Centre for Archaeology Report 70/2005

Conservation and analysis of a Roman glass vessel and associated material from Botchergate, Carlisle

Jennifer Jones

ISSN 1473-9224

The Centre for Archaeology Report Series incorporates the former Ancient Monuments Laboratory Report Series. Copies of Ancient Monuments Laboratory Reports will continue to be available from the Centre for Archaeology (see back cover for details).

Centre for Archaeology Report 70/2005

Conservation and analysis of a Roman glass vessel and associated material from Botchergate, Carlisle

Jennifer Jones

Summary

A complete early second century Roman glass vessel containing a cremation was excavated from a pit. The vessel fill was found to contain some fragments of melted glass mixed with the cremated bone. The vessel was reconstructed, and EDXRF analysis carried out on the vessel glass and melted glass fragments. A quantity of associated ironwork, some with mineralised wood, was also examined.

Keywords

Conservation
Roman
Glass
EDXRF analysis

Author's address
Jennifer Jones: Department of Conservation, University of Durham, 46 Saddler Street, Durham.
Telephone: 0191 3341139. Email: j.a.jones@durham.ac.uk

Conservation and analysis of a Roman glass vessel and associated material from Botchergate, Carlisle

Jennifer Jones

Contents

Introduction

A Roman glass vessel containing cremated bone was discovered by Carlisle Archaeological Unit (CAU) in early 1999, during developer-funded excavations in Botchergate, Carlisle (BGT99 C3996 1155Δ). It appeared to be complete though broken, and was located in a rectangular pit. It was associated with burnt material, though the vessel itself did not seem to have been burnt.

The glass vessel was lifted by the excavator, using polyurethane foam (PUF) to encase it. It was packed and transported to the Conservation Lab at Durham for treatment.

Excavation of the vessel fill (3982)

In the laboratory it was difficult to assess the completeness and condition of the glass vessel, as it was almost completely encased in PUF, and was too large to fit into the available X-ray chamber. Cautious removal of some of the PUF from around the top revealed an intact rim, though some of the glass visible below this was broken. Fragments of cremated bone could be seen in the vessel fill.

As the vessel was broken, it was decided to excavate the fill before removing the remainder of the PUF, to provide support for the glass fragments. The vessel fill was excavated in 30mm spits, the top spit containing very finely broken cremated bone. Below this the fragments became larger, and some were up to 95mm long. The fill was fairly loose, with little soil between the bone fragments, many of which were covered with a discontinuous layer of fine silt.

The cremated bone fragments varied in colour, suggesting differential degrees of burning. Few pieces were the grey/white colour of completely calcined bone, and most were found to be white or brownish. Once removed from the vessel, the cremated bone was soaked in water inside a 600 micron mesh sieve, and then washed and allowed to air dry. Any material which did not pass through the sieve was oven dried and retained. The dried bone was bagged in spits, keeping small and large pieces separate as far as possible. The oven dried sievings were also bagged in spits and retained.

Amongst the vessel fill were a few small pieces of stone and pebble plus fragments of charcoal. All were retained. In spit 3, several fragments of cremated bone had become attached by corrosion to a small, complete iron tack, 25mm long, which showed signs of burning, with a thin black, slightly bubbly layer visible at X16 magnification, above the magnetite.

Four pieces of melted and distorted glass were also recovered from spits 1 and 2, all of a similar colour (translucent pale blue/green). One fragment was attached to a piece of cremated bone, and another had a small fragment of bone caught in a melted fold. The surfaces of these glass fragments were slightly weathered and the matrix bubbly. Their condition was consistent with the melted remains of a glass object – possibly one included in the cremation. This glass was analysed using Energy Dispersive X-Ray Fluorescence (EDXRF), see below.

Conservation of the glass (1155Δ)

Dismantling and washing
With the vessel empty, it could be seen that the rim was complete but cracked, and that most of the body of the vessel was present, though fragmented. A layer of cling film had been used as a separator between the vessel and the PUF during lifting, and it was possible to remove most of the glass fragments without having to cut into the block of PUF. Some of the foam had to be cut away to remove the final, large piece comprising the vessel base and part of the wall.

The glass is a transparent pale blue/green in colour, and in very good condition with few signs of deterioration. Some areas of slight cloudiness and discolouration were observed at roughly the same level on the inside of the vessel. This may be the result of a reaction between the cremated bone and water and could indicate the depth of seepage into the vessel during burial.

The glass was washed with soft brushes using tap water, and allowed to air dry. The pieces did not require consolidation.

The rim, which was made by drawing the hot glass up and then folding it out on itself, had one crack running through both layers and extending down onto the body of the vessel. A brownish deposit, which appeared bubbly and crazed when viewed through the microscope, had built up inside the hollow rim. This was thought to be a biological slime created by water and micro-organisms entering through the crack in the rim during burial, and flourishing in the conditions found there, leaving the dried slime and soil now coating the inside of the hollow rim.

Fig 1 : Discolouration of the rim caused by biological slime

An attempt was made to dissolve and remove this discoloured deposit by soaking the rim in a solution of biological washing powder (Persil). However, after more than an hour, the water had penetrated less than 20mm along the inside of the rim. It was

clear that it would not be possible to remove the deposit in the time available, so the attempt was abandoned and the rim was rinsed and allowed to dry.

Reassembly
The dried glass fragments were first assembled temporarily using narrow strips of Scotch Magic Tape™, to assess the vessel's completeness. Very little was found to be missing, and only a few small fragments could not be placed. Assembly of the pieces was carried out with the vessel upside down in a sand tray for stability, as the rim was the thickest and heaviest part

Epo-Tek 301-2™, a clear two-part epoxy adhesive with very low viscosity and good optical properties, was chosen to join the glass. Because of the adhesive's tendency to run out of the joins before curing, the fragments were first tacked using spots of Loctite Glassbond, a cyanoacrylate adhesive which is cured by exposure to ultraviolet (UV) light. This was done to hold the awkward joins in place, while the epoxy was curing. A UV lamp was used to accelerate the curing of the cyanoacrylate.

Fig 2 : Cyanoacrylate adhesive curing under UV light

The Epo-Tek was then introduced using a very thin brush applied to minor points of imperfection along the tacked joins, and the adhesive carried in by capillary action. Curing of the epoxy was complete in two days. Reassembly of the vessel was fairly successful. One or two joins could not be made perfectly, possibly due to differences in the thickness of the glass having led to 'springing'.

Storage
Following assembly, the vessel was repacked in a suitable cardboard box, standing upright with its base in a cut-out block of Plastazote™ (polyethylene foam), and held in position with sealed polythene bags of polystyrene chips.

Description of the vessel

The vessel is a convex jar of clear blue/green glass, and dates from the late first to early second century A.D (Price & Cottam 1998). It has a drawn-up slightly everted rim, which has been simply folded outwards to form a double thickness of glass with a slight air gap between the layers. Decorative ribs have been drawn out from the body of the vessel during manufacture. The glass varies in thickness, being thickest towards the base of the vessel, especially just below the ribs, where it measures up to 3.9mm, and thinnest at the point of greatest curvature above the ribs, where it is as thin as 0.9mm. Stresses in the glass matrix caused by this variation in thickness have probably led to some 'springing' when the vessel broke. The disc inside the foot ring was applied separately, is slightly off-centre, and was loose as received. The foot ring is flat on the underside.

When it was reassembled, it could be seen that the vessel is somewhat misshapen, with the curve of the shoulder being greater on one side than on the other Above the foot ring on the outside of the glass are several fairly deep scratches. The cause of these is not clear. They could be the result of some part of the manufacturing process, and were not removed either because the (slightly sub-standard?) vessel was destined for burial or because it was not customary. Alternatively, they may have been acquired during the life of the vessel. A further deep 'serrated' scratch is visible on the outside of the rim, and contained traces of a red material. It was not possible to analyse this material due to difficulties with positioning the fragment inside the EDXRF chamber.

Fig 3 : Assembled vessel

Along a break between two of the vessel fragments was a small nodule of whitish material, which appeared vitreous at X16 magnification. This may be a fragment of the crucible used for the glass melt (Prof J.Price, pers. comment). It was unfortunately not possible to remove any of the substance for analysis.

Fig 4 : Possible nodule of slag in the vessel wall (X16)

No sign of a lid for the vessel remains, though the small amount of soil and stones found mixed with the cremated bone would suggest that it was covered in some way during burial.

EDXRF Analysis

Vessel glass
The vessel glass was analysed by energy dispersive X-ray fluorescence (EDXRF), using a Link System XR200 facility. Surface analysis was carried out on several fragments - the inside and outside of the foot ring, the top edge of the rim, and the inside and outside of a body sherd.

Each piece was analysed three times, using one Method to determine the constituents of the glass, and two Methods to detect the elements used for colouration.

EDXRF analysis found the material to be a soda-lime glass, with a low potash level. The level of sodium detected was very low - 2% or less, probably because although the glass appears in good condition, some of the sodium has leached out during burial. The pale blue-green colour was probably achieved using copper, though there was also iron present in the analysis, which may be used to produce a blue-green colour under reducing conditions.

Melted glass from inside the vessel
The composition of the melted glass fragments was found to be similar to the vessel glass, but it had a slightly higher level of potash, and the range of detected colourants was different. Higher levels of copper were present, plus lead and antimony (Pb and Sb), which would have produced a brighter glass. Only two of the melted fragments could be analysed, as the others were too small to sit safely above the detector of the EDXRF facility. All were surface analyses.

Examination and conservation of associated metalwork

Metalwork from the layers surrounding the glass cremation vessel was also received for investigation. This consisted of 1 piece of copper alloy, 19 iron nails or nail fragments, and 6 pieces of thin iron 'plate' (some pierced). The unburnt copper alloy **(1150Δ**) appeared to be the remains of a brooch pin. The nails were a variety of shapes and sizes, some very large (up to 148mm long), and many were broken. All were stable as received, though highly corroded with little metal remaining. Many of the nails had traces of mineralised wood on the surface, and in some examples the direction of the wood grain could be seen on the nail shank.

Several 'bright spots' of denser metal were observed on X-radiographs, eg on **1143Δ** a plate fragment and **1146Δ** a nail. Where this material could be detected visually among the iron corrosion products, it was analysed using EDXRF, and found to be (probably) leaded bronze.

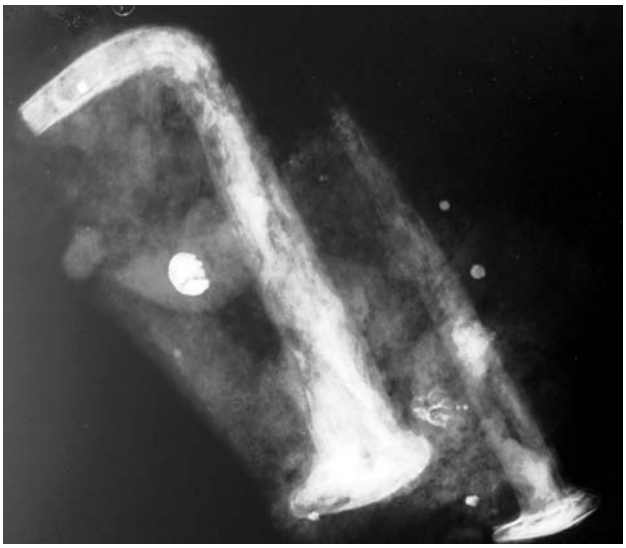

Fig 5 : Melted CuA spots visible on XR of nails

The head of the largest nail **(1141Δ**) had a melted lump of glass adhering to the iron corrosion products. Visually, this was similar in colour both to the vessel glass and to the pieces of melted glass found mixed with the fill. EDXRF analysis showed it to be most similar in composition and colourants to the melted glass fragments.

Fig 6. Melted glass on nail head

When examined through the microscope, much of the ironwork was found to have minute pieces of cremated bone and also random charcoal fragments mixed in with the iron corrosion products.

The iron nails and plate fragments were examined and the soil removed using powderless air abrasion to reveal the direction and extent of the mineralised wood, where possible. If the section of a nail could not be seen, the object was selectively air abraded, and some nail heads were defined by air abrading. The ironwork was stabilised by storage in a sealed polythene box with a desiccant.

The copper alloy **(1150Δ)** was mechanically cleaned and chemically stabilised.

Conclusions

- The glass vessel was probably covered during burial, as there was mainly fine silt in the fill.
- A small glass object was probably included in the funeral pyre, and the glass pieces found among the cremated bone are the melted remains of this.
- The small iron tack found in the glass jar has been burned and was probably picked up unnoticed along with the cremated bone.
- The nails are very variable in size and some are very large (**eg 1141Δ**), Evidence of the grain direction in the mineralised wood on its shank shows that this nail has been used to join two pieces of wood which together were more than 120mm thick.
- Some of the nails and iron plate fragments show evidence of burning, both in reddish areas visible on the surfaces, and also in the amount of charcoal fragments observed among the corrosion products. The metalwork has also been in close contact with cremated bone, as many minute pieces are mixed with the iron corrosion and charcoal on their surfaces. Both these facts suggest that the nails and charcoal fragments are the residue from pieces of wood used in the cremation process.

- Analysis of the melted glass found adhering to the head of nail **1141Δ** suggests a close relationship between the glass on the nail and the melted glass fragments found in the cremation vessel, supporting the notion that the wood containing the nails had been used for the funeral pyre.

- The spots of melted copper alloy found adhering to stone and iron (**1143** & **1146Δ**) are similar in composition (leaded bronze) to the brooch pin fragment (**1150Δ**), and may possibly be the melted remains of the rest of the object.

- It seems possible that the body was cremated where the vessel was excavated. The bone (and other accidentally associated fragments) were then gathered up and placed in the glass vessel, which was buried (possibly in a wooden box) among debris from the cremation.

Bibliography

Price, J and Cottam, S,1998 Romano-British Glass Vessels: A Handbook, *Practical Handbook in Archaeology 14*, Council for British Archaeology, York