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Summary

Report on a selected group of ironwork which had non-ferrous metal and visible organic material preserved. The objects comprise twelve knives, two arrow heads, a sword hilt and a punch which came from refuse pits and wells from this medieval site, dating between 14th-16th centuries. The knives are particularly interesting as originally most had highly decorated handles made from precious materials such as ivory and mother-of-pearl, as well as wood or bone, attached to the iron tang with non-ferrous metal rivets, shoulder and end-plates. The report is illustrated with digital images of the X-radiographs and electron micrographs of some organic material.

Keywords

Iron
Copper alloy
Lead
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Quita Mould selected sixteen metal objects with traces of organic material preserved in the corrosion layers for identification and comment. All but four of these objects are knives and they were retrieved from refuse pits and wells, with dates from the 14th - 16th century. All the objects were examined using a low-powered binocular microscope in order to distinguish between the different organic materials. In several instances samples were examined on the scanning electron microscope (SEM), particularly to confirm the wood species (Watson, 1988), and where this technique has been used the sample numbers are indicated in the catalogue.

In addition to the organic components, characteristic corrosion products and X-radiography indicated the presence of non-ferrous metal rivets and decoration on many of the handles, as well as the ferrous components such as the knife tangs. The majority of the knives have non-ferrous shoulder plates (between the handle and the blade) and end plates (at the far end of the handle). X-ray fluorescence (XRF) was used to analyse the non-ferrous metal fittings on each knife. This technique is non-destructive and rapid, although not quantitative. A variety of copper alloys were identified and the terms used to describe them are as follows: brass is an alloy of copper and zinc, bronze is an alloy of copper and tin, and gunmetal is an alloy of copper with significant amounts of both zinc and tin (Bayley, 1991). X-radiography of the knives was undertaken by Karla Graham.

Detailed descriptions of both the organic and metal components are given below for each object. The table in appendix 1 summarises this information for all of the objects examined.

Knives

Despite their current corroded appearance, many of the knives originally had highly decorated handles of various materials including ivory and mother-of-pearl, as well as the more normal bone, horn and wood. Many of the scale-tang knives have non-ferrous metal components to attach the organic scales to the knife and as decorative elements on the handles.

The condition of the preserved organic material is highly variable. The elephant ivory scales on the knife tang sf. 7434 are in an excellent condition, with the lines of Retzius clearly visible (Penniman, 1952) while the condition of the iron-preserved wood is completely different. At low magnification there are extensive remains which appear to be well preserved, but in some cases at high magnifications it can be seen that the wood structure has been reduced to replaced cells, with no trace of the middle lamella (see fig.1). In several instances none of the essential diagnostic features remain within the vessels, with the result that identification to species level has not been possible.

Figure 1. The vessel walls have been delignified by iron oxides, which have also created negative casts of these cells. Sf. 5658.

Some of the handles are made from wooden sections with many knots visible, which may have been a deliberate choice for decorative effect, or poor quality wood was used which was coloured (Cowgill et al, 1987). Two of these knife handles (250 & 7035.20) had previously been identified as possibly being made from walnut or burr elm. Unfortunately neither of these samples could be positively identified, as their microscopic structures had not retained sufficient diagnostic features, but the use of either of these woods for knife handles has not been recorded in the archaeological record.

As mentioned above, one of the knives has a distinct ivory handle, but another (sf. 7531) could also be made of this material or it may just be bone or antler. The whittle tang handle of the knife sf. 6978.13 was possibly made of bone or antler.

The scale-tang knife sf. 7162/3 may originally have had mother-of-pearl scales, but the organic remains are in a very poor condition, having been reduced almost completely to iron corrosion. On examination under the SEM (see fig.2), these corrosion products had the same structure as mother-of-pearl scales on a similar type of knife from Camber Castle, Sussex which comes from a 16th - 17th century context. Mother-of-pearl is made from the nacreous lining of shells, in particular pearl oysters of genus Pinctada (pers comm. S.Payne). The genus has many species in tropical regions all round the world including the Red Sea, Zanzibar, India, the Caribbean and the Pacific. Mother-of-pearl is also widespread in other shells, including fresh-water mussels, ormers and top shells which are native to Britain and the Channel Islands, but most of these are considerably smaller and thinner than Pinctada and are unlikely to be of a sufficient size to produce the handle scales for this knife. The tropical shell may have been available in Tudor England, but with the exception of the Camber Castle example, no handles made from mother-of-pearl have been recorded for this period - there are certainly no examples from any of the periods covered in the Museum of London's Medieval Knives and Scabbards volume (Cowgill et al, 1987).

Figure 3. X-radiograph of knife handle (sf 5357), actual size.

5658 50083 4262 Scale tang knife
The scales on this knife are wooden but they are too degraded to identify (SEM B808). The two rivets visible on the handle are iron. There is also a shoulder plate, with traces of green corrosion products, which analysis showed to be brass.

6863.9 50285 5305 Scale tang knife
This knife had wooden scales, possibly *Salix* sp. (willow) or *Populus* sp. (poplar) (SEM B810). No non-ferrous metals were detected.

6978.13 50296 4660/1 Small whittle tang knife
This knife has the remains of a bone or antler handle and random fragments of wood on the blade.

6989.1 50301 4663/5302 16.1996 Scale tang knife
This knife has wooden (SEM B811) scales, made from *Salix* sp. (Willow) or *Populus* sp. (poplar). At the blade end, the handle is bound with tightly wound plyed thread (SEM B812). At high magnification the thread appears to be made up of very fine fibres with no visible scale patterns or nodes. The size of the fibres suggests that they are vegetable fibres rather than animal hair.

7035.20 50317 2709 Scale tang knife
This knife has wooden scales (SEM B813) with a very knotty grain. It had previously been suggested that these scales were walnut or burr elm. Unfortunately the wood species could not be definitely identified, as the microscopic structure had not retained sufficient diagnostic features. There are three tubular rivets through the knife handle, with associated green corrosion products, which analysis showed are brass.

7139 50284 4759 Scale tang knife
This knife has horn scales.

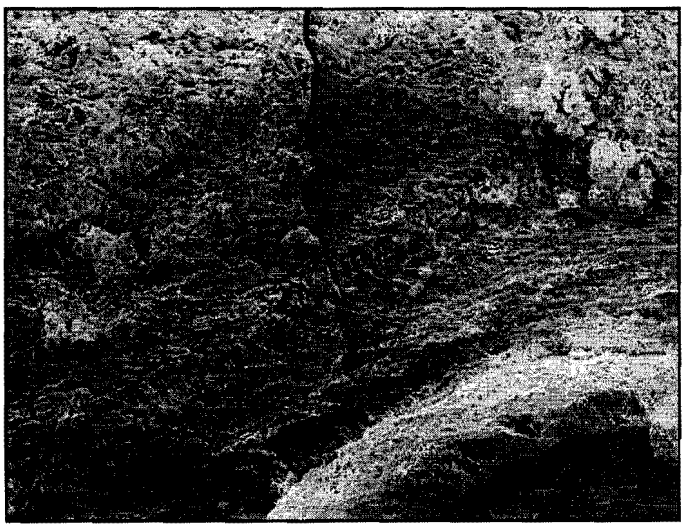

Figure 2. Detail of the iron corrosion on knife tang sf. 7162/3, in which a platelet structure can clearly be seen.

250 10199 2813 Scale tang knife

This knife has remains of wooden scales (SEM B807) that have a very curly grain. It had previously been suggested that these scales were walnut or burr elm. Unfortunately the wood could not be definitely identified as the microscopic structure had not retained sufficient diagnostic features.

5357 11058 3711 Scale tang knife handle

The scales of this knife are wooden, made from *Buxus* sp. (box) (SEM B809). X-radiography shows that there are five small tubular rivets through the handle, only three of which are visible (see fig.3). Analysis of the rivets showed that they are brass. There are also two heart-shaped, sheet metal rivets through the thickness of the handle, which are also brass. Traces of lead were detected in one small area on the handle, near a rivet. This is possibly a spot of solder. It appears that the end plate of the knife has become detached, exposing the iron tang where it would have been fitted, and leaving green corrosion products. This plate was probably brass, as analysis identified predominantly copper and zinc in this area. There is also a thin layer of grey metal at the end of the handle, which analysis showed was tin. The two materials, silver-coloured tin and gold-coloured brass, would have had an attractive appearance side by side. The shoulder plate has also become detached from the handle, leaving traces of green corrosion. This plate was probably brass, as analysis identified predominantly copper and zinc. High concentrations of lead were detected next to the shoulder plate, which may indicate that the shoulder plate was made of sheet metal with a lead filling.

7162 / 3 50320 4729 Scale tang knife

The scale-tang knife sf. 7162/3 may originally have had mother-of-pearl scales, but the organic remains are in a very poor condition. The blade of the knife is a ferrous alloy (see fig.4). Traces of green corrosion products indicate that a copper alloy shoulder plate, which analysis showed was probably brass, was once attached to the knife. The rivets through both the handle and blade are iron. Blue / green corrosion products indicate that a copper alloy end plate was once attached to the handle. Analysis showed that the plate was probably brass. Traces of mercury and tin were detected in some areas near the end and shoulder plates. Although mercury was used in the gilding and (rarer) silvering processes, neither gold nor silver were detected.

Figure 4. X-radiograph of knife (sf 7162/3), actual size.

7434 50285 4786 Scale tang knife

The elephant ivory scales on the knife tang are in an excellent condition, with the lines of Retzius clearly visible (Penniman, 1952).

7531 50296 4660 / 4856 Scale tang knife

The scales of this knife are highly polished or have a resin surface. They are possibly made from elephant ivory, bone or antler, but not wood. Chopped stems are also preserved on top of the handle.

The handle of the knife is iron and has a shallow groove running along each edge on one side. These grooves may have contained inlaid metal as there are traces of green corrosion products in one of them. Analysis detected copper and zinc, indicating brass. Alternatively these corrosion products may have originated from another brass fitting. The handle also contains groups of small tubular rivets, which analysis showed are impure copper (see fig.5). At the end of the handle, where an end plate was once attached, there are traces of green corrosion products. Copper and zinc were detected, indicating that the plate would have been brass. There are large amounts of ferrous concretion at the other end of the handle but traces of green corrosion are just visible and a shoulder plate is visible on the x-ray (see fig. 5). Copper and zinc were detected which indicates that the shoulder plate is brass.

Figure 5. X-radiograph of knife handle(sf 7531), actual size.

7535 50296 4661 Scale tang knife
This knife has wooden scales (SEM B814), made from *Buxus* sp. (Box), with a very knotty grain. The two fragments are very degraded. The handle has three rivets, which analysis shows to be tin-plated iron (see fig.6).

Figure 6. X-radiograph of knife handle (sf 7535), actual size.

Other Metalwork

The organic material associated with this group of objects is fairly typical. Arrowheads of this date traditionally have poplar shafts (Morris, 1997) and 7063.30 has a willow or poplar shaft (note: it is almost impossible to distinguish between these two woods microscopically). The other arrowhead is more likely to be a broken spearhead or tool as it is hafted with maple or cherry.

The punch/drift has a horn handle which may well indicate that it was a hand-held tool rather than one to which force was applied with a hammer or mallet.

The sword hilt guard probably has the remains of an elephant ivory grip, which fits perfectly with other examples from most periods.

230 20172 2709
Large "arrowhead" with mineral preserved wood in the socket, probably *Acer* sp. (Maple) or *Prunus* sp. (one of the wild cherries), made from a young stem or sapling. This object may in fact be a broken spearhead. SEM B815

5250 10199 3702
Punch or drift with mineral preserved horn, not wood, on the tang.

5250 10199 3702
Punch or drift with mineral preserved horn, not wood, on the tang.

7063.30 50318 5293
Arrowhead with remains of wooden haft, *Salix* sp. (willow) or *Populus* sp. (poplar).

7526 50285 4704
Sword hilt guard, the organic material relating to the grip only remains as a very powdery residue with fine parallel wavy lines which may indicate the use of elephant ivory.

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APPENDIX 1.

Summary table of associated organic material and non-ferrous metal components.

Object	Description	Organic	Metal
250 10199 2813	Scale tang knife.	Wooden scales, very curly grain.	
5357 11058 3711	Scale tang knife handle.	Wooden scales, *Buxus* sp. (box).	Brass tubular and heart-shaped rivets, end plate is brass plus layer of tin, shoulder plate is brass.
5658 50083 4262	Scale tang knife.	Wooden scales, too degraded to identify.	Iron rod rivets, brass shoulder plate.
6863.9 50285 5305	Scale tang knife.	Wooden scales, possibly *Salix* sp. (willow) or *Populus* sp. (poplar).	
6978.13 50296 4660/1	Small, whittle tang knife.	Bone or antler handle, random fragments of wood on blade.	
6989.1 50301 4663/5302 16.1996	Scale tang knife.	Wooden scales, *Salix* sp. (willow) or *Populus* sp (poplar). Plyed thread, probably vegetable fibre, binding at blade end of handle.	
7035.20 50317 2709	Scale tang knife.	Wooden scales, very knotty grain but the structure is too degraded to identify the species.	
7139 50284 4759		Horn scales.	
7162/3 50320 4729	Scale tang knife.	Possible shell or mother-of-pearl scales.	Iron rod rivets, brass end plate and brass shoulder plate with traces of mercury and tin.
7434 50285 4786	Scale tang knife.	Elephant ivory scales.	
7531 50296 4660/4856	Scale tang knife.	Highly polished or resin surface scales, possibly ivory, bone or antler. Chopped stems preserved on top handle.	Iron scales with possible brass inlay, brass tubular rivets, brass end plate and brass shoulder plate.
7535 50296 4661	Scale tang knife.	Wooden scales, *Buxus* sp. (Box), very knotty grain.	Tin-plated iron rod rivets.
230 20172 2709	Possibly a broken spearhead, rather than an arrowhead.	Wood in socket, probably *Acer* sp. (Maple) or *Prunus* sp. (one of the wild cherries), young stem or sapling.	Brass tubular rivets.
5250 10199 3702	Punch or drift.	Horn on tang.	
7063.30 50318 5293	Arrowhead with remains of haft	*Salix* sp. (willow) or *Populus* sp. (poplar).	
7526 50285 4704	Sword hilt guard.	Possibly elephant ivory on grip.	Iron sword hilt.