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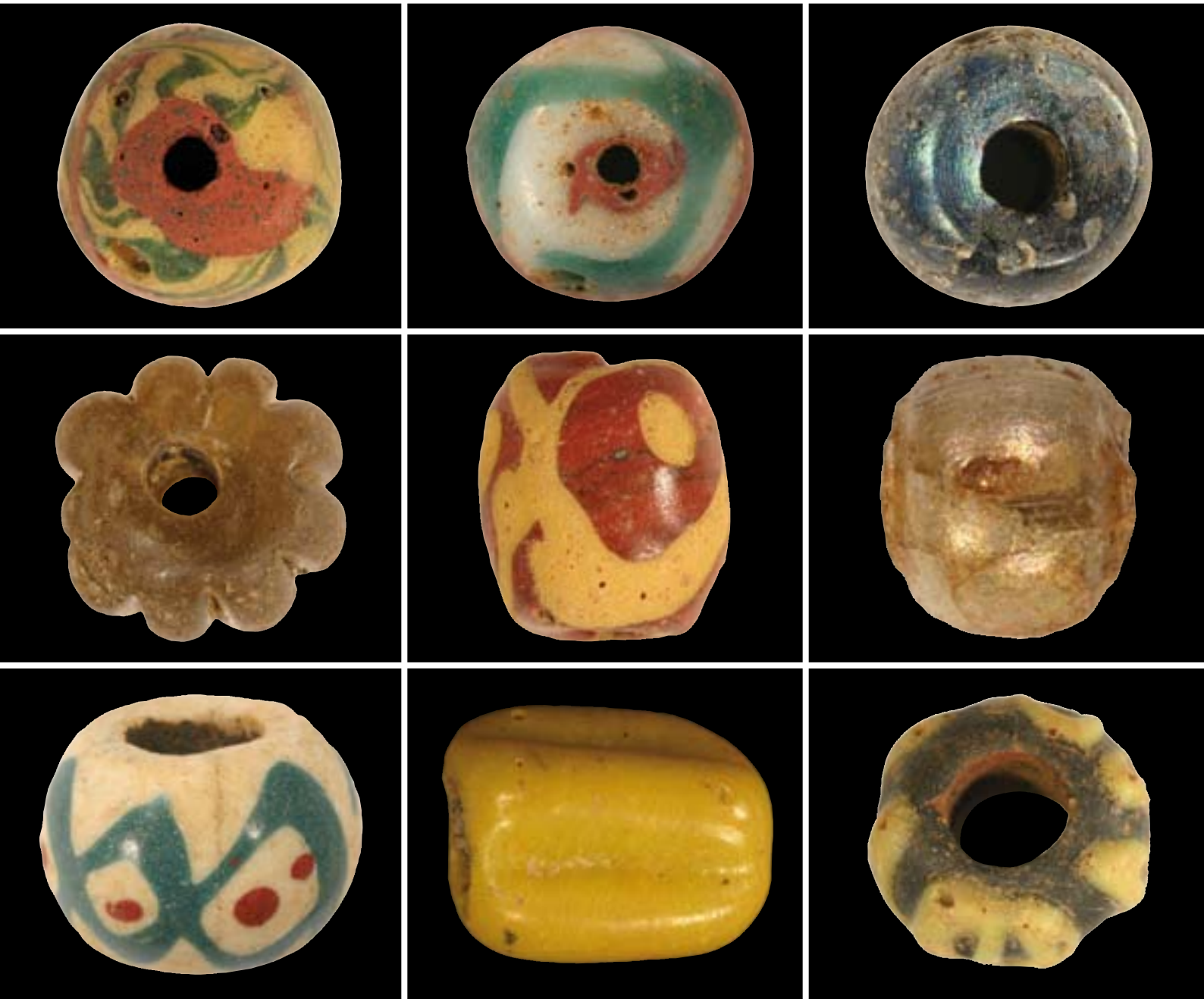
FLIXTON PARK QUARRY, SUFFOLK
INVESTIGATIVE CONSERVATION OF THE ANGLO-SAXON CEMETERY MATERIAL FROM SITES FLN 053 AND FLN 062

ARCHAEOLOGICAL CONSERVATION REPORT

Vanessa Fell and Jacqui Watson



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Flixton Park Quarry, Suffolk
Investigative Conservation of the Anglo-Saxon Cemetery Material from Sites FLNO53 and FLN 062

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Summary

This report describes the conservation, examination and analysis of artefacts from two areas of this Anglo-Saxon cemetery. The material studied was selected by the finds specialists for the project. Various analytical techniques were used, such as radiography, microscopy, and X-ray fluorescence, to identify the composition of the individual items as well as other materials preserved by their close proximity to the metalwork. This report includes detailed studies of the shields, spears, knives and beads.

Keywords

Conservation

Early Medieval

Mineral Preserved Organic

Iron

Copper Alloy

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Contents

1. Introduction 1
   - Conservation
   - Condition of the finds

2. The shields (Jacqui Watson) 4
   - Construction
   - Grave covers
   - Summary of organic remains associated with the shields
   - Silver studs on boss 053: 0397 OP 1237

3. The spearheads (Jacqui Watson) 16
   - Catalogue of wood identifications from the spearheads

4. The knives (Vanessa Fell) 21
   - Handles
   - Sheaths
   - Catalogue of knife handles and sheaths

5. The other wood remains (Jacqui Watson) 28
   - Lead spindle whorl from Grave 0727
   - Wood vessel from Grave 0358

6. Other mineralised fibres (Vanessa Fell) 30
   - Textile
   - Plant fibres

7. The beads (Vanessa Fell) 32
   - Glass beads
   - Amber beads
   - Copper alloy bucket beads

8. X-ray fluorescence (XRF) analysis (Vanessa Fell) 34

9. X-ray diffraction (XRD) analysis (Vanessa Fell) 37

Acknowledgements 37

References 37

Appendix 1. Weights and dimensions of the beads (Vanessa Fell) 39

1. Introduction

The Flixton cemetery sites (centred on TM 3033 8640) included in this report were excavated by Suffolk County Council's Archaeological Service Field Projects Team from 1997 onwards, in advance of gravel extraction (Boulter and Goffin 2006). The excavation and analysis of site FLN 053 was funded by ALSF whilst the excavation and analysis of FLN 062 was covered by RMC Atlas Aggregates Ltd (now Cemex). Both sites are being worked on by the same group of specialists towards a single publication.

The original conservation assessment for sites FLN 013 and FLN 053 was completed in December 1999. A revised assessment was submitted in April 2006, which also included sites FLN 008 and FLN 062 for which conservation requirements were extrapolated from the previous data submitted in 1999. The revised and updated project design for sites FLN 008, FLN 013, FLN 053 and FLN 062 was completed in June 2006.

Only the finds from the two larger assemblages (FLN 053 and FLN 062) are discussed in the present conservation report. Owing to time constraints for the overall post-excavation programme and the geographic separation of finds specialists involved, finds for examination and analysis were targeted partly from the requirements of the finds specialists involved in the project. Some categories of finds were examined in greater detail than others, notably those where mineralised organic materials were anticipated, and to identify specific types of materials on groups such as shields and knives.

Finds are identified by their 'OP' number or by Site: Grave OP number.

Conservation

The programme of investigative conservation and related analysis concentrated on the metal finds and their associated mineralised organic remains. Other materials include amber and glass beads.

The principal aims of the programme were:

- Investigative conservation to facilitate study, description and illustration
- Scientific analysis to identify materials
- Stabilization or controlled storage of artefacts.

To achieve these aims, all metal finds were x-rayed prior to assessment. Standard conservation methods were used during the programme of investigative conservation, principally the examination of artefacts by binocular microscopy and selective removal of accretions to examine underlying surfaces or deposits. Treatment of the beads is described separately in Section 7.

Where metal types were uncertain, or where metal coatings were suspected, these were analysed qualitatively by X-ray fluorescence (Section 8). Organic materials were identified using optical microscopy, or where necessary, samples were removed and examined under a scanning electron microscope.

Condition of the finds

The graves were dug into sand and gravel (Boulter and Goffin 2006). Such soils are usually well-drained and acidic, and these conditions normally cause rapid corrosion of metals. Although this is often detrimental to the ironwork, it can be advantageous for adjacent organic materials, which will often be preserved through mineralization (Janaway and Scott 1989).

At Flixton, the burial environment had the following effects on the artefacts:

a) Some iron finds and components had become totally mineralised, indicated only by cavities surrounded by corrosion products, as for example the pins on copper alloy brooches – where the iron pin had corroded preferentially (eg Fig 1.1).

Figure 1.1 Part of copper alloy annular brooch OP 1368 showing the rear side where the iron pin (arrowed) has corroded away to a hollow form. The attached textile has become mineralised through the presence of the ferrous corrosion products in the soil solution.

b) The organic materials had decayed to partly mineralised forms, or they had been totally replaced by metal corrosion products to form pseudomorphs or casts of their original structures, as for example with the wood (Figs 1.2 and 1.3) and many of the textile fibres (eg Figs 6.1 and 6.2).

c) Non-ferrous metal alloys are sometimes de-alloyed in acidic soils whereby one or more components of the alloy will preferentially dissolve out. This may have occurred on 062: 0997 OP 1276, where metal washers no longer survive but tin and calcium have re-deposited around rivet stems (Fig 2.4).

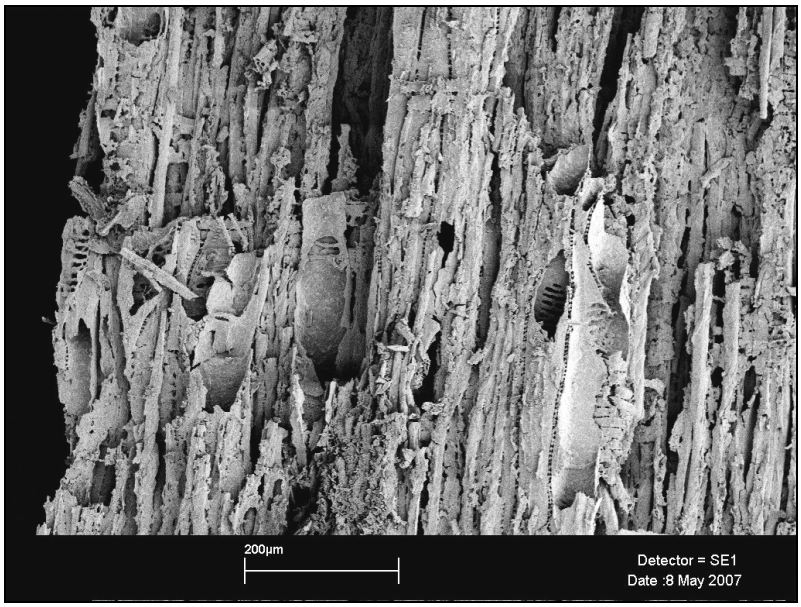


Figure 1.2. Iron-preserved wood from a spearhead socket OP 1380, where the wood structure is beginning to fracture. Wood: hazel.

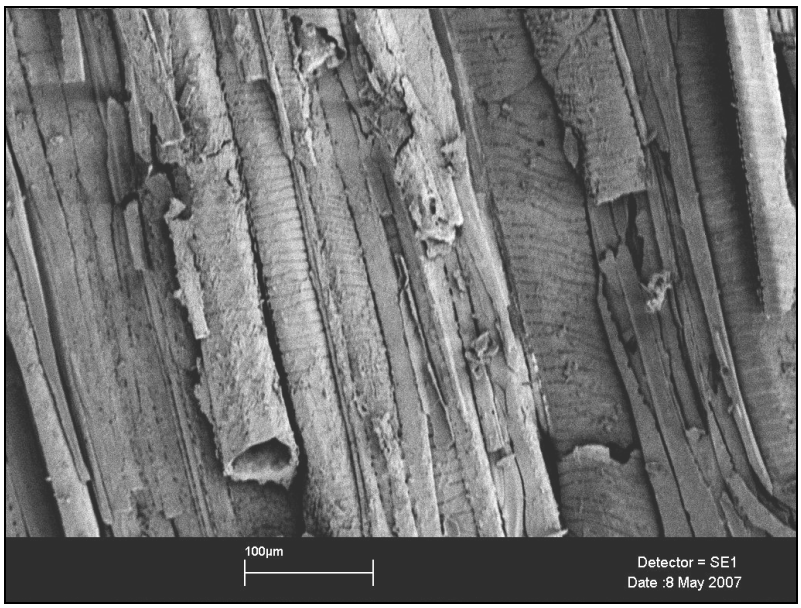


Figure 1.3. Iron-preserved wood from shield boss flange OP 1322, where the original wood cell walls have dissolved leaving a cast of the surface features in iron oxides. Wood: lime or maple.

2. The shields

Jacqui Watson

There are seven sets of shield fittings, all with traces of preserved organic material, which is summarised in Table 2.1. Based on Dickinson and Härke's typology (1993) the bosses have been attributed to the following groups by Stephanie Spain.

Group	Date	Graves
1	450-600AD	0001
3	550-650 AD	0303; 0397; 0716
6	c.570-650 AD	0553B; 0993; 0997

The wood used for shield boards is as follows:-

Group	Wood
1	n/a
3	Ash (2); willow/poplar (1)
6	Lime/maple (2); alder (1)

All the woods used for these shield boards were readily available throughout England and most of North-West Europe at this date, so it is not possible to suggest where they were made on the basis of wood type. The choice of woods is slightly unusual in that willow or poplar is underrepresented; as this species normally accounts for around 50% of the shields, followed by lime (25%), and six other species including ash and alder account for the remainder (Watson, 1995). But this is a rather small sample and one should probably not read too much into this distribution!

Construction

At least two of the shields (0397, 0553B) and possibly a third (0993) had rebated grips, where a separate piece of wood has been inserted into the front of the shield board (Dickinson and Härke, 1993). This can be clearly seen on the rivet used to attach the iron grip on the shield from grave 0397 (Fig 2.1), as well as on the flange of the boss from 0553B (Fig 2.2).

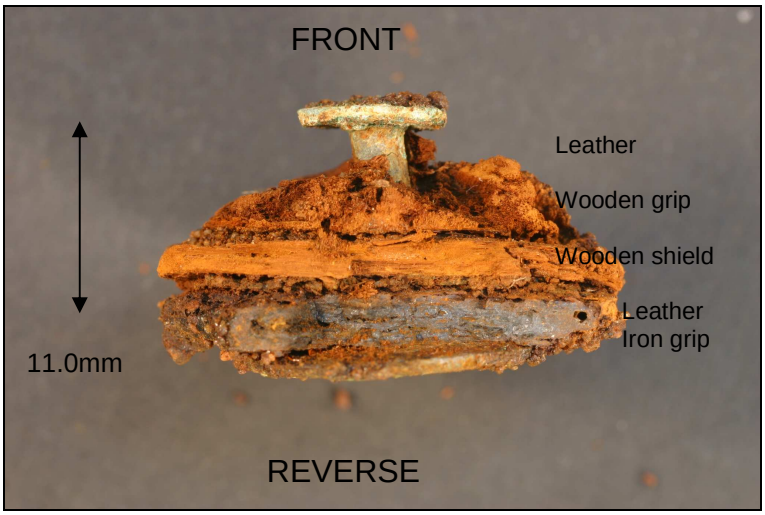


Figure 2.1 Layers of organic material preserved on the copper alloy stud OP 1237b used to attach the iron grip to the shieldboard.

Figure 2.2 Separate wooden grip rebated into the front of the wooden shield board on boss OP 1322.

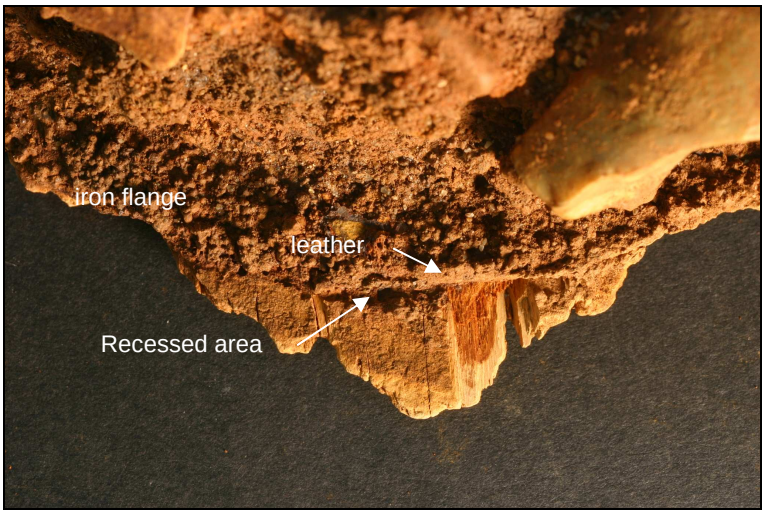


Figure 2.3 Wooden shield board rebated to take the boss flange (OP1275).

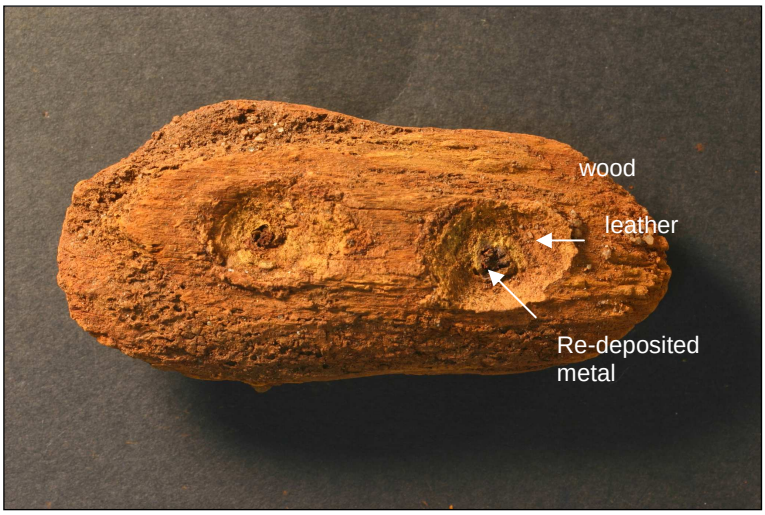


Figure 2.4 Decorative mounts OP 1276 with counter sunk areas in the wood.

On the shield boss from grave 0997 (OP 1275) a fragment of the wooden shield board extends beyond the flange and it is possible to see that it has been cut and rebated to fit the boss flange (Fig 2.3). The thin leather covering on the front of the shield folds around the edge of the flange. Presumably this was to make the upper side of the boss flange level with the composite layers of the shield board. On the same shield, the outer pair of decorative mounts also have extensive organic remains and it can be seen that on the reverse of the shield the rivets were countersunk into the wooden surface with the leather compressed into the recessed area (Fig 2.4). The metal washers are not preserved, just an impression in the surface of the leather, but they may have been made from copper alloy as there are low levels of tin and calcium around the iron rivet shank that may have been re-deposited there from the corroding metal?

All the wooden shield boards were covered in leather, and there seems to be a consistent choice of thin leather over the front with a thicker type on the back such as illustrated by the shield stud from grave 0397. The possible reasons for this could be:-

a. the front was decorated with relief carving in the wooden surface, which was taken up by the thin leather when applied wet and left to dry on the wood. Carved wooden scabbards with skin coverings from Nydam, Denmark are illustrated in Cameron (2000, fig 7). Designs could also be made using coils of coarse thread between the wood and leather, as used on book bindings and sword scabbards (ibid, figs 12 and 14).
b. Possibly the thin leather would take up dyes, or be easier to paint?
c. Thick leather, especially if shrunk to fit, would be very hard and effective at holding the shield together.

There is evidence for a carrying strap on the shield from grave 0397, with the leather strap pulled around the grip: OP 1237b (Fig 2.5). Also there is a small buckle positioned near the shield rim, which may have been used to attach the strap like the examples from grave 96, Boss Hall, Ipswich (Watson 2001) and Grave 46, Edix Hill, Barrington (Watson 2002). See Figure 2.6 for how this might have looked when placed in the grave.

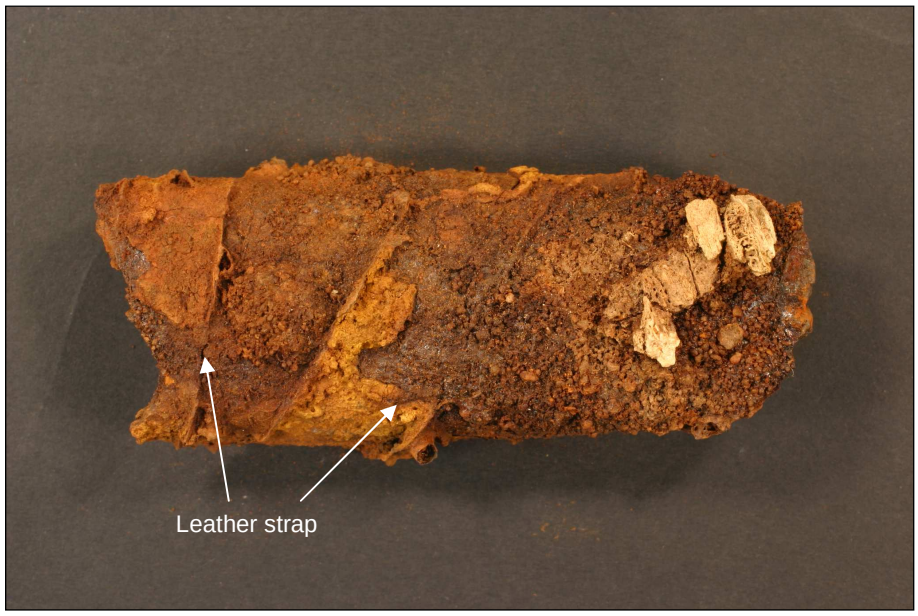


Figure 2.5. Iron shield grip OP 1237b, with remains of leather carrying strap pulled over grip.

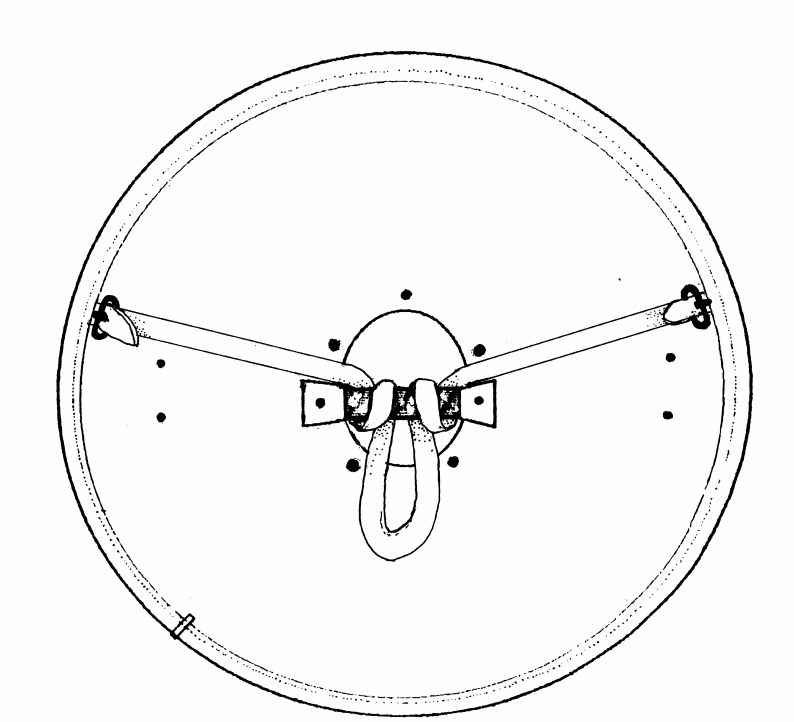


Figure 2.6 How the carrying strap might have been attached to the shield from grave 0397, and looped through the grip when placed in the grave.

The diameter of the shields can be estimated from the distance between the centre of the boss and the outer studs or mounts, and this gives the minimum diameter. These measurements give a fairly consistent size of at least 400mm, well within the average size of 600mm noted by Härke.

Grave covers

Wood has also been preserved on the outer cone of some of the shield bosses, and this is likely to have come from a coffin or wooden planks laid over the burial. The shield boss from grave 0993 has the remains of ash with a tangential surface and the shield boss from grave 0997 has the remains of oak with a radial surface. The surfaces presented by these two sets of wooden planks indicate how the timber was reduced; the oak being radially split and the ash tree was sawn or tangentially split – the standard method used to produce long planks from these trees (Morris 2000, 2102).

A number of objects, especially the shield bosses, have layers of chopped plant stems or straw preserved on them. This suggests that graves 0303 and 0553B were possibly lined and covered with plant materials before being backfilled with soil or turf.

Table 2.1. Details of the organic materials preserved on the shield fittings.

FLN053

Context	Group	Board details	Grip	Diameter	Thickness at Boss	Thickness at fitting
0001	1	Thin layer of leather preserved on flange; also leather/skin/pelt on outside of cone.	-	-	-	-
0303	3	Shield board made from ash (TLS), with leather on the front c. 2.2mm thick, and back 3.6 – 4.0mm thick. Plant stems on the front of large studs (1185).	Cut out	> 0.4m	14.0mm	14.0mm
0397	3	Shield board made from willow or poplar (RLS), grip same. Thin layer of leather over the front, and thicker layer of leather on back. Evidence for a carrying strap pulled through the grip.	Rebated	> 0.45m	10.0mm	10.0mm
0553 burial B	6	Wood* (TLS). Rebated grip visible with wooden portion 18-21mm wide. Thin layer of leather between flange and wood. Chopped plant stems on front of shield boss.	Rebated	-	> 10.0mm	-
0716	3	Shield board possibly made from ash (TLS), with leather on the front c.2.0mm thick, and on the back 3.5 - 4.0mm thick, wood 6.0mm thick. The grip also has leather on the outer side, c. 4.0mm thick, and underneath layers of textile. The shield was probably placed against the side of grave cut and on top of spearhead OP1380.	-	>0.26m	-	12.0mm

FLN062

Context	Group	Board details	Grip	Diameter	Thickness at Boss	Thickness at fitting
0993	6	Wood* (TLS). Leather preserved on front c.1mm thick, and back 2.4mm, wood 7.0mm. Very degraded textile on the outside of grip. Wood preserved on front of boss and studs ash (TLS), probably represents a grave cover.	?rebated	>0.445m	c.10.4mm	-
0997	6	Wood* (both TLS and RLS) – possibly indicates the use of several sawn planks. Leather covered on both sides, front c. 1mm thick, back c. 3.6mm. Wooden board recessed to take boss flange, and counter sunk on the reverse to take the stud rivets. Wood preserved on front of shield mount, oak (RLS), possible evidence for a grave cover,	-	>0.36m, or c. 0.46m from soil stain.	-	8.4mm

Summary of organic remains associated with the shields

FLN 053

Grave 0303

0148a Iron shield boss.
Bone preserved on underside of flange.

0148b Iron shield grip.
Wood: *Fraxinus* sp. (ash) with tangential surface (TLS). Grain direction is perpendicular to the axis of the iron grip and suggests it is integral with the shield board, so must be one of the cut out types in Härke (1993).
The wooden shield board is covered on both the front, c. 2.2mm thick, and back, 3.6-4.0mm, with leather; the wooden board is between 4.4-7.8mm thick.

1185 Iron shield board mounts.
Miscellaneous plant stems preserved on the front.

Grave 0397

1237a Iron shield boss.
3 rivets on flange, probably silvered copper alloy; central stud probably silvered?

1237b Iron shield grip.
Strap of leather/skin, 13-15 mm wide and c.3mm thick, wrapped around grip (PWR) and may be connected to buckle 1238.
Rebated grip, with separate piece of wood inserted into the front of the shield board. Both grip and board made from *Salix* sp. (willow) or *Populus* sp. (poplar), with a radial surface (RLS). Thickness of shield board at this point is c. 11.0mm; made up of leather on front c.1.5mm, wood 4.5 and 3mm, leather on back 3mm.
Leather is preserved inside the iron grip. The shape of the grip also indicates that the organic components originally had a sub-rectangular form similar to the grip from grave 48 at Barrington, Cambs.

1238 Iron buckle
This buckle may be part of the shield from its position in the grave.

1239 Copper-alloy shield rivet.
Thickness of the shield board at this point is c. 10.0mm, made up of the following layers leather front, 1.5mm; wood, 4.5mm; leather back, 4mm.

1243 Iron shield mount
1242/3 These two mounts were probably part of another wooden object, as both were mounted on wood c. 7.0mm thick*, *Fraxinus* sp. (ash), no leather present. These items are unlikely to be part of the shield, based on the organic material

preserved on them.

Grave 0553B

1322 Iron shield boss
Rebated grip clearly visible in the wood preserved on the underside of the flange, 18-21mm wide. Wooden* shield board, made from *Tilia* sp. (lime) or *Acer* sp. (maple) and has a tangential surface. Thin layer of leather between the iron flange and wood. Chopped plant stems on the front of shield boss.
Wood SEM B867

Grave 0716

1376 Iron shield boss.
Little of the flange remains, with almost no organic material except for possible leather.

1377 Iron shield board mount.
Organic materials: leather on front c. 2.0mm; wood (TLS) 6.0mm; leather on reverse 4.0mm.

1378 Iron shield board mount.
Organic materials: thin layer of leather between the iron and the wood, wood probably *Fraxinus* sp. (ash).

1379 Iron shield board mount.
Organic materials: leather and wood (TLS).

1383 Iron shield board mount.
Organic materials: leather and wood.

1386 Iron shield grip.
Leather preserved on both sides of the iron grip, inside (reverse of shield) c. 3.5mm thick, outer is c. 4.0mm thick and underneath a layer of textile – no evidence for function or how attached.

Unstratified (0001)

0132 Iron shield boss.
Thin layer of possible leather preserved on underside of flange. Also possible leather/skin/pelt preserved on upper side of boss cone.

FLN062

Grave 0993 – evidence for a possible grave cover made from ash (TLS).

1269 Iron shield boss

Organic materials: leather (front of shield) c. 1mm thick, wood* (TLS) 7.0mm, leather (back) 2.4mm. Wooden shield board made from *Alnus* sp. (alder). SEM B868
Wood preserved on front of boss *Fraxinus* sp. (ash, TLS), same as noted on spearhead OP 1268.

1269a Iron shield grip.
The wooden part may have been rebated into the front of the shield board, or the change in grain direction could have resulted from damage at some stage. Very degraded textile preserved on the outside of the grip.

1271 Iron shield board mount.
Organic materials on reverse: leather (front) c. 2.0mm, wood.
Wood preserved on front of mount, possibly ash (TLS), same as boss.

Grave 0997 – evidence for a grave cover of oak (RLS).

1275 Iron shield boss
Organic materials: leather between flange and wood c. 1mm thick, and in one place this extends up the side of the flange. In the same area the wooden board appears to have been rebated to take the boss flange. Wood* *Tilia* sp. (lime) or *Acer* sp. (maple), with a tangential surface. SEM B869.
Wood also preserved on the upper surface of cone, *Quercus* sp. (oak, RLS).

1275a Iron shield grip.
On one side no organic material has been preserved except for wood at the terminals, possibly where the grip was attached to the shield board. On the other side are layers of chopped stems, straw etc. which possibly covered the burial.

1276 Iron shield board mount.
Shield board at this point 8.4mm, wood (TLS), and leather on back c. 3.6mm thick. There appear to be counter-sunk areas on the reverse of the wooden shield board to accommodate the back of the studs.

1277 1277 Iron shield rivet or mount.
Organic materials: thin layer of leather between wood and iron, wood from shield board RLS. Wood also preserved on the front of mount oak (RLS).

Silver studs on shield boss 053: 0397 OP 1237

Vanessa Fell

The three studs surviving *in situ* on boss OP 1237 (Fig 2.7) have thick silver foils attached to copper or bronze heads. The studs are secured on the underside of the flange by copper washers, and the stems of the studs are copper or bronze. On one stud head the outer silver foil has partly detached and this shows that the foil is less than 0.1mm thick (Fig 2.8). The two detached studs from the boss have lost their silver foil coatings.

The top of the iron boss retains an impression of a disc of the same size as the other stud heads (Fig 2.9), so it seems likely that this may also have had a decorative foil that has since been lost. This would make the distribution of the silver decorations on this boss similar to other shield bosses, for example at West Heslerton (Haughton and Powlesland 1999, 326).

The two studs found to the left side of the body and boss (OP 1239 and OP 1240) are of similar form and dimensions to the *in situ* studs on the boss, but these do not seem to have had silver coatings. These are brass and bronze respectively.

Figure 2.7 Shield boss OP 1237, with part of the grip shown upper right and the two detached studs shown lower right.

Figure 2.8 In situ stud head showing the silver foil detaching from the bronze base.

Figure 2.9 Detail of the apex of the boss showing where a stud has been lost.

3. Spearheads

Jacqui Watson

There are fifteen spearheads and two ferrules, which belonged with sixteen spears, and all had wood remains in their sockets which could be identified as follows:-

Ash: 12
Hazel: 2
Alder: 1
Willow or poplar: 1

Twelve of the spearshafts were made from ash, which is the traditional wood for this weapon but is rarely found in this proportion (75%) with the other woods.

In twelve cases it was possible to note that the wooden spearshaft had been trimmed from a piece of mature timber rather than using a suitable sized sapling or coppiced pole. In these examples the annual growth rings could be seen as horizontal lines in the socket cross section, in the case of roundwood annual rings would appear as concentric circles. It was not possible to specify the type of wood used in the remaining four examples, but they could have been the same. Such a high incidence of this carefully selected timber could imply that that these weapons were intended to be thrown, as the use of mature timber does increase the accuracy of the flight of the projectile (Urbon 1991). Also ash is a very springy wood, and less likely to shatter on impact.

The remains of organic materials relating to other items placed in the graves, have been noted on several of the spearheads, for example:

a. Grave 716, OP 1380 where plant stems are preserved on one side of the blade. These could indicate that the grave was lined or the body covered in straw at the time of burial. The same was observed on the spearhead OP 1268 from grave 993.

b. In grave 997, on the spearhead OP 1274, flattened plant stems were found on one side of the socket. These may have been woven, and could have been some form of mat used to line the grave.

c. In grave 993, ash preserved on the blade tip of spearhead OP 1268, and also noted on the shield boss OP 1269, is probably part of the grave cover (see above).

d. In grave 553 on spearhead OP 1316, are the remains of animal hairs in patches along the blade and socket. As the hairs seem to be aligned more or less in one direction they may be part of a pelt or fleece, that was either worn or used as a cover over the burial, see Figures 3.1 and 3.2.

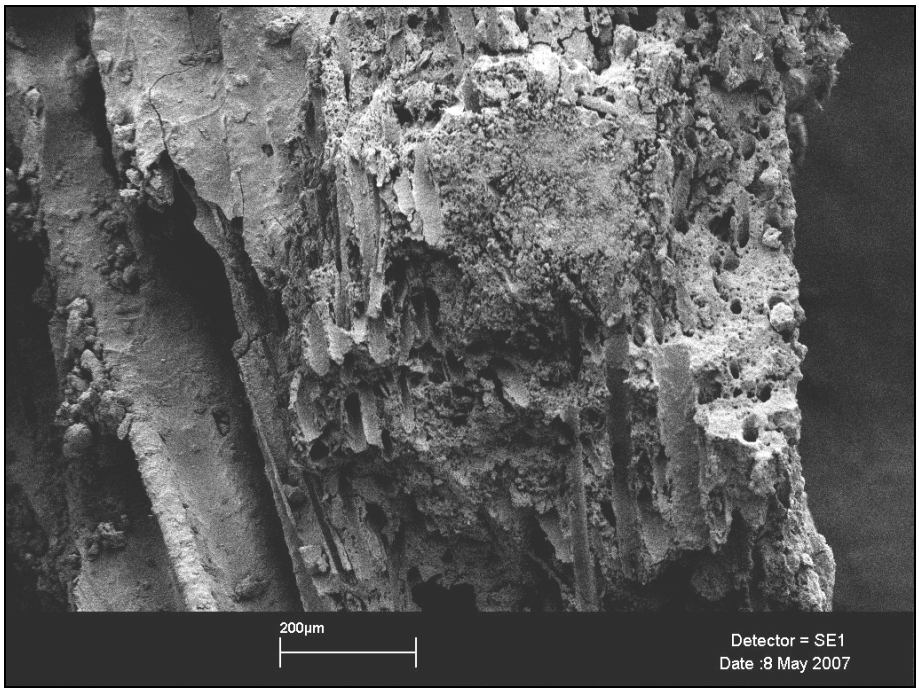


Figure 3.1 Mineral preserved hairs from spearhead OP 1316.

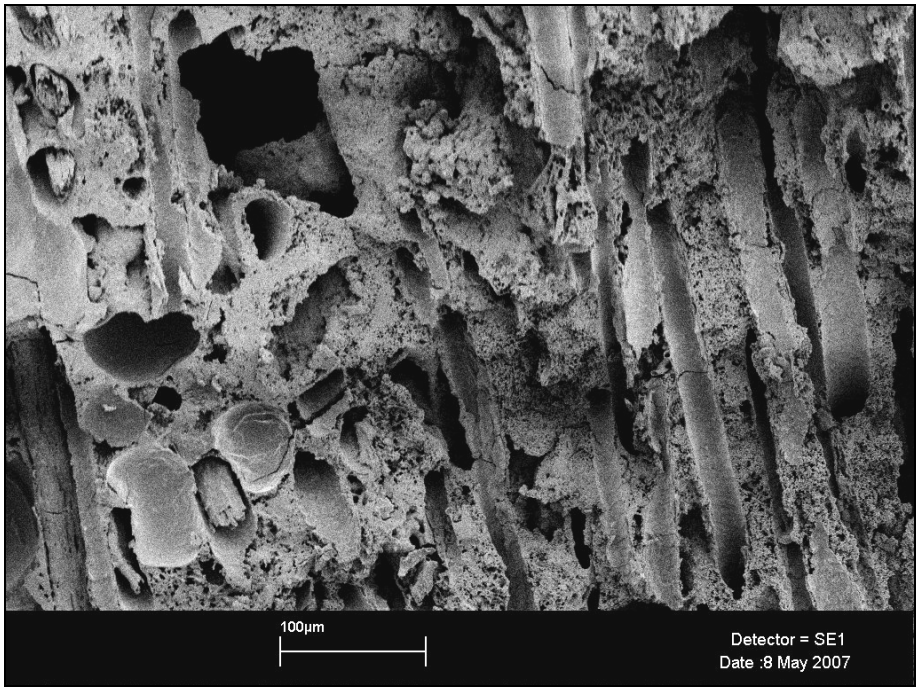


Figure 3.2 Mineral preserved hairs from spearhead OP 1316.

Catalogue of wood identifications from the spearheads

* sample taken

FLN 053

Grave 0303

OP 0119 Iron spearhead with mineral preserved wood* in socket; *Alnus* sp. (alder).
SEM B857

OP 0120 Iron spearhead with mineral preserved wood in the socket, *Fraxinus* sp. (ash) made from mature timber.

Context 0305

OP 0138 Iron spearhead socket with mineral preserved wood*, *Fraxinus* sp. (ash).

Context 0313

OP 1183 Broken spearhead socket with mineral preserved wood inside; *Fraxinus* sp. (ash) made from mature timber.

Grave 0349

1192 Iron ferrule with mineral preserved wood in the socket, *Fraxinus* sp. (ash) made from mature timber.

Grave 0504

OP 1281 Iron spearhead with mineral preserved wood in the socket, *Fraxinus* sp. (ash) made from mature timber.

Context 0553

OP 1316 Iron spearhead with mineral preserved wood* in socket, possibly *Fraxinus sp.* (ash) and made from mature timber.
SEM B858

Thin layer of fibrous organic material* on one side in patches over the blade and socket – could possibly be crushed textile/fleece/even feathers – may in fact be in strips, c.12mm wide, wound round the spearhead.
SEM B860 – fine animal hairs which seem to be aligned in one direction, these could have belonged to a pelt/fleece that was either worn as a garment or laid over the burial.

Grave 0575

OP 1317 Iron spearhead with mineral preserved wood in the socket, *Fraxinus* sp. (ash) made from mature timber.

Grave 0716

OP 1375 Iron spearhead with mineral preserved wood in the socket, *Fraxinus* sp. (ash) made from mature timber.

OP 1380 Iron spearhead with mineral preserved wood* in socket; *Corylus* sp. (hazel) made from mature timber.
SEM B861

On one side of blade is an area of mineral preserved plant stems, very like chopped straw.

OP 1381 Broken ferrule socket of small diameter with mineral preserved wood*, *Corylus* sp. (hazel), so it probably belonged with spearhead OP 1380.
SEM B862

There is also a fragment of wood preserved on the outside, near the cleft, which could be the remains of one of the haftings.

Grave 0729

OP 1388 Iron spearhead with mineral preserved wood in the socket, *Fraxinus* sp. (ash) made from mature timber.

Grave 0737

OP 1412 Iron spearhead with mineral preserved wood in socket*, *Salix* sp. (willow) or *Populus* sp. (poplar).
SEM B863

FLN 062

Grave 0993 Context 0993

OP 1268 Iron spearhead with mineral preserved wood in socket*: *Corylus* sp. (hazel) made from mature timber.
SEM B864

On the tip of the blade is a fragment of wood; *Fraxinus* sp. (ash) with a tangential surface.

Masses of plant material on both sides of spearhead, mainly stems some of which are over 10mm long, and aligned in the same direction on the socket with a small fragment of textile preserved on top.

Grave 0997 Context 0997

OP 1274 Iron spearhead with mineral preserved wood in the socket, *Fraxinus* sp. (ash) made from mature timber.

Grave 1828 Context 1829

OP 1284 Iron spearhead with mineral preserved wood in socket*; *Fraxinus* sp. (ash) made from mature timber.

A section of wood is also preserved on the exterior of the socket and from its shape and grain alignment appears to be part of the hafting.

Fragments of flattened plant stems, possibly woven, on one side of socket.

Grave 1842 Context 1841

OP 1288 Iron spearhead with mineral preserved wood in socket*, *Fraxinus* sp. (ash).

4. The knives

Vanessa Fell

Handles

Mineralised horn survives on the tangs of twenty-seven of the thirty-six knives from the graves, as for example on knife OP 1278 (Figure 4.1), and also on the one unstratified knife OP 0135. Of the other knives, five show evidence of having had a handle at the time of burial but the material cannot be identified, a few knives do not have tangs, or no evidence of a handle survives. One knife (053: 0716 OP 0387) may have a repaired horn handle because the ridges are orientated diagonally on one side of the tang.

Horn handles are common in the Saxon period (eg Watson 1984; 2001; 2002). They are often confused with wood owing to the ridged structure having the appearance of wood grain (Watson and Edwards 1990, 103).

Figure 4.1 Knife OP 1278 showing well-preserved horn (arrowed) on the tang. The extent of the original handle is revealed by the vertical line to the left.

Sheaths

Mineralised organic materials survive on the surfaces of most of the knife blades, and in some instances extend partly over the handles. These materials include animal product of skin or leather, sometimes with associated fleece or other animal fibres, or distinct (ie spun) textile fibres, and occasionally with plant remains surviving over.

There are twenty-seven knives and possibly two others that retain evidence of mineralised skin product. These may include containers and grave wrappings, but some were certainly sheaths.

The skin product discussed here includes leather and untanned skin, where collagen fibres are visible but which are indistinguishable from each other in their physical characteristics and appearance. Knives were examined for evidence of sheaths or covers, grave

wrappings, clothing or other remains. There was some evidence of sheaths or covers. In many cases this was limited to isolated patches of collagen-like fibres, assumed to be from skin product. The grain pattern survives particularly well on one blade (053: 0716 OP 1387), and this was bovine. Another knife (053: 0395 OP 1235) has very faint grain pattern, again bovine.

On the best example, knife 053: 0716 OP 1387, a grain pattern from a skin product was preserved on one side of a knife blade (Fig 4.2). A detached sample of this was mounted for SEM analysis (Fig 4.3). Examination of the reverse (underside) showed clear collagen fibres (Fig 4.4) as well as casts of animal hairs suggesting cow or calf (Fig 4.5).

Figure 4.2 Knife OP 1387 showing also detail of the sheath.

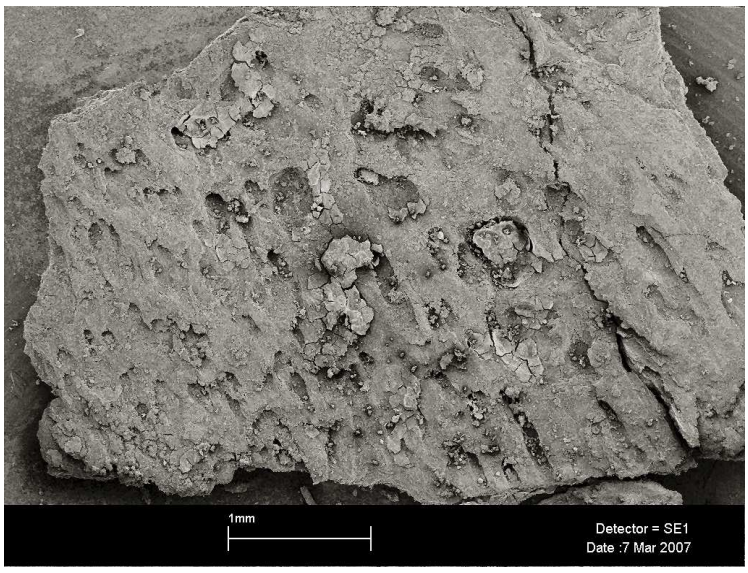


Figure 4.3 Scanning electron micrograph showing grain pattern of OP 1387.

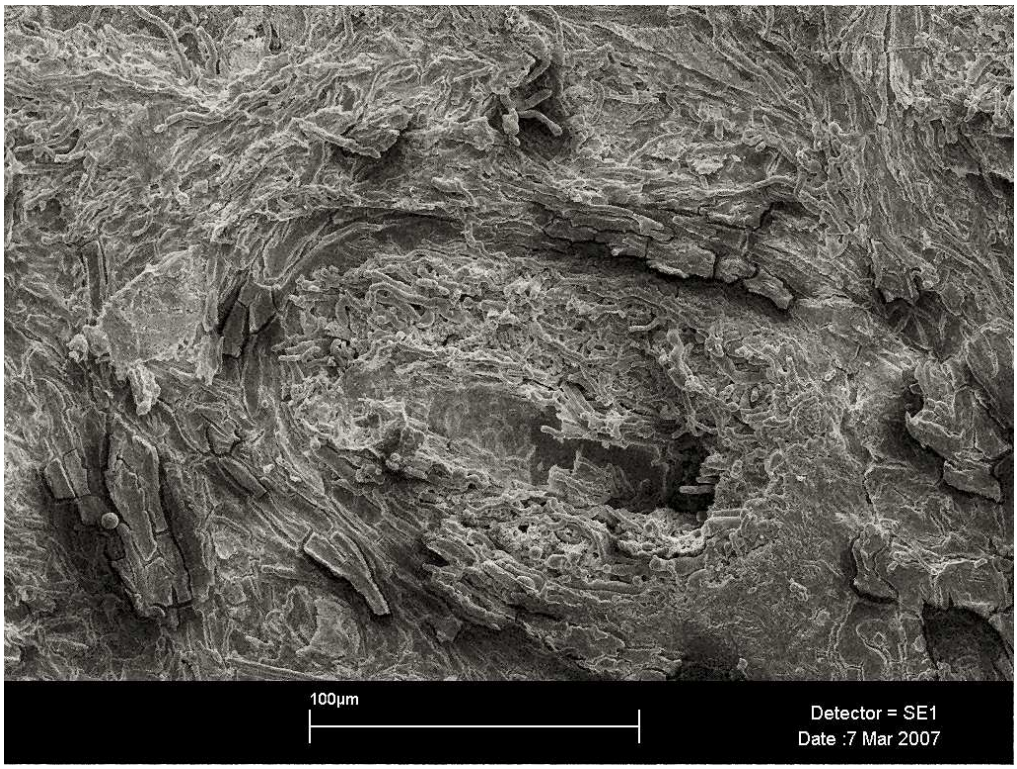


Figure 4.4 Scanning electron micrograph of the underside of the skin fragment shown in Fig 4.3. Here there are collagen fibres surrounding a hair follicle (centre).

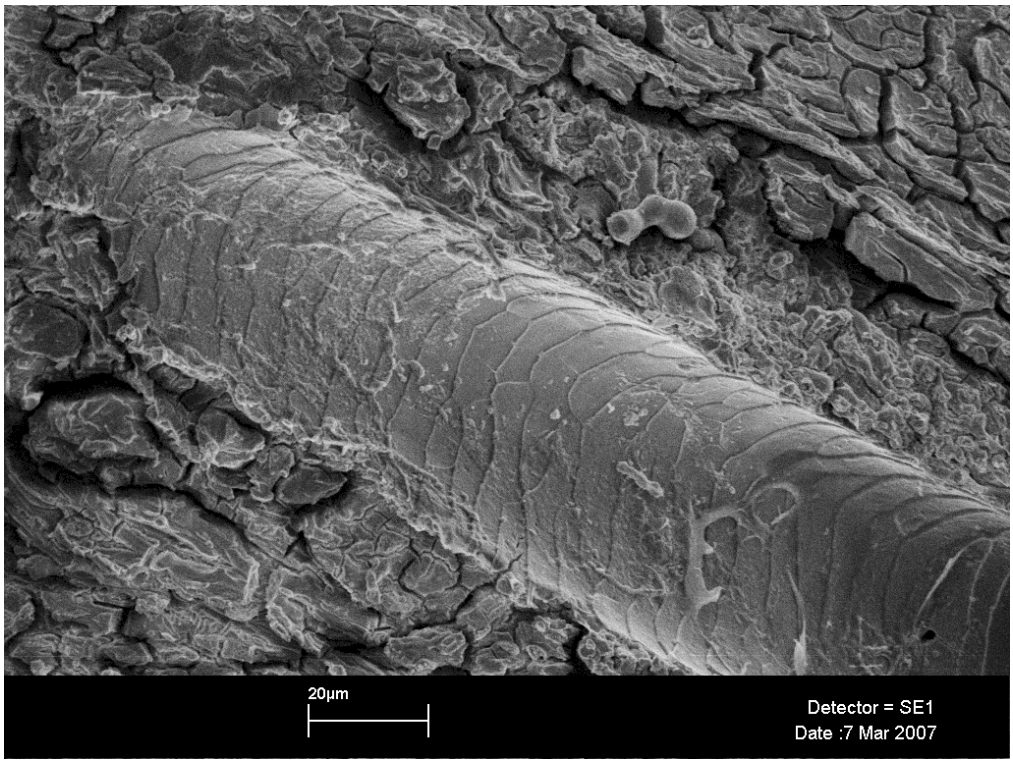


Figure 4.5 Scanning electron micrograph of the underside of the skin fragment shown in Fig 4.3, here showing a cast of a fibre with clearly visible bovine scale pattern.

One sheath (053: 0504 OP 1283) was seamed along the spine (P. Rogers pers. comm.), whereas another sheath (053: 0729 OP 1406b) was seamed at the cutting edge (Fig 4.6).

In other instances, the presence of a sheath was suspected from thick cohesive corrosion layers on the blades, often several millimetres in thickness but occurring in isolated patches. These appeared to be fibrous, and may be decayed collagen, or pseudomorphs of skin product, conceivably much altered through insect or micro-organism attack, or chemical damage. However, for these deposits it is difficult to be certain of the original materials that were present, and they are described in the catalogue below as 'mineralised organic remains'.

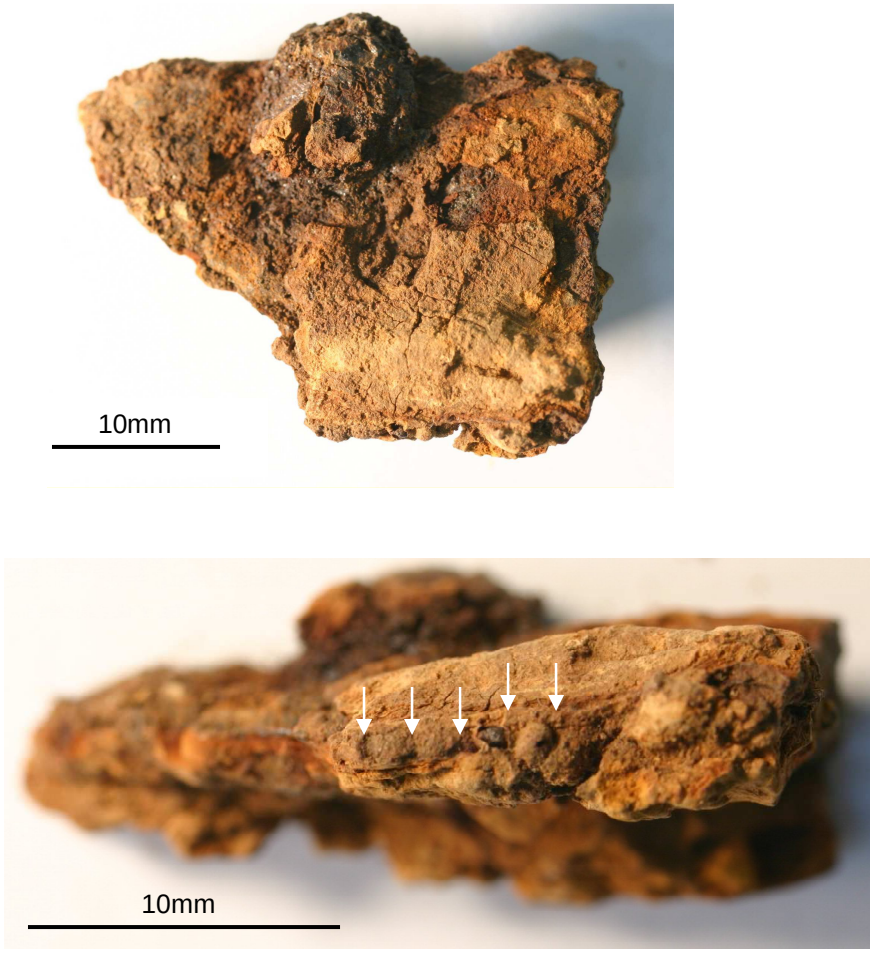


Figure 4.6 Part of a sheath made of skin product from knife OP 1406b. The seam at the cutting edge of the knife is shown lower centre in the upper image, and shown turned side-on in the lower image, where there are impressions from stitch holes along the edge of the sheath (arrowed).

Catalogue of knife handles and sheaths

FLN 053

Grave	OP	Mineralised organic remains
Cxt 001	0135	Horn survives on the tang.
0303	1186	Horn survives on the tang. Textile fibres on both sides of blade.
0305	0136	No certain evidence for handle or sheath.
0307	0145	Horn survives on the tang. No evidence for sheath.
0309	0139	Horn survives on the tang. Skin product on both sides of blade, up to 4mm thick. Textile above.
0349	1193	Horn survives on the tang. Traces of skin product on both sides of blade.
0358	1197b	No evidence of handle. Traces of mineralised organic remains on the blade, possibly from a sheath.
0388	1234	Horn survives on the tang. Skin product 3mm thick survives in places on both sides of the blade.
0395	1235	Horn survives on the tang. Skin product 1mm thick survives on both sides of blade and traces of grain pattern on one side near the tip suggest bovine, possibly calf.
0397	1246	Too broken for any evidence of handle or sheath.
0438	1248	No evidence for handle. Skin product on one side of blade.
0441	1252	Horn survives on the tang. Traces of mineralised skin product on blade, with textile over.
0501	1282	Horn survives on the tang. Slight traces of skin product survive on both sides of blade.
0501	1282b	No tang survives. Skin product up to 5mm thick survives on both sides of blade.
0504	1283	Very fragmented. No evidence of handle. Sheath with stitch holes were recorded by Penelope Rogers.
0533	1288	Horn survives on the tang. Skin product 2mm thick survives on one side of blade. Traces of plant material above.
0553	1289	Horn survives on the tang. On the blade there are slight traces of mineralised organic material, possibly skin product, with textile over.

0553	1323	Horn survives on the tang. Extensive skin product sheath survives on both sides of blade and wraps over the blade back and was joined at the cutting edge. Traces of fibres from fleece or textile over.
0575	1318	Horn survives on the tang. No certain evidence for a sheath.
0612	1355	Horn survives on the tang. Some skin product on both sides, with textile over on one side.
0615	1342	Traces of possible horn survive on the tang. Traces of skin product on both sides of blade.
0618	1344	No evidence of handle. Traces of skin product 2mm thick and plant material survive intermittently on at least one side of the blade.
0663	1372	Horn survives on the tang. Traces of skin product survive on both sides of the blade and may also have covered most of the handle
0716	1387	Abundant remains of horn on handle, which on one side has the ridges orientated diagonally suggesting a possible repair to the handle. On one side of the blade there is extensive skin product up to 2mm thick that shows the grain pattern. Scale pattern of fibres suggest bovine (possibly calf).
0729	1406a	Horn survives on the tang. No certain evidence of sheath.
0729	1406b	No evidence of handle. Bulky mineralised skin product on the blade, at least 5mm thick, is the remains of a sheath that was joined at the cutting edge, where there are six stitch holes visible in 7mm.
0742	1415	Traces of horn on one side of tang. Some skin product on both sides of blade and over the back and cutting edge.

FLN 062

0993	1270	Horn survives on the tang. Abundant skin product on both sides of the blade, 1.5mm thick and joined at the blade edge. Textile over.
0997	1278	Horn survives on the tang. Some skin product on both sides of the blade, with fibres from textile or fleece over.
1825	1272	Horn survives on the tang. Some skin product on both sides of the blade, with textile over.
1829	1285	Small knife broken into 4 pieces. Horn survives on the tang. Traces of skin product with fibres from fleece or textile over including on the horn handle.

1841	1289	On the tang, mineralised material is probably horn. Mineralised organic material on one side, possibly skin product. On the blade back and orientated longitudinally are some plant remains, probably wood, 35mm in length.
1850	1303	No tang survives. Non-orientated plant debris is present on the blade.
1863	1297	Horn survives on the tang. Traces of mineralised organic material on both sides of the blade.
1865	1351	Horn survives on the tang. Traces of skin product on both sides of blade, with textile over including on the horn handle and the blade on both sides.
1872	1366	Horn survives on the tang. Traces of thin skin product on both sides of blade.
1872	1368	Slight traces of possible horn survive on the tang. Slight traces of mineralised organic remains on both sides of the blade including fleece or textile fibres.

5. The other wood remains

Jacqui Watson

Most of the organic materials were preserved by iron corrosion products, but in addition to these are two other examples of wood preserved by lead or copper fittings.

Lead spindle whorl from Grave 0727

OP 1385
A lead spindle whorl with traces of the wooden spindle, was examined on the SEM but wood remains were not well enough preserved to identify species.

Wood vessel from Grave 0358

Three pieces of copper alloy strips are probably the remains of a vessel rim mount and two repair staples, which were attached to a small wooden bowl or bottle made from maple (*Acer* sp.). The position of the rim mount (1229) and the staple (1227) on the grave plan indicate that the vessel had a diameter in the region of 85mm, with sides 3-5mm thick. As only one fragment of wood remains it is possible to produce two variations of body shape for this vessel – see figure 5.1.

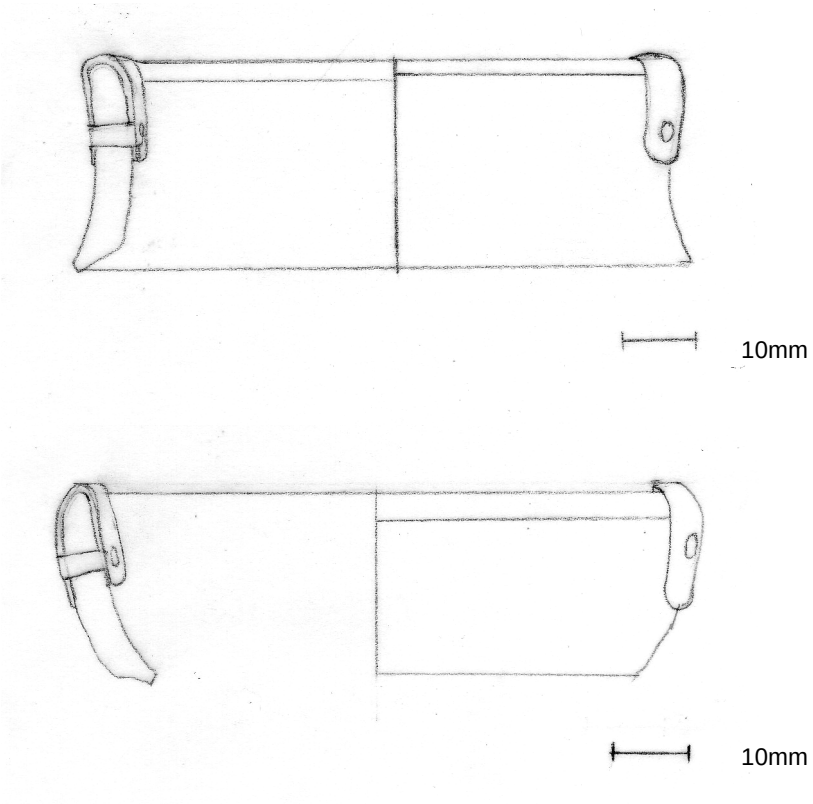


Figure 5.1 Alternative vessel profiles for cup mount OP 1229.

The grain orientation of this wooden fragment suggests that it is from a face-turned vessel with external surfaces of transverse and radial sections (Morris, 2000, 2122). All the copper alloy pieces were attached to a transverse section, the wood surface that is prone to splitting, so it is quite likely that the staples (1226, 1227) were holding together a crack on this side of the vessel (fig. 5.2). The fragment of wood attached to the rim mount does not appear to be broken, and the wood surface appears to be covered in little knots of wood that would have given the vessel an attractive appearance when in use.

This may have been similar in form to two of the wooden cups from Sutton Hoo, Suffolk (Bruce-Mitford 1983, 368, 372), but these are much smaller with rim diameters of around 35mm. Maple was used for vessels at both Sutton Hoo and Taplow, Berkshire as well as being the traditional choice for mazers, where again a type of burr wood was chosen for its highly patterned grain.

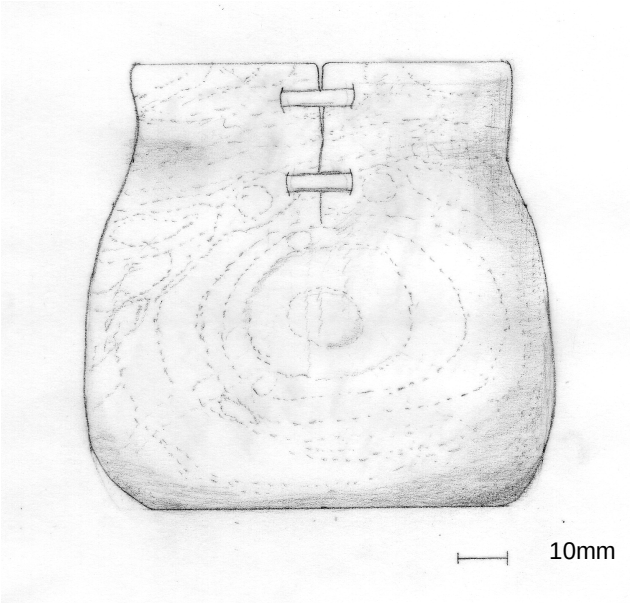


Figure 5.2 A possible reconstruction of the original wooden vessel, illustrating how the staples could have been used to repair a crack in the vessel rim.

OP 1226
Fragment of a rectangular-section copper-alloy staple. L.13 mm, arm 4 mm; W. 3 mm.

OP 1227
Almost complete rectangular-section copper-alloy staple. L.14 mm, arm 4 mm; W. 3 mm. Embedded in mineral-preserved wood, 15 x 4 mm.

OP 1229
Fragment of wood, pierced by a rolled tube of copper-alloy sheet, 2 mm diameter, with remains of a flat plate on one end. 20 x 9 x 4 mm.

6. Other mineralised fibres

Vanessa Fell

Skin and leather are discussed earlier, under shield components (Section 2) and sheaths (Section 4).

Textile

Selected samples of mineralised fibres were examined by scanning electron microscopy in an attempt to identify the fibre type, to assist by Penelope Rogers with recording the textile. Two examples of wool are shown below. Note in particular the hollowed fibres which are casts of the original fibres (due to mineralization) and which show the scale patterns in reverse. In some instances identifications were not possible, either because their condition did not allow sampling and mounting for SEM, or because examination did not reveal sufficient features to enable identification. Plant fibres in particular were difficult to identify (because of the absence of scale patterns).

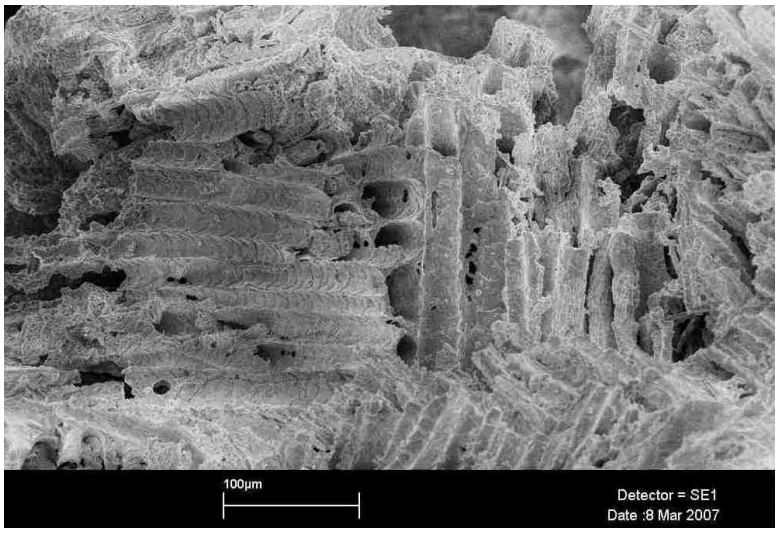


Figure 6.1 Iron buckle OP 1257 showing casts of wool fibres from attached textile.

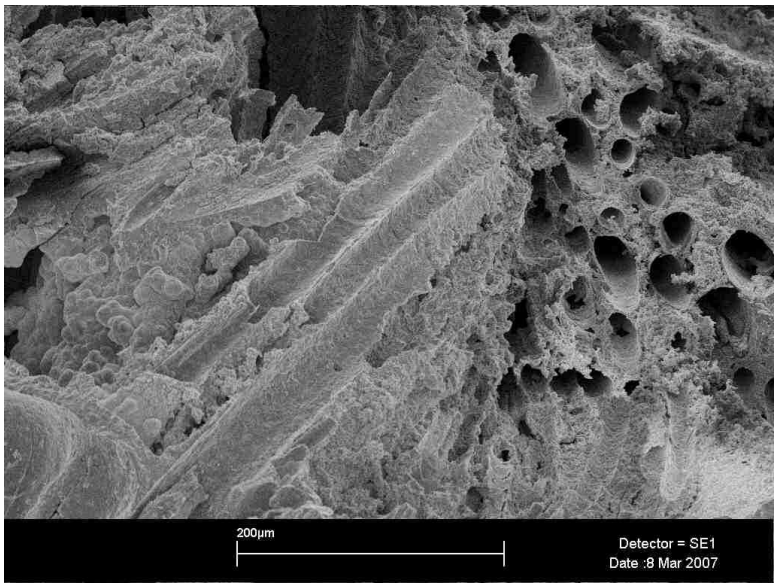


Figure 6.2 Copper alloy brooch OP 1368 showing casts of wool fibres from the rear of the hollow iron pin.

Plant fibres

Plant fibres were found on a variety of different types of artefacts including the outside of shield bosses, knives and spearheads (eg Fig 6.3).

Fibres on spearhead sockets 053: 0305 OP 0138 and 062: 0829 OP 1284 were identified by Dr David Robinson as straw, most likely grass or sedge.

The positions of the plant fibres, often on top of the artefacts as laid in the grave, suggests that plant material may have been placed within graves as covering of the grave prior to backfilling.

Figure 6.3 Spearhead socket OP 1268 with mineralised plant remains. Scale in mm.

7. The beads

Vanessa Fell

A total of 200 beads of glass or amber were recovered from the graves, and in addition, there are approximately 12 copper alloy bucket beads (Table 7.1). A small selection of the glass beads are shown on the front cover of this report (not to scale).

Table 7.1 Distribution of the beads between the two sites

	FLN 053	FLN 062
Glass beads - Total	80	18
Consolidated or repaired	*19*	*2*
Broken beyond repair	*4*	*0*
Amber beads - Total	68	34
Consolidated or repaired	*68*	*34*
Total glass & amber beads	148	52
Copper alloy bucket beads	c.12	0

Glass beads

Condition

The majority of the glass beads were complete and robust, requiring only superficial cleaning to remove soil and quartz grains from their surfaces. However, several beads were friable and required consolidation or repair. Four beads had fractured beyond repair.

Treatment

Beads were initially photographed as a record of their condition before treatment. They were cleaned free of soil by dry brushing where possible, otherwise they were cleaned with wooden cocktail sticks or swabbed with a solution of water and industrial methylated spirits (1:1). Beads were weighed after cleaning, as well as prior to cleaning if there was likely to be any damage during that process (Appendix 1). The beads from FLN 062 had been cleaned elsewhere and did not require additional work.

In the few instances where the beads required consolidation, these were treated with 2.5% or 5% Paraloid B72 (acrylic copolymer) solution in acetone (cf. Gao 2006a). Minor repairs were also made with 5% Paraloid B72. Beads were again weighed after consolidation (Appendix 1). There was no significant difference in weight before and after consolidation (maximum difference of 0.01g is within experimental error).

Amber beads

Condition

All of the amber beads showed some evidence of deterioration. Some were only slightly decayed on their surfaces but retained much of their original transparency. Others had become opaque through more extensive decay. A number had fissured badly, had become sugary, or had fractured, or lost surface layers.

Treatment

All amber beads were initially photographed as a record of their condition before treatment. Beads were weighed before cleaning (Appendix 1). (FLN 062 beads had been cleaned elsewhere and did not require additional work.) Beads were cleaned free of soil by dry brushing where possible, otherwise these were cleaned with wooden cocktail sticks or swabbed with a solution of water and industrial methylated spirits (1:1). Beads were weighed again after cleaning (Appendix 1).

The beads were consolidated with 5% Paraloid B67 (butyl methacrylate) solution in white spirit with c. 20% Butan-2-ol (cf. Gao 2006b). Most of the beads required several applications of consolidant, using a soft brush. This process usually took around a week before the solvent (white spirit) had evaporated. The beads were then left exposed to the air for another week.

Beads were reweighed (Appendix 1). There was no significant difference between the two sets of measurements, -0.01g to +0.04g, and these slight variations could be due to changes in temperature or humidity. Any increase in weight should be due only to the applied solvent that had not yet been released. (A calculation of the weight increase expected from applying two drops of a 5% solution of Paraloid B67 shows that this would be equivalent to 0.005g after solvent evaporation, based on the volume of a single drop being approximately 0.05ml). This suggests that there should be no significant increase in weight when amber is consolidated providing that the solvents have evaporated satisfactorily.

Copper alloy bucket beads

There are approximately 12 copper alloy beads from two graves from FLN 053 (Table 7.2). These few beads were X-rayed and examined for textile and fibres, and no other treatment given because this could interfere with the recovery of mineralised fibres.

Table 7.2 Copper alloy bucket beads from FLN 053

No.	Number of beads	X-radiographs	Comment
053: 0463 OP 1259b	2 or 3 (One is almost complete, plus one or two broken beads)	P2526	Possible fibres present. Also fungal hyphae
053: 0553 OP 1315	? 9 (Six are almost complete beads plus c. three others)	P2527	Detached fibres are present but there is no really convincing evidence for textile within the buckets.

8. X-ray fluorescence (XRF) analysis

Vanessa Fell

The composition of selected metal finds was determined by X-ray fluorescence analysis, which is a surface analytical technique. The results are qualitative only, due to surface corrosion, but they serve to indicate the presence of applied metals, such as solder and platings.

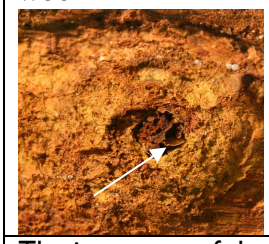
Analyses of most items were made on a small area, c. 0.3mm diameter, under vacuum at 40kV, 220μA in an Eagle II X-ray fluorescent spectrometer with a lithium-drifted silicon detector. However, the *in situ* studs of the shield boss 053: 0397 OP 1237 were determined (very qualitatively) on a Link Analytical XR400 system owing to the size of the boss that would not fit into the chamber of the Eagle spectrometer. This is an older and less sensitive spectrometer but nevertheless the measurements are perfectly adequate.

Table 8.1 Summary of XRF results

Bracketed are minor and trace peaks

No and identity	Item and area analysed	Result	Interpretation
053: 0309 OP 0144 Ring	Fragments of a ring, analysed across broken metal edge	Pb	Almost pure lead
053: 0438 OP 1249 Sleeve clasp	Hook-piece, rear, edge	Cu Sn (Pb Zn)	The metal seems to be bronze with a trace of lead and zinc (analysed on the cleaned dark shiny surface on the rear)
	Hook-piece, front	Cu Sn (Pb Zn)	Same as the rear surface
	Hook-piece, ?edge of solder	Cu Sn Pb	Much more tin and lead than the base metal, suggested that the hook was attached with a tin-lead solder
	Catch-piece	Cu Au Sn Pb	Gilding on a leaded bronze. No mercury was detected in the gilding. No gilding was determined on the rear.
053: 0395 OP 1236 Buckle	White metal studs on buckle 	Ag (Cu S Au)	The studs are made of silver in which there is a small amount of copper and a trace of gold. Sulphur was also determined, which will be from the surface black tarnish layer.

053: 0438 OP 1250 Sleeve clasp	Hook-piece	Cu Au (Zn Pb)	The base metal is copper with a possible trace of zinc and lead. The base metal may be de-alloyed. The hook-piece was gilded (no mercury detected).
	The hook itself	Cu (Sn Zn Pb)	A grey area showed mainly copper
	Hook-piece. Probable solder under the detached hook plate	Cu Sn (Pb)	Abundant tin suggests that the plate was attached with a tin solder
	Catch-piece, front	Cu Au	Gilded (no mercury detected).
	Catch-piece, rear	Cu Sn Pb (Zn)	Where the surface has been part cleaned, the metal seems to be a leaded bronze
053: 0553 OP 1291 Brooch	Broken pin catch on reverse of brooch	Cu Sn Pb (Fe)	Leaded bronze. The pinkish-grey corroded metal at the modern break showed no evidence of a silver alloy as suspected, but was a leaded bronze. Similarly, a dark area on the front was shown also to be a leaded bronze.
053: – OP 1157 Brooch	White metal on the wings near to a probable repair on copper alloy brooch 	Cu Sn (Pb)	The area bearing the white metal on the front of the wings was shown to comprise copper and tin (although the tin did not show as strongly as expected). Nevertheless, there was more tin here than on the reverse side and on the top of the bow, suggesting that a solder had been applied. Although no secondary component now survives, the appearance suggests that the wings may have been repaired in antiquity.
062: 0997 OP 1279 Buckle	The rivets from an iron buckle with plates	Sn (Fe Cu Pb)	Two rivets that are fractured across were analysed. Both show that the rivets seem to be made of tin with only very small amounts of lead and also some copper. A second analysis was made after sampling for XRD but the results were the same. The rivets seem to be made of a tin alloy that comprised mainly tin but with some lead and possibly a trace of copper. This is an unusual composition for rivets; it is possible that the composition is due to the de-alloying of bronze during burial.

062: 1865 OP 1347 Brooch	Annular brooch – yellow metal on the front	Cu (Zn Pb)	A small area of yellow metal was analysed in case this was the remains of gilding. No gold was detected. The metal is a low zinc brass with traces of lead. The yellow colour will be due to the brass visible beneath the green copper corrosion products.
053: 0397 OP1237 Shield boss	Stud 1. Head	Ag	The top layer of the stud head is silver, which is attached to a copper or bronze base, with rivet and washer
	Stud 2. Head		As Stud 1
	Stud 3. Head		As Stud 1
	Stud 4. Head (detached)	Cu Sn (Pb)	The head is bronze with some lead. It has the appearance of possibly having had another layer attached; perhaps it was originally another silver foil coated stud head (like stud 1).
	Stud 5 (detached)	Cu Sn (Pb)	The head is bronze with some lead. It has the appearance of possibly having had another layer attached; perhaps it was originally another silver foil coated stud head (like stud 1). The washer contains no tin suggesting that it was plain copper.
	Stud 1239 head	Cu Zn (Sn Pb)	The head was a low-alloy brass with small amounts of tin and lead.
	Stud 1239 washer	Cu	The washer was copper with insignificant amounts of tin.
	Stud 1240 Head	Cu Sn (Pb)	The head is a low-alloy tin bronze with some lead.
062: 0997 OP 1276 Decorative shield mount (Fig 2.4)	Around the broken stem of a rivet, adjacent to the wood 	Fe Sn Ca	Low levels of tin and calcium. These may have arisen through re-deposition of the tin from a corroding bronze, the tin depositing around the rivet stem.
	The iron stem of the stud	Fe (Cu Pb)	The iron stem had traces of copper and lead (like the surrounding area away from the immediate stem surface) which may have derived from a corroded bronze.

Bracketed are minor and trace peaks

9. X-ray diffraction (XRD) analysis

Vanessa Fell

The iron buckle 062: 0997 OP 1279 has non-ferrous metal rivets that survive as beige-white powder. XRF analysis of the rivets showed mainly tin (see table above). These rivets were sampled and analysed by XRD to attempt to clarify the metal composition, and to investigate if the presence of the tin could be due to decuprification of bronze. The latter is known to occur in acidic soils, and was determined at Snape, Suffolk, for example (Filmer-Sankey and Pestell 2001, 17).

However, despite several attempts no clear XRD spectrum was obtained and therefore, presumably, the sample was not crystalline and thus could not be determined by this analytical technique.

Acknowledgements

We thank Dr David Robinson for identifying plant remains and Roger Wilkes for assistance with the scanning electron microscope.

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Appendix 1. Weights and dimensions of the beads

Vanessa Fell

FLN 053

Grave	OP	Material	Wt (g) before	Wt (g) after cleaning	Wt (g) after treatment	Length mm	Width mm	Consolidated
0311	0147 a	Glass		0.73				
0311	0147 b	Glass		0.45	0.45			Repaired
0311	0147 c	Glass		0.55				
0311	0147 d	Glass		0.5				
0311	0147 e	Amber	0.34	0.32	0.33	9	9.7	Yes
0311	0147 f	Amber	0.37	0.37	0.37	10.5	8.3	Yes
0311	0147 g	Amber	0.37	0.35	0.36	9.5	9.3	Yes
0311	0147 h	Amber	0.45	0.43	0.43	10	8.3	Yes
0311	0147 i	Amber	0.76	0.72	0.72	12.9	12.8	Yes
0307	1154	Glass		0.24				
0307	1158	Glass		0.29				
0307	1159	Glass		0.34				
0307	1160	Glass		0.44	0.44			Yes
0307	1161	Glass		0.26	0.26			Cons & Repaired
0307	1162	Glass		0.34				
0307	1163	Glass		0.39				No
0307	1164	Glass		0.5				
0307	1165	Glass		0.62	0.62			
0307	1166	Glass		0.36	0.36			Cons & Repaired
0307	1167	Glass		0.23				Not repaired
0344	1170	Amber	0.31	0.3	0.3	4	12.3	Yes
0344	1171	Glass		0.22				
0344	1172	Glass		0.21				
0344	1173	Glass		0.19				
0344	1429	Glass		0.46	0.46	6.4	7.5	Yes
0307	1174	Glass		1.61	1.63			Yes
0307	1175	Glass		0.97	0.97			Yes
0307	1176	Glass		0.72				
0307	1177	Glass		3.12				
0307	1178	Amber	1.42	1.34	1.34	8.5	16.3	Yes
0307	1179	Amber	4.08	3.9	3.92	10	25	Yes
0307	1180	Amber	1.57	1.44	1.45	12.5	14.5	Yes
0307	1181	Amber	1.15	1.09	1.09	6.6	17.1	Yes
0307	1182	Glass		1.37				
0349	1198	Glass		3.16				
0349	1199	Glass		1.4				
0349	1200	Amber	0.42	0.42	0.42	10	9.3	Yes
0349	1201	Glass		0.98				
0349	1202	Glass		0.38				

0349	1203	Amber	0.31	0.3	0.3	9	8.5	Yes
0349	1204	Amber	0.21	0.2	0.2	8.1	7.6	Yes
0349	1205	Glass		1.44				No
0349	1206	Amber	0.87	0.83	0.83	13	13.1	Yes
0349	1207	Amber	0.79	0.78	0.78	12.8	12.1	Yes
0349	1208	Glass						
0349	1209	Amber	0.86	0.86	0.85	14.3	10.6	Yes
0349	1210	Glass		3.77				
0349	1211	Amber	0.81	0.8	0.81	14.3	11	Yes
0349	1212	Glass						
0349	1213	Amber	0.87	0.86	0.87	13.5	11.9	Yes
0349	1214	Amber	0.79	0.77	0.78	12.6	12	Yes
0349	1215	Amber	0.68	0.66	0.67	12.5	11.7	Yes
0349	1216	Amber	0.25	0.24	0.25	10.5	7.9	Yes
0349	1217	Glass		0.52	0.52			Yes
0349	1218	Amber	0.36	0.34	0.34	10.1	9.4	Yes
0349	1219	Glass		0.86				
0349	1220	Amber	0.45	0.44	0.45	13.5	12.5	Yes
0463	1259b	Bronze						
0463	1261	Glass		0.27				
0463	1262	Amber	0.27	0.24	0.24	7.3	7.8	Yes
0463	1263	Amber	0.11	0.1	0.11	6.8	6.5	
0463	1264	Glass		0.25	0.26			Cons & Repaired
0463	1265	Glass		1.09				
0463	1266	Glass		0.3				
0463	1267	Glass		0.85				
0463	1268	Glass		0.4				
0463	1269	Amber	0.4	0.37	0.38	8.3	8.7	
0463	1270	Amber	0.88	0.8	0.8	10.2	12.3	Yes
0463	1271	Amber	0.16	0.14	0.13	6.1	6.5	Yes
0463	1272	Amber	0.11	0.1	0.08	6.2	6	Yes
0463	1273	Glass		1.87	1.88			Yes
0467	1278	Amber	2.81	2.65	2.66	11.5	20.6	Yes
0533	1293	Amber	1.18	1.1	1.13	7	17.2	Yes
0533	1294	Amber	1.29	1.27	1.28	12	17	Yes
0533	1295	Amber	0.57	0.54	0.56	10	10.5	Yes
0533	1296	Glass		0.21				
0533	1297	Amber	0.31	0.3	0.29	9	8.8	Yes
0533	1298	Amber	0.25	0.24	0.24	7.8	8.2	Yes
0533	1299	Amber	0.22	0.21	0.23	8.5	8.6	Yes
0533	1300	Glass		0.37				
0533	1301	Amber	0.44	0.43	0.42	10	9.1	Yes
0533	1302	Amber	0.64	0.6	0.62	10.3	11.5	Yes
0533	1303	Amber	0.23	0.21	0.21	8	7.4	Yes
0533	1304	Amber	0.39	0.37	0.37	10.2	9.2	Yes
0533	1305	Glass		0.36				
0533	1306	Glass		0.29				
0553	1307	Glass		1.44				
0553	1308	Amber	0.07	0.07	0.06	5.5	4.6	Yes

0553	1309	Amber	0.07	0.07	0.06	5.1	4.8	Yes
0553	1310	Amber	0.02	0.02	0.03	4.5	4	Yes
0553	1311	Amber	0.08	0.06	0.06	4.8	5.7	Yes
0553	1312	Glass		0.1	0.1			Yes
0553	1313	Amber	0.08	0.06	0.05	5	4.7	Yes
0553	1314	Amber	0.06	0.05	0.05	5	5.4	Yes
0553	1315	Bronze						
0553	1319	Amber	0.05	0.05	0.05	4.3	4.6	Yes
0553	1320	Glass		0.07	0.07			
0553	1321	Glass		0.04	0.04			Yes
0612	1328	Amber	0.2	0.18	0.18	7.1	6.4	Yes
0612	1329	Amber	0.22	0.21	0.2	7.7	6.3	Yes
0612	1330	Glass		0.35				
0612	1331	Amber	1.29	1.24	1.25	14	13.8	Yes
0612	1332	Amber	0.9	0.86	0.87	11.5	11.4	Yes
0612	1333	Glass		0.97	0.97			Yes
0612	1334	Amber	0.75	0.71	0.71	12.5	11	Yes
0612	1335	Glass		0.96	0.95			Yes
0612	1336	Amber	0.22	0.2	0.2	4.2	8.8	Yes
0612	1337	Glass		0.32				
0612	1338	Glass		0.29				
0612	1339	Amber	0.29	0.26	0.27	7.5	7.6	Yes
0612	1340	Amber	0.31	0.28	0.28	7.5	7.8	Yes
0618	1345	Glass		0.04	0.05			Yes
0618	1346	Glass		0.05	0.06			Yes
0618	1347	Glass		0.08	0.08			Yes
0618	1348	Amber	0.56	0.47	0.48	10.2	10.3	Yes
0618	1349	Glass		0.48				
0618	1350	Glass		0.62				
0612	1351	Amber	9.43	9.12	9.16	15.2	33.1	Yes
0597	1361	Glass		0.49				
0597	1362	Glass		0.59				
0597	1363	Glass		0.49				
0597	1364	Glass		0.56				
0597	1365	Glass		0.49				
0618	1366	Amber	0.39	0.33	0.33	9.8	9	Yes
0597?	1374	Glass		0.59				
0727	1389	Glass		1.5				
0727	1390	Glass		0.73				
0727	1391	Amber	0.48	0.4	0.4	11	9.5	Yes
0727	1392	Amber	0.71	0.69	0.69	11.8	10.9	Yes
0727	1393	Glass		0.45				
0727	1394	Amber	0.44	0.39	0.38	9	9.5	Yes
0727	1395	Amber	0.56	0.49	0.49	11.7	10,.2	Yes
0727	1396	Amber	0.61	0.53	0.53	11.8	10.9	Yes
0727	1397	Amber	0.45	0.4	0.4	9.6	10.3	Yes
0727	1398	Glass		0.7				
0727	1399	Amber	0.43	0.37	0.38	10.3	10	Yes
0727	1400	Amber	0.71	0.62	0.63	12.2	10.7	Yes

0727	1401	Amber	0.41	0.37	0.38	10.2	10.6	Yes
0727	1403	Glass		0.42				
0733	1405	Glass		0.38				
0725	1407	Glass		0.83				
0725	1408	Glass		0.35	0.35			Yes
0725	1409	Amber	0.39	0.35	0.36	8.9	9.1	Yes
0725	1410	Glass		0.73				
0725	1411	Glass		0.68				
0725	1416	Glass		0.2				
0725	1417	Glass		0.3	0.3			Yes
0725	1418	Glass		0.32				
0725	1419	Glass		0.71				
0725	1420	Glass		0.38				

FLN 062

Grave	OP	Material	Wt (g) cleaned	Wt (g) after	Length mm	Width mm	Condition	Consolidated
1860	1305	Amber	2.1	2.11	18.4	16.7	Incomplete	Yes
1860	1306	Glass	0.3		6	7.4		No
1860	1307	Glass	0.38		6.5	7.7	Incomplete	No
1860	1308	Glass	0.77		6.3	9.3		No
1860	1309	Glass	0.64		7.3	8.6		No
1860	1310	Glass	0.48		7	7.3		No
1860	1311	Glass	0.4	0.4	7	7.3		Yes
1860	1312	Glass	0.46		4.6	8.2		No
1860	1313	Glass	0.24		6	6.8		No
1860	1314	Glass	0.47	0.47	6	8.7	Incomplete	Yes
1860	1315	Glass	0.23		5.1	6.5	Incomplete	No
1860	1316	Glass	0.3		7.4	6.4		No
1865	1317	Amber	12.01	12.04	31.7	29.7	2 flecks lost	Yes
1865	1318	Amber	0.55	0.55	11.8	11		Yes
1865	1319	Amber	2.27	2.27	17.7	16		Yes
1865	1320	Amber	1.71	1.74	15.4	15.5		Yes
1865	1321	Glass	2.62		10.9	15.6		No
1865	1322	Amber	0.72	0.72	10.3	10.5		Yes
1865	1323	Amber	0.85	0.85	12.9	11.5		Yes
1865	1324	Amber	0.87	0.89	12.8	12.4		Yes
1865	1325	Amber	0.51	0.53	11.2	10.8		Yes
1865	1326	Amber	2.46	2.46	19.1	16.8		Yes
1865	1327	Amber	2.29	2.3	17.5	17.3		Yes
1865	1328	Amber	1.64	1.66	16.6	15.3		Yes
1865	1329	Amber	0.36	0.36	10	9.1		Yes
1865	1330	Amber	0.92	0.92	12.6	11.6		Yes
1865	1331	Amber	1.14	1.15	14.8	13.5	chipped	Yes
1865	1332	Amber	0.67	0.69	10	11		Yes
1865	1333	Amber	1.12	1.13	14.4	14		Yes

1865	1334	Amber	0.9	0.9	12.1	11.9		Yes
1865	1335	Amber	0.68	0.69	10.4	11.3		Yes
1865	1336	Amber	0.86	0.86	12.5	12.3		Yes
1865	1337	Amber	0.46	0.46	11.5	10	?Incomplete	Yes
1865	1338	Amber	1.74	1.75	15.9	16		Yes
1865	1339	Amber	1.67	1.68	15.3	14.7		Yes
1865	1340	Amber	0.57	0.57	12.6	11.3		Yes
1865	1341	Amber	1.85	1.87	16.9	17		Yes
1865	1342	Amber	0.26	0.26	8.6	8	chipped	Yes
1865	1343	Amber	0.51	0.52	10.8	10.6		Yes
1865	1344	Amber	1.11	1.11	13.5	11.4		Yes
1865	1345	Amber	0.81	0.82	14.7	13		Yes
1865	1346	Glass	0.34		5.5	7.5		No
1865	1354	Glass	0.32		5.7	7.5		No
1865	1355	Glass	0.26		4.5	7.4		No
1865	1356	Amber	0.5	0.51	10.3	9.8		Yes
1865	1357	Glass	0.33		4.6	6.8		No
1865	1358	Glass	0.35		5.7	7.5		No
1865	1361	Amber	0.71	0.71	12.3	11.7		Yes
1865	1362	Glass	2.61		13.3	14		No
1865	1363	Amber	0.97	0.99	13	13.2		Yes
1865	1364	Amber	1.09	1.1	12.9	12		Yes
1865	1365	Amber	1.12	1.14	12.4	14		Yes

Weights (g) include all fragments and detached pieces.
Weights were determined on the same balance and are correct to c. 0.1g.
Width (mm) is the maximum thickness or outside diameter of the bead.
Length (mm) is the length as if threaded.
Dimensions (length and width) were measured simply in case there were any 'swap-overs' during treatment and were not checked; therefore these are not necessarily accurate.






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