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Investigative Conservation of Anglo-Saxon Finds from Bloodmoor Hill, Carlton Colville, Suffolk

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Summary

This is a report on the examination, conservation and analysis of artefacts from a late Anglo-Saxon cemetery and associated settlement. Many illustrations of X-ray images and micrographs are used to explain the function and materials used in selected objects and corroded groups, including in-depth studies of a keystone garnet inlaid brooch, a purse group and the reconstruction of a small padlocked casket.

Keywords

Copper Alloy
Iron
Silver
Mineral Preserved
Conservation
Early Medieval

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Introduction

The Romano-British and Anglo-Saxon site at Carlton Colville, Suffolk was excavated between 1998 and 2000. Finds were recorded from such features as *Grubenhauser*, post-buildings, pits, middens, a cemetery and features associated with industrial activity. The priority of the excavations was the Anglo-Saxon settlement.

When the authors began work on this material at the Centre for Archaeology, a large part of the assemblage had previously been X-rayed and assessed by Dylan Cox. Approximately 150 objects had not been assessed, but many of these proved to be modern. This report includes a note on the general condition of all the objects, followed by the analysis and conservation of the cemetery material. Around 250 objects have been examined and analysed using X-ray fluorescence (XRF). Those results are discussed in the final section of this report and the results are listed in the appendix.

Summary of Conservation

The aims of the conservation were:

1. To clarify material composition
2. To reveal the nature of the artefacts
3. To reveal information and details about the finds and their manufacture and the nature of the site and burial conditions.
4. To stabilise the objects for future handling, transport and storage.

This was achieved using the following methods:

1. X-radiography of the objects for the assessment was completed. The previous X-radiographs were re-examined and in some cases objects were X-rayed again in order to reveal additional information.
2. Stereo X-radiography was used on complex bundles of objects to assist in the interpretation of the contents.
3. Optical microscopy using up to 80x magnification and where necessary investigative examination of finds to recover evidence for manufacture, burial practices and conditions.
4. X-ray fluorescence analysis of the objects labelled as copper alloy or finds of unknown material composition.
5. Scanning electron microscope (SEM) analysis to identify materials, in particular mineral preserved organic materials.

Survival of material

The soil conditions at Carlton Colville are well aerated, sandy and slightly acidic, which has lead to the poor preservation of bone and other organic material. The metalwork was fairly well preserved and organic material has survived merely as small traces preserved by the metal corrosion products, especially on the ironwork. On the copper alloy objects small amounts of organic material have

been preserved by contact with copper salts which have acted as biocides against soil micro-organisms. The organic material preserved by contact with metals is in sufficiently good condition to enable the identification of the original materials and to put forward a reconstruction for the casket from Grave 15.

Condition of iron

The iron finds are generally much corroded and mineralised. Post excavation corrosion has caused some flaking and fragmentation of the objects. Where possible these fragments were re-attached using Paraloid B72 (acrylic copolymer, supplied by HMG), but a few objects were in very poor condition and needed to be repaired for identification and packing for transport.

Condition of copper alloy

The copper alloy finds are in a fairly good condition and are quite robust, although heavily corroded, leaving little if any core of metallic copper. Many of the copper alloy finds were examined using XRF in order to attempt to establish their original composition, and some evidence was found of surface tinning, gilding and silvering. It also enabled the different components and solders to be categorized as copper, bronze, gun metal (mixed copper alloy containing zinc and tin), brass and leaded copper alloys. The XRF results will be discussed later in this report.

Due to the length of time between excavation and conservation, the soil on the objects had hardened and created some difficultly in the investigative cleaning. Often the soil was harder than the object and so great care had to be taken in it's removal. Hand tools such as scalpels, mounted needles, a vibro-tool and airbrasive were used to carefully reveal information on the surfaces of the objects.

After treatment and investigation, objects were carefully packaged (repackaged where necessary) individually in Stewart™ boxes with desiccated silica gel; or pierced polyethylene bags containing jiffy foam and placed into large Stewart boxes together with desiccated silica gel and a relative humidity indicator strip.

Settlement remains

The settlement remains produced a large number of objects from numerous contexts which have been assessed and analysed during conservation. Mineral preserved organic material was present on much of the ironwork but it was usually random in appearance and likely to be traces of dung, straw, grass and other organic matter which became incorporated into deposits such as pits, ditches and middens. Some tools such as knives often had broken blades or were devoid of mineral preserved handles.

The conservation of individual objects from the settlement will not be described here but many were analysed using XRF and these findings are discussed at the end of this report and in Appendix 1.

Cemetery material

Grave 11 F268
1.90 x 0.87 x c 0.12m deep Sub-rectangular grave NNE-SSW
Position of the grave goods: fragments of the silver bulla pendants and the two crosses were located by the head. The shears, the blade and the rivet were found in a cluster of grave goods by the waist.

Only selected items were examined from this grave and these are included in Table 1.

Silver bulla pendants:
<0680> <06891> <06892> <06893> <06894> <06895> <06896>
This grave contained two crosses as well as the fragments of a silver bulla pendant necklace (see Figure 1). Both crosses are made from silver, but only one appears to be gilded. It is however possible that the gilding has been lost on the second cross. The silver bullae are also gilded, and this is visible on the inside surface of the pendants. Possibly the two crosses were originally attached to the pendant necklace.

Figure 1. Bulla pendant necklet with silver rings. (Taken from Meany 1981, 182).

Shears <06249a> <06245>
The fragments of <06245> join together with the handle and blade fragments from <06249a> as parts of the same set of shears measuring 170mm long (Fig 2). In addition there are two smaller fragments from assemblage <06249a> which do not join but are probably part of a suspension ring. Traces of textile were found on the hook and the two smaller fragments. On the blades and handle there is some coarsely woven mineralised textile in plain weave. There is evidence that the shears were buried contained within a leather case as there are fragments of mineral preserved skin on the handle and blades. The grain pattern is discernable on a detached fragment and as the depth of the skin is too thin to be that of cattle hide it is likely that the case was constructed from calf skin. There is no surviving evidence for the leather case ever being decorated.

Figure 2. <06245> and <06249a> Shears after investigative conservation.

Knife <06246>
The blade measures 75mm in length. Investigative cleaning revealed mineral preserved horn on the tang and the remains of a leather sheath on the blade.

Bundle of composite material <06249b>
There are two bundles of metal objects wrapped in mineral preserved textiles. The bigger of the two contains a number of pins and rings of both copper alloy and iron (Fig 3). From the X-radiograph and the exposed parts of the objects this could be part of a chain; the pins clearly interlock. There is a small copper alloy wire ring visible with a copper alloy setting attached to it. This resembles the setting for a crystal ball (Meany 1981, 81) but lacks the characteristic attachment loops, and is more likely to be the clasp/setting for a pendant or another type of amulet. There are two very similar settings in Grave 15 which both have the remnants of mineral preserved wood inside them.

The smaller bundle appears to be mineral preserved textile with iron corrosion products and does not contain any objects. It was probably once attached to the larger bundle.

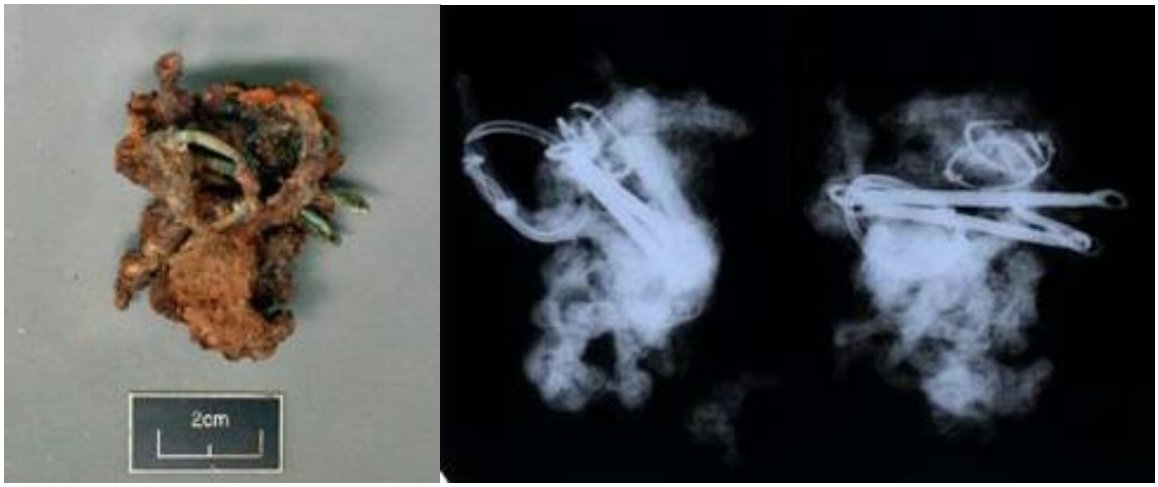

Figure 3. <06249b> front and X-ray images from two different angles.

Table 1. Finds from Grave 11 F268

No	Description	Conservation treatment
<06242**>**	Iron objects. Possible disturbed in the grave fill.	Soil removed.
<06244>	Iron rivet with mineral preserved organic material – ivory/bone? Possibly the remains of a comb.	Soil removed.
<06246>	Iron blade with tang. Preserved horn on tang. Traces of leather sheath.	Soil removed.
<06248>	The item appears to be mostly textile preserved in iron corrosion products	Soil removed.
<06249a> <06245>	Iron shears: two blades and a rod shaped fragment associated with this object. Traces of textile on surface.	Soil removed and some fragments were repaired.
<06249b>	Various iron fragments and copper alloy objects (rings/earrings and linked, flat strips). Some textile remains and other possible mineral preserved organic material can also be seen.	See text
<06890**>**	Top half of silver bulla pendant	
<06893>	Disc and dome of 1 silver bulla pendant	
<06895>	3 fragments of cross. 1 fragment - Part of a gilded cross. Joins with <6896>	
<06896>	3 fragments of silver bulla pendant. 1 fragment - Part of a gilded cross. Joins with <6895>	
<06889>	Silver object	

Grave 12 F261
This irregular elongated oval grave measured 1.85m x 0.76m and 0.3m deep. The skeleton and grave goods suggest a female burial. They include a girdle hanger, with attached chain and a pair of shears. There are small traces of mineral preserved textile on several objects that may be the remains of clothing.

Shears
There is mineral preserved evidence on the shears that suggests they were originally inside a leather case. The grain pattern is not visible and so the species cannot be determined. However, there are a number of incised lines on the leather surface which probably indicates that the case was originally decorated.

Figure 4. Remains of leather case.

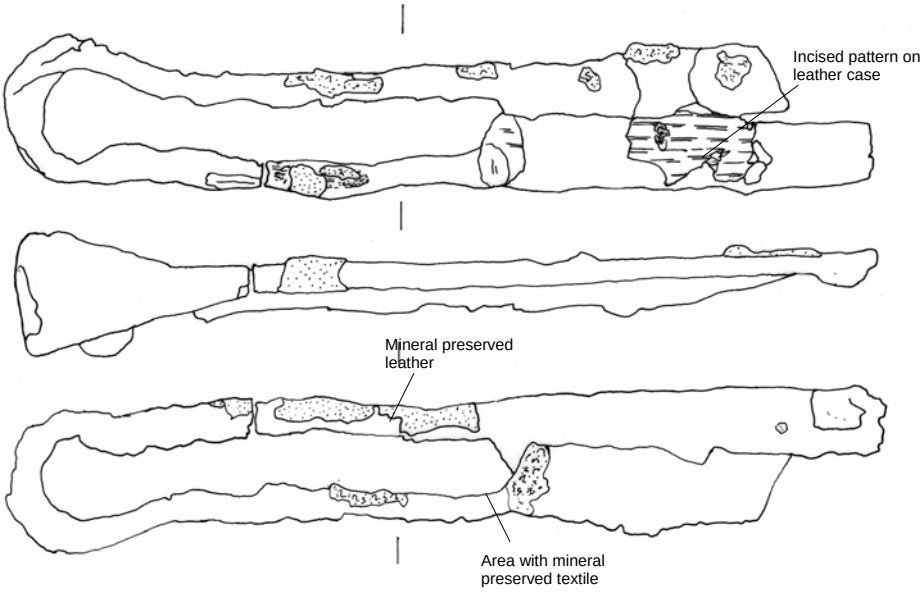

Figure 5. Drawing of shears <6239> with incised leather case.

Girdle hanger with chain <6240>.
The terminal of the girdle hanger curves over to form a closed hook. The object is in relatively good condition although there is no evidence for any preservation of associated organic material. Broken fragments of the hanger were repaired where possible.

Table 2. Finds from Grave 12 F261

No	Description	Conservation treatment
6238	2 iron fragments, probably a part of the girdle hanger chain.	
6239	Pair or iron shears with the mineral preserved remains of a leather case.	Soil removed and fragments repaired using Paraloid B72 (acrylic copolymer).
6240	Iron girdle hanger with associated iron rings/chain.	Soil removed.

Grave 23 F260
1.90 x 1.00 x 0.37m deep Sub-rectangular grave E-W
Position of the grave goods: the keystone garnet disc brooch was positioned face up in the middle of the grave, the knife 0.25m below the brooch and the complex bundle 0.25m below the knife towards the east.

Keystone garnet disc brooch <6902>
D.46mm . Avent's Class 5 or Class 6. Type 2.1 settings. Type 11 ornament
The brooch is cast in silver; the front plate has circular and rectangular shaped raised mounts with garnet and shell settings. There is niello inlay around the central garnet, and decorative beaded silver collars around the circular settings. The front plate and silver collars are gilded.

XRF analysis has detected traces of mercury in the gilding suggesting that the gold was applied as a mercury amalgam. Niello consists of sulphides of silver, lead, copper or a mixture of these, which is fused and often burnished into place. XRF analysis of the black inlay on this disc brooch indicated the presence of silver as well as sulphur and lead suggesting the presence of niello around the central garnet. The identification of the white inlay was made after investigating its structure under an optical as well as a scanning electron microscope, and this revealed that the inlay has a curious layered structure, with laminated layers of white powdery material. The parallel lines of laminations in these layers seem to form at right angles to the layer lying beneath.

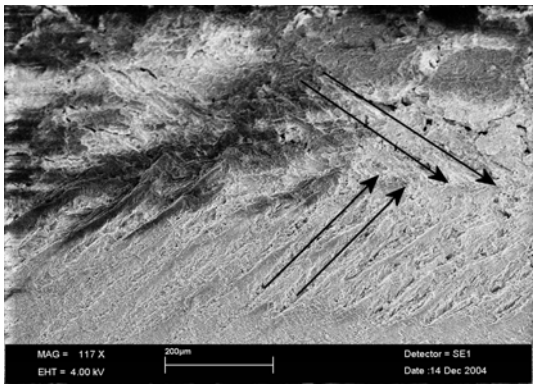

Fig 6. SEM image of inlay.

Fig 7. White inlay 10x.

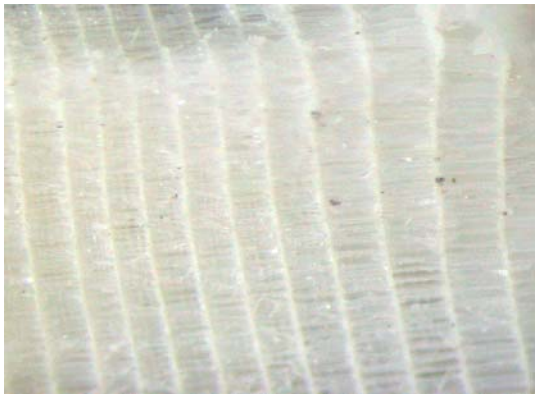

Fig 8. Modern cuttlefish bone Approx. 20x.

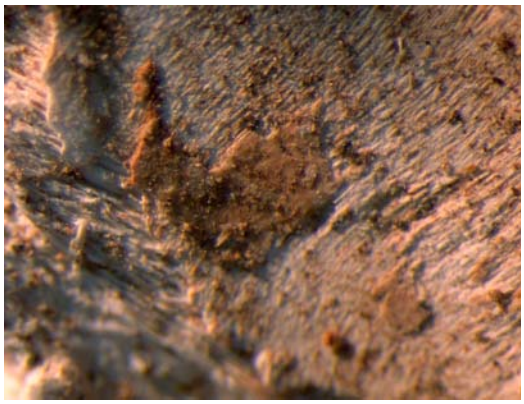

Fig 9. Archaeological shell (Ormer shell). Approx 20x.

Evison (1951) carried out some research on the white inlay often found on Kentish disc brooches and suggested that it was sometimes made from cuttlefish bone. The authors have investigated this suggestion by examining and comparing modern cuttlefish bone and archaeological shell with the white inlay in the disc brooch. Cuttlefish bone has a soft laminar structure with a hard outer crust. In structure the bone is visibly similar to shell (see Fig 8). However, although highly laminated, when viewed under 20 – 40x magnification cuttlefish bone does not match the disc brooch inlay in appearance. Also it seems unlikely that cuttlefish bone could possess the strength to survive sufficiently well through years of use and burial. In contrast, when examined under a microscope, a fragment of shell from Grave 15 (Fig 9), which has been identified as possible Ormer shell (Greg Campbell pers comm), has many similarities in structure to the white inlay from the brooch. Ormer shell was favoured in antiquity for its iridescent mother-of-pearl surface. Centuries of burial has caused the surface of the white inlay to deteriorate and lose the iridescent appearance leaving a compact but laminated outer layer with a more powdery surface underneath – the laminations running at a right angle to the one above. This leads the authors to suggest that the inlay in the brooch was originally constructed from shell but the iridescent surface has not been preserved during burial.

One of the larger garnets and one small rectangular one are detached, revealing cross-hatched gold foil mounted underneath. The method of decoration was used in sixth and seventh century AD jewellery to give a multiple reflective surface and thus enhancing the sparkle and brilliance of the garnet (East 1985).

Figure 10. Detail of brooch showing niello surrounding the central garnet, gilded silver beaded collars and cross-hatched gold foils.

The brooch has four small circular mounts inlayed with shell, and each shell inlay has a setting in its centre. The contents are now lost but three of the four settings still retain a small circular stamped gold foil. The presence of the foil suggests that at one time there were garnets there which were set into the shell above the reflective gold foils.

The back plate has a decorated pin but there is no mineral preserved textile to suggest that the brooch was worn during burial. Also associated with the brooch were fragments of skin or leather. These fragments are now detached but their original position on the front of the brooch was recorded by archaeologists on the grave plans. A small fragment has a residual grain pattern but the species is now unidentifiable due to the extent of decay. The position of this material (on the front plate facing up), and that it seems to have quite dense pattern left by the hair follicles means that it is unlikely to be human skin. The brooch could have been placed in a leather pouch or bag and then placed with the body at the time of burial, and not actually worn. The abundance of pupae cases found in association with the brooch and leather also supports this theory as the larvae may have been feeding on the leather pouch. The pupae cases measure 3mm in length. If analysed by a specialist these may tell us more about the burial conditions and time of year of the burial judging by the maturity and species type.

Figure 11. <6902> Disc brooch front after treatment, pupae case and skin/leather.

Possible purse in three corroded groups:
(a) The largest group is almost completely covered in textile and appears to contain at least two iron rings and an iron rod. The X-radiograph also indicates that it contains a large copper alloy ring, a small copper alloy wire ring and a triangular shaped object with curling ends and a perforation at the tip of the triangle (Fig 12). Stereo x-radiography has been used to demonstrate that the wire copper alloy ring is looped through this perforation. This triangular object is in a similar form to an iron strike-a-light but since it is manufactured from softer copper alloy and could not be used to strike sparks it is more likely to be a decorative purse mount.

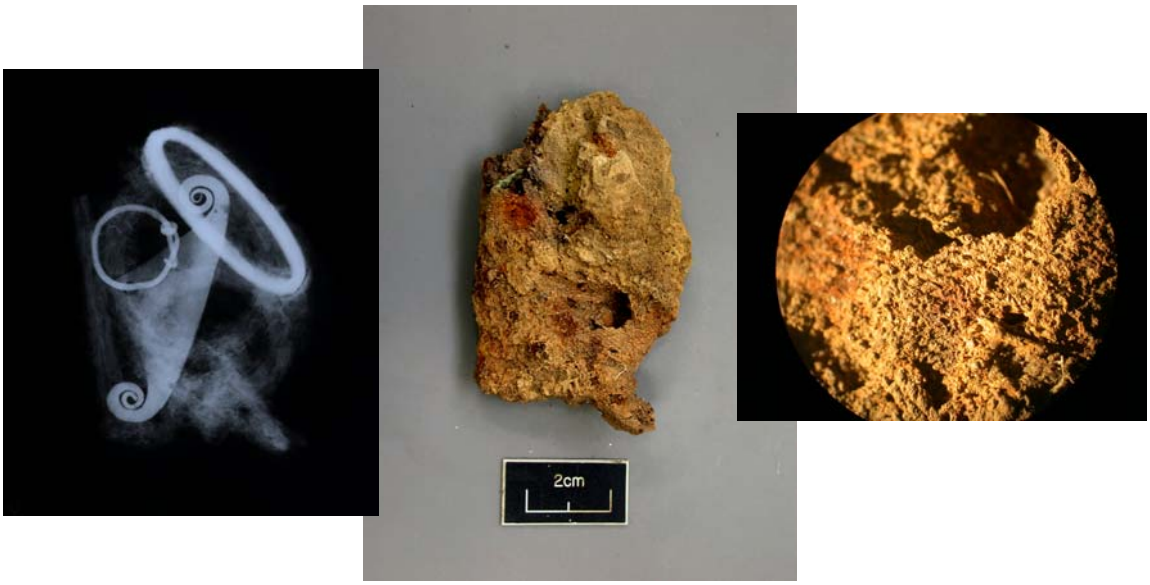

Fig 12. <6905a> X-ray image, front, and detail of textile.

(b) The second group (Fig 13) shows traces of bone and textile on the surface and contains part of a chain or link (interconnected circular and straight elements). The X-radiograph shows all metal elements inside to be constructed from iron. Stereo X-radiography shows the rings to be interconnected.

Fig 13. <6905b> front, X-ray image, and back.

(c) The third group has large areas with preserved textile and contains various iron elements (mostly ring and possibly chain components) and two copper alloy rings/ear-rings. The textile has a layer of finer textile underneath a layer of a more coarsely woven layer as can be seen in Figure 14. Even after examining the X-ray images from different angles it is still hard to determine the number of iron rings present.

Fig 14. <6905c> front, X-ray image, and back.

The three bundles are possibly the contents of a bag. They were found lying next to each other and so it is likely that they were one group originally. The metal inside these bundles appears to be in good condition but the mineral preserved organic is brittle and fragile and can not withstand much handling. The decision was made not to do any further cleaning or removal of the obscuring layers of corrosion from these bundles until they have been assessed and documented by a textile specialist.

Iron knife <6904>
Conservation has revealed preserved organics on the tang, identified as horn. The preserved organics on the blade are possibly the remains of a leather sheath, yet it is too deteriorated to make a positive identification.

Table 3. Finds from Grave 23 F260

No	Description	Conservation treatment
<06902>	Keystone brooch	The niello inlay has been reattached previously, leaving a small area of adhesive on the surface of the shell. Formic acid used to remove copper corrosion. Ammonium thiosulphate and thiourea was used to remove silver sulphide from the surface of the gilding. Garnets cleaned with IMS.
<06904>	Iron knife with mineral preserved horn visible on side of tang. Fibrous material on blade appears to be remains of a skin product - possibly a leather sheath	Adhesive from previous conservation was removed. Fragments rejoined using Paraloid B72 (acrylic copolymer). Powdery orange corrosion from beneath flakes of corrosion was removed and flakes reattached.
<06905>	3 bundles of copper alloy objects, iron rings, textile and bone.	Soil removed.

Grave 15 F252
Grave15 contains the fittings and contents of a wooden box/casket. The soil block was X-rayed and then excavated to reveal a number of objects and fragments of objects which were contained within or attached to the wooden box.

These objects include fragments of an iron ring which originally would have had a number of beads and other objects suspended on it. One of the beads is made of glass, another of the beads is a similar size and is made of black jet or possibly lignite. Also attached to the iron ring is a large chalcedony bead. This is attached to the large iron ring using a length of copper alloy wire which passes through its centre. There are also two other objects suspended on the iron ring. These have small copper alloy cup shaped settings (6mm diameter) which have a short loop of copper alloy wire penetrating through them to attach them to the iron ring. Preserved within both cup settings are small traces of mineral preserved wood. A sample of the wood from one of the clasps/settings was mounted and has been analysed to attempt to identify the wood species using SEM. Unfortunately the fragment was too small and not enough features were preserved for identification. It is likely that the two clasps held wooden objects which may have been carved.

Figure 15. Contents of soil block.

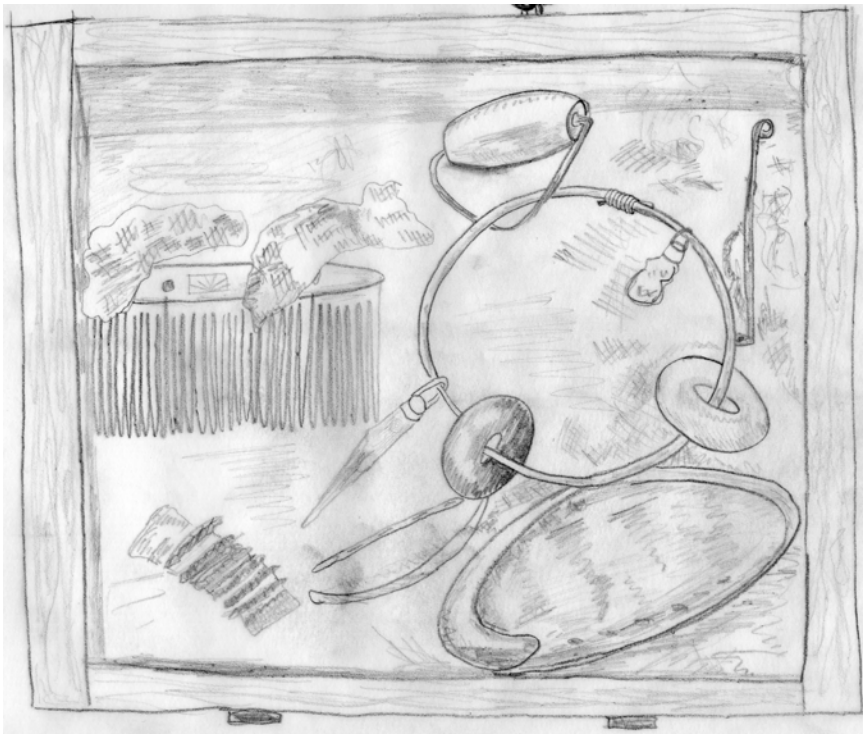

Figure 16. Reconstruction drawing of box contents.

Most of the iron objects contained within the wooden box retain small remnants of mineral preserved textile on their surface of a plain and relatively fine weave. The small fragments remaining are not enough to determine the original function of the textile but the piece which is preserved on the key appears to wrap around it and may have been formed from a textile strip or ribbon.

Part of the box contents is a length of iron with a flattened terminal at a right angle to the length. The terminal has a rectangular shaped perforation in it which was revealed by X-ray. This is the key which fits a small barrel padlock which is now corroded to the iron ring and copper alloy wire with the chalcedony bead.

The padlock has been X-rayed in order to interpret how the locking mechanism once worked. This is illustrated in the reconstruction diagram below.

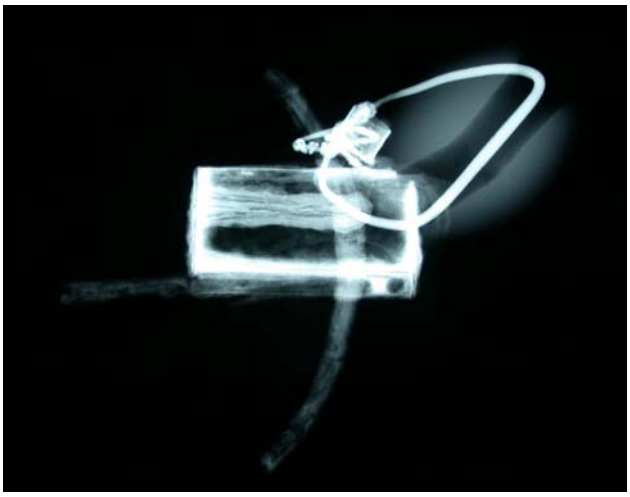

Figure 17. X-radiograph of padlock.

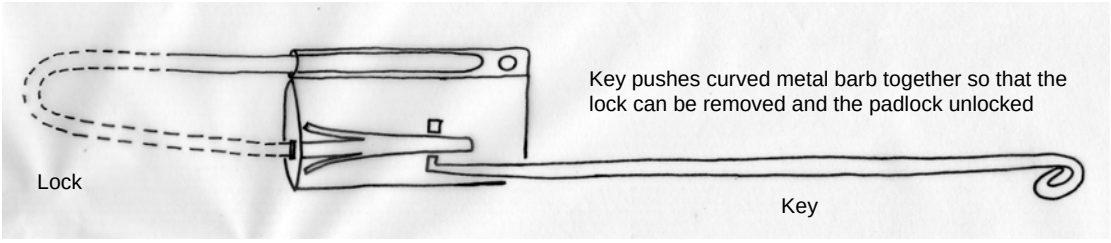

Figure 18. Reconstruction of padlock.

The padlock was locked at burial as the remains of the lockspring can be seen inside the lock on the X-radiograph. But the lock was found among the box contents due to disturbance of the grave sometime after the burial.

The hasp, handle and one of the two hinges have been conserved previously, unlike hinge <6889>, all shown in Figure 19. This hinge has a large amount of wood attached to the rivets. It also has a white compact but powdery layer attached intimately to the internal surface of the copper alloy hinge plate between the wood and the metal. This white substance has a slightly bubbly texture and has preserved an impression of the wood. The bubbly texture of the white material (Fig 20) makes it unlikely to be a corrosion product or re-deposited calcite. Possibly this could be a glue or filler used to hold the hinges and hasp in place, but this is unlikely because the hinges were securely riveted to the wood. Traces of the white substance have been preserved on the wood attached to all the box fittings, as can be seen in Figure 21, and there are also small traces on the wood of the white material in places where the fittings did not cover and protect it. This

suggests that the whole box may originally have been coated in a layer of the white material.

Figure 19. Box fittings.

Figure 20. White deposit with bubbly texture.

Wood grain has left an impression

Traces of the white deposit still visible on the deteriorated wood

Figure 21. White deposits on hinge and wood.

A sample of the white deposit was ground down to a fine powder and its composition analysed using X-ray diffraction. It was identified as calcium carbonate and judging by the fine texture and ease of grinding up the powder this suggests that the white material is chalk.

During medieval times ground up chalk or gypsum was mixed with size (usually animal glue, gelatine) to form gesso, and this was applied to a surface such as wood as a preparation layer for painting or gilding (Thompson 1956, 32). The presence of the bubbly chalk layer preserved on the box is therefore a strong indication that it was originally prepared with a smooth layer of gesso and painted but no traces of paint have survived.

Table 4. Finds from Grave 15 F252

No	Description	Conservation treatment
<6898> sf211	Small copper alloy handle and split pin fastenings from the lid of a small box	Previously conserved. Wood identified.
<6899> sf216	Copper alloy hinge from box	Soil removed.
<6900>sf237	Copper alloy hinge from box	Previously conserved
<6901>sf215	Copper alloy hasp from box	Previously conserved and lacquered
<6226>sf218 <6227>sf220	Fragments of iron padlock key.	repaired
<06897> sf224 <6225> sf217	Contents of a wooden box. Part of padlock, iron ring with various beads and amulets suspending from it.	Soil block planned and excavated. Soil removed from the chalcedony and jet/lignite beads. Detached fragments of a large iron ring were reattached where possible.
<6228> sf221	Curved iron object	Examined and no joins found.
<6230> sf223	Iron objects	Examined under microscope. Re X-rayed to reveal structure
<6903> sf 239	Iron comb rivets and shell fragment	Examined under microscope.
<6222>	Large iron rivet. Possibly part of coffin?	Examined.

The disturbance of objects within Grave 15 has made it difficult to reconstruct the original dimensions and appearance of the box. However, using measurements

taken from the grave plans and the box fittings it has been possible to suggest how it may have been constructed.

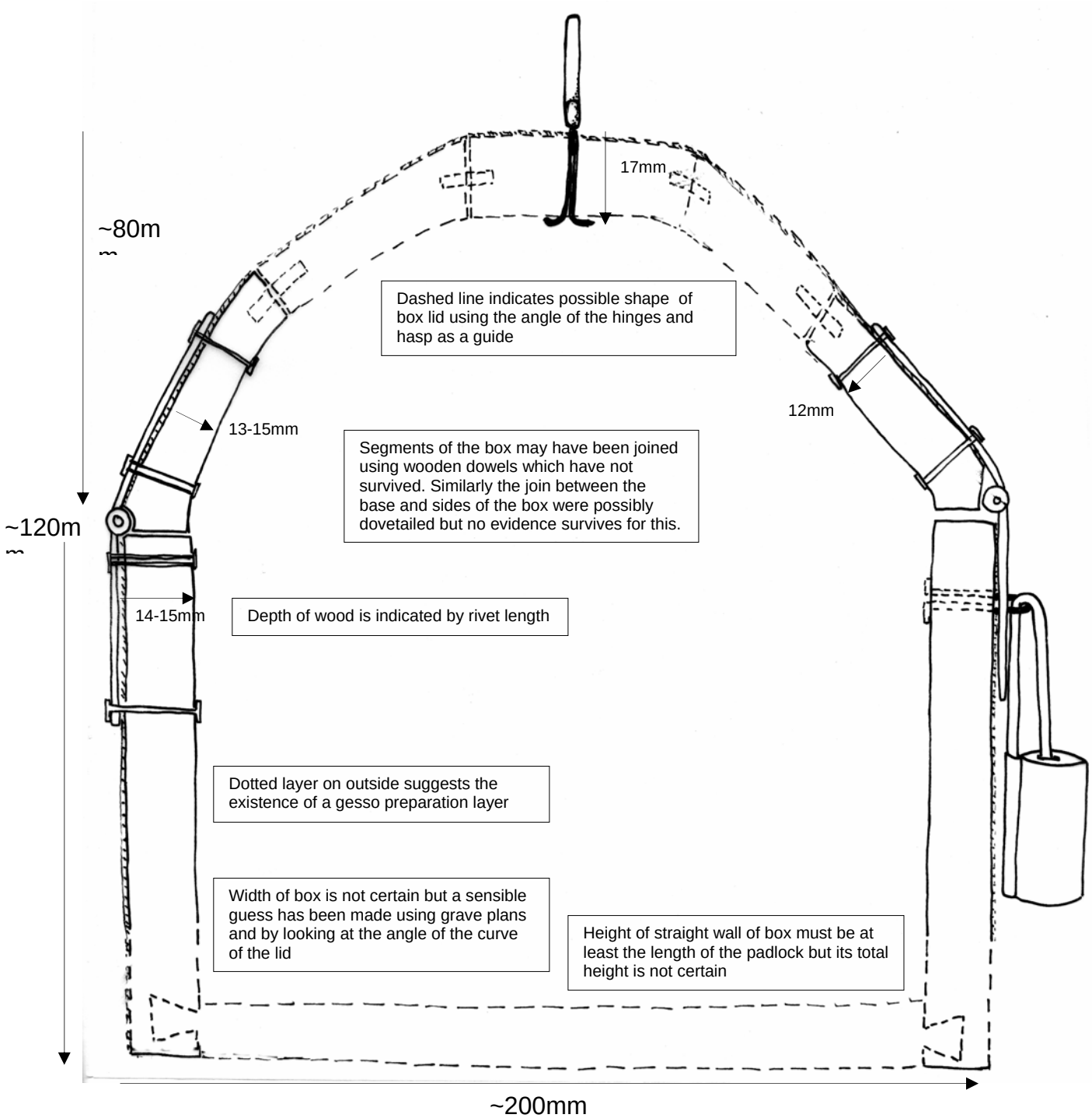

Figure 22. Reconstruction drawing of box.

Grave 22 F236

Grave 22 is oriented East-West, it has a sub oval shape with steep sides and flat base. It is 1.79 x 0.78m and 0.30m deep.

The gold pendant and the silver link chains with slip-knot ring were found next to the head area which suggests that the different silver links were a part of one necklace that has been damaged and broken into many parts.

Other finds were collected from the chest and the leg areas, they consisted of a chatelaine, knife and linked pin found on the chest area presumably as a dress fastening. The lace tag was recovered from underneath the left leg, next to the ankle, which suggests this individual may have been wearing shoes or leg-bindings. The girdle hanger from this grave was fragmentary but preserved extremely well a layer of finely woven tabby textile which was either part of a pouch or was from the clothes of the person buried. In order to interpret this further it requires examination by a textile specialist.

Table 5. Finds from Grave 22 F236

No	Material	Description	Conservation treatment
<6217> F 236	Iron	Iron girdle hanger and chain broken to many pieces badly corroded with some textiles preserved on surface.	Partially cleaned and some pieces joined
<6857> F 236	Copper	Fragment of copper alloy sheet.	Removal of some soil and repackaged
<6859>	Copper	Lace tag rolled small sheet.	
<6881> F 236	Silver	Three chain links with possible MPO on the surface.	Partially cleaned and examined under the microscope
<6882> F 236	Silver	Two chain links attached to silver knot-ring suspended in a silver pin.	Soil removed.
<6883> F 236	Silver	Two link silver chain and slip knot-ring, broken to pieces.	
<6684> F 236	Silver	Pin and silver hook	Soil removed.
<6685> F 236	Silver	Silver slip-knot ring	Soil removed and examined under the microscope
<6686> F 236	Silver	Two silver slip-knot rings with a detached hook.	
<6687> F 236	Silver	Two silver slip-knot ring	
<6888>	Gold	Looped gold pendant back and setting are missing.	Soil removed and examined under the microscope.

Figure 23. Gold pendant 6888.

Figure 24. Silver chain links and slip knot ring.

Figure 25. Blade and girdle hanger fragments.

Figure 26. Spatula.

Figure 27. Lozengiform fragment of girdle hanger.

Figure 28. Mineral preserved textile on girdle hanger.

Grave 5 F241; Grave 24 F257; Grave 17 F270; and F364
Only two objects from Grave 5, one from Grave 24 and one from Grave 17 were analysed and treated in the conservation department during this latter stage of the project. Their condition was fair but very little additional information was recovered.

Table 6. Finds from Grave 5, Grave 24, Grave 17, and F364

No	Description	Conservation treatment
<6218>F241	Iron knife badly corroded, with a possible sheath.	Soil removed and repaired with Paraloid B72 (acrylic copolymer).
<6220>F241	Iron spatula with some MPO preserved on its surface but in bad condition.	Soil removed and repaired.
<6252>F270	Iron rod/handle?	Soil and some corrosion removed in order to determine whether there are teeth which show that it is a file.
<6235>F257	Iron knife or seax with small area of mineral preserved horn.	Soil removed. Fragments and detached flakes were rejoined using Paraloid B72 (acrylic copolymer) where possible.
<6241>F364	Iron knife	Examined under microscope

XRF analysis

X-ray fluorescence analysis has been carried on a number of objects from the settlement and grave deposits from Carlton Colville. This took place in order to identify the general composition of the copper alloy objects selected for analysis and to confirm the presence of gilding, tinning and silvered surfaces. An EDAX-EAGLE II, X- ray fluorescence spectrometer was used to carry out the analysis.

XRF provides an analysis of the surface composition of the object. Its limitations are that the analysis may not be accurate in the case of heavily corroded objects or surface encrustations. The XRF results attained from the corroded surface of an artefact are unlikely to represent the composition of any remaining un-corroded metal in the centre of the object. Equally the composition of the metal is likely to have changed since manufacture due to leaching of elements such as zinc, tin and copper at different rates during corrosion.

Objects were analyzed at 40kV and between 200 and 400 mA. The analysis was targeted, wherever possible, on smooth and even surfaces. All components of each object were analysed including plates, rivets, pins, etc. The table in Appendix 1 shows the compositional results from different spots targeted on each of the objects analysed.

A high number of these objects, or fragments, were constructed from copper or bronze, and a large proportion of these also contain lead. There are many sheet

fragments and pieces of bowls made from copper. The softness and malleability of leaded copper and leaded bronze make them ideal for the production of bowls and thin sheets by hammering and annealing. The presence of casting features such as dendrites in the surface microstructure indicates that quite a few objects appear to have been cast (cf. Goodburn-Brown 1995, 61). These may have been copper alloys containing only low levels of tin or zinc, but sufficient to produce dendritic microstructures. Once again, lead has been used in these alloys as it was known to flow particularly well in a mould and produce a better casting. In particular, these metals were used here for making annular brooches, rings, studs, and buckle fragments.

The presence of a large number of bronze objects from Carlton Colville is quite typical of the 6th and 7th centuries. However, there are fewer mixed alloy/gunmetal objects and many more of copper than is usual from this period. The presence of crucible fragments and a mould (see Blakelock 2005) most with residual traces of copper and leaded copper indicates that metalworking was carried out on site and that many of the objects produced were cast or worked from copper or leaded copper. This could explain the unusually high proportions of these metals.

In addition, some of the analyses have shown the selection of different metals for the various parts of an object. For instance there appears to be a difference between the composition of an object and the rivets used to join it. There are a few objects from this site which have been mercury gilded or are silver gilt and the silver composition confirmed in a number of cases.

Conclusion

This report is a based on the work of several conservators spread over a number of years. Despite this lack of continuity and the existence of many confusing lists and tables, the conservation and investigation of the finds from Carlton Colville has added to our knowledge of and brought to light some interesting information about the objects, along with the burial and living practices of Anglo-Saxons in 7th century East Anglia.

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Appendix 1: XRF Results

Appendix 1. XRF results

NOTE: These results are only a guide, and due to condition of the material, some items identified as copper may in fact have been copper alloys

Cat.no	Description	XRF results
14116	Looks modern.	Copper
6409	A large part of the surface is covered with a bright-red deposit (possibly hematite). This could indicate the burning of material surrounding this object before it was buried (cf. Cronyn, 1990).	Iron
6748	Copper alloy decorative object	Leaded bronze
6744	4 fragments. At least one of the fragments appears to be decorated. Three of the fragments join together and the fourth seems to join as well according to decoration revealed on X-ray. Radiograph shows a border with the letter A and some decoration.	Bronze. Some areas very high Sn.
6750	Copper alloy rod	Leaded bronze
6753	Flat sheet appears to have some incised decoration.	Four-sided figure frag: Copper, Bar frag: Tinned copper? Rod: Leaded copper? Frag: Leaded bronze?
6765	Flat strip shaped into ring with the remains of a base. Possibly a bucket pendant?	Leaded bronze
6778	Copper alloy sheet - folded/crushed	Leaded copper
6779	Folded fragments - original function is unclear	Leaded gunmetal
6784	9 stamped decorations. Perforation in one end.	Leaded copper
6787	Pin - may have metal coating	Leaded copper. Tinned surface
6816	Copper alloy with some possibly gilded fragments.	**Round fragment**: Leaded bronze. **Four-sided figure fragment**: Gilded silver
6831	Copper sheet - crushed/folded	Copper
6838	Silver appearance to object.	Leaded gunmetal
6840	Clear decoration revealed in Xray	**strip frag**: Leaded copper **coin**: Leaded gunmetal
6850	X-ray reveals a finely turned head. This item might be coated with a different metal.	Leaded bronze
6866	Xray shows a D shaped object - ear ring?	Ring: copper
6878	Ag sheet fragments?	Iron
6922	Copper alloy cruciform brooch	Leaded copper, **"Uncorroded" surface:** Leaded bronze

12554	Fragment which may be silvered	Leaded bronze
12557	Object with perforation	Leaded copper
12569	Object with some unusual black accretions.	Leaded bronze
12580	Mainly MPOs	Leaded copper
12597	Neither X-ray or cleaning showed any decoration preserved on coin. One of the bar fragments has a short section with a layer/coating of what might be silver (white metal).	**Coin**: Leaded gunmetal, **Big frag**: Leaded gunmetal, **Small frag**: Leaded bronze, **Bar frag**: Leaded gunmetal
12600	Group -Crumbling edges highly mineralised. X-ray shows perforation where iron corrosion is; possible traces of rivet?	**Strap-end:** Leaded gunmetal**,** **Laminating fragment:** Leaded gunmetal
12613	X-ray shows curved-shaped iron object underneath corrosion. No obvious join between the two Copper -alloy rings.	**Part of ring:** Leaded gunmetal, **Part of ring joined with Iron frag:** Leaded gunmetal
12649	Object originally described as Iron	Gilded silver
12687	Sheet	Copper?
12720	Two fragments with unknown composition	Iron
[4823]	Cruciform brooch	Copper
<6792>	Copper alloy strip	Copper
<6797>	Annular Brooch fragment	Leaded Copper
<12530>MD401	Bird pendant	Silver
<12540>MD428	Annular Brooch fragment	Leaded Copper
<12543> M434	Tweezers	Leaded Bronze
<12544> MD 437	Fragment of decorated sheet	Bronze
<12547> MD 444	Wrist Clasp	Leaded Copper
<12560> MD 468	Thinly beaten sheet	Tinned Copper
<12564> MD 475	Buckle	Bronze
<12579>[4098]F510	Ring	Leaded Copper
<12588>	Wrist Clasp	Leaded Bronze
<12733> F 503	Trade token	Copper
<12970>[4825]	Fibula	Copper
<12982>	Disc	Silvered Gunmetal
<13037>5000/32	Spur	Bronze
<13234>[5106]	Copper alloy strip	Gilded Copper
<13235>[5107]	Curved fragment.	Leaded Bronze
<13509>	Cruciform Brooch fragment	Leaded Copper
<6501> M014	Loop	Leaded Copper
<6502>M016	Roman Coin	Leaded Copper
<6712> M258	Possible metalwork waste	Leaded Copper

<6715> M261	Possible metalwork Waste	Leaded Copper
<6740>[205] F5	Pin	Tinned Bronze
<6741>	Possible pinhead	Copper
<6742>	Sheet material	Copper
<6743>	Fragment of bowl	Leaded Copper
<6745>	Unidentifiable fragments	Copper
<6746>[294]	Sheet	Copper
<6747>[384]	Fragment of ring	Bronze
<6749>	Sheet	Copper
<6751>[384]	Droplet	Copper
<6752>	Sheet	Copper
<6755>[1010]	Sheet	Leaded gunmetal/ bronze
<6756>	Sheet	Copper
<6757>	Pin fragment	Tinned copper or gunmetal
<6758>	Sheet	Copper
<6759>	Fragment of figure of 8 chain link	Leaded Copper
<6760>	Splayed pin	Copper
<6761>	Sheet	Leaded Copper
<6762>	Sheet	Leaded Gunmetal
<6763>	Hook	Leaded Bronze
<6764>	Safety pin	Copper
<6766>	Stud	Leaded Bronze
<6767>	Sheet	Copper
<6768>	Sheet	Brass
<6769>[1669]F200	Sheet	Leaded Bronze
<6770>[1669]F 200	Ring	Copper
<6771>[1669]	Decorated sheet	Copper
<6772>	Twisted wire	Leaded Copper
<6773>	Ring	Copper
<6773>	Ring	Copper
<6774>[1672]F200	Sheet	Copper
<6775>	Small fragment of pin finial	High tin bronze
<6776>[11730]F 200	Sheet	Copper
<6777>	Buckle loop	Leaded Copper
<6780>	Fragment of sheet	Copper
<6782>	Sheet	Bronze
<6782>	Sheet	Bronze
<6785>	Sheet	Leaded Copper

<6786>	Sheet	Copper
<6788>	Bronze pin	High tin bronze/tinned
<6789>	Unidentified Copper	Copper
<6790>	Sheet	Leaded Copper
<6793>	Chain	Copper
<6795>	Bronze pin	Leaded Copper
<6798>	Sheet	Copper
<6799>[094] F1	Lace tag	Bronze
<6800>[101] F1	Tiny sheet	Leaded Bronze
<6801> [106] F1	Sheet with rivet	Bronze
<6802> [109] F1	Possible bracelet fragment	Leaded Brass
<6803>[175] F159	Folded sheet with rivet	Leaded Brass/ the spot on the rivet revealed that is leaded copper
<6804>[177] F 159	Unidentified Fragment	Copper
<6805> [190] F 159	Thick sheet	Copper
<6806>[261]	Annular Brooch	Leaded Bronze
<6807>	Strip	Leaded Copper
<6808>[1766] F 213	Sheet	Brass
<6809>	Folded thin sheet	Bronze
<6810> [350] F 40	Sheet	Bronze
<6812> [381]	Two sheets with rivet	Leaded Brass/ the spot on the rivet revealed that is leaded copper
<6815>	Broken Annular Brooch	Leaded Brass
<6817>[916] F11	Strip	Tinned Copper
<6818>[1219] F 718	Hemispherical Artefact	Bronze
<6820> [1389]	Cartridge Cap?	Brass
<6821>[1414]	Hooked Tag	Bronze
<6822>	Fragment of a flattened sheet	Copper
<6823>[1641] F182	Strip	Brass
<6824>[1643] F182	Roman Coin 2nd century	Copper
<6825>	Strip	Copper
<6826> [1868] F3	Sheet Fragment	Leaded Copper
<6827>	Sheet	Copper
<6828>[1892] F240	Sheet	Bronze
<6829>[2176]	Pin	Bronze
<6832>	Sheet with square rivet	Copper
<6834>[2370] F 276	Folded sheet fragment	Copper
<6835>[2392]	Pin	Copper
<6841> [3103]	Sheet	Leaded Copper

<6846>[3518]	Decorated fragment	Leaded Bronze
<6847>	Strip	Leaded Copper
<6848>	Strip	Copper
<6854>	Rod	Bronze
<6855>	Strip	Bronze
<6856>	Strip with rivet	The strip is bronze while the rivet is copper but with high amount of Iron
<6879>	Small disk	Silver
<6880>	Seal “Penny”	Silver
<6898>	Handle	Copper
<6899> [2201]F252	Hinge	The spot on the hinge revealed copper while the one on the rivet revealed Leaded Copper
<6900> [2201]F252	Hinge	Copper /the rivets Leaded Copper
<6901> [2201]F252	Hinge	Copper with concentration of Iron in the joins
6902	Keystone garnet disc brooch	Silver with mercury gilt surface and decorative collars; Niello inlay;
<6918>	Fragments of Copper alloy bowl	Copper
<9006>	Three small sheet fragments	Copper
<9057>	Unidentified fragment	Leaded Copper
<9253>	Figure of 8 shaped link	Leaded Bronze