that the helmet from Bretzenheim might have had a mail skirt attached to the base of the skull [39], but there is no evidence for an analogous feature on the Shorwell helmet.
6. Nerman's published reconstruction of Endrebacke [40] is only partly correct. The element identified as a crest is from a shield grip as might be the nasal. The helmet also had an iron face guard and hinged cheek flaps, making it likely that it belongs to a form intermediate between the Nordic and Frankish types.
7. The Wollaston and Coppergate helmets also have two separate lateral bands, but the existing evidence is too limited to determine with certainty whether these helmets were influenced by the form of construction seen on the Shorwell find and that twin lateral bands were, therefore, a specifically British feature; this possible variation in construction is also discussed in note 6.
8. At the time of writing (2012) it had been suggested that fragmentary silver sheet panels embossed with warriors, similar to those featured on the Sutton Hoo helmet – found in July 2009 with the 'Staffordshire hoard' of sixth–seventh-century Anglo-Saxon martial, equestrian and ecclesiastical objects – may have derived from a further helmet.
9. www.david-laserscanner.com.