Conservation of Ceramics
Condition and Treatment Report

Conservator **Jamie Rigsby**	**Date assessed** **12/11/2018**
Object Unprovenanced Greyware Urn	
Treatment start date 13/11/2018	**Treatment completion date** 28/05/2019

Image of Object as Received

Dimensions: **H: 39cm x D: 37cm**

Description of Object

The urn is made of a hard, grey clay with an undecorated matte surface. It has a wide mouth and heavy-lipped rim, but a narrow base. There are red striations in the body of the clay and the interior has yellowish spots in some areas. The urn is 'unprovenanced' and has no further background information.

Condition in Detail

The urn is in 33 pieces but was previously repaired and several of the sherds are still adhered to one another in four large masses, as seen in Figure 2.

Figure 2, showing one of the large masses of adhered pieces.

Initial fitting together of the sherds suggests that most of the urn is present, but enough pieces are missing to question the structural stability of the urn. The walls of the urn near the rim are much thicker than those at the base indicating the urn may be top-heavy and could have difficulties supporting its own weight if strategic areas of the body are missing.

The base of the urn has a hole in the bottom with a large area of loss around it. There is also a 6cm stress fracture running through the base of the urn (Figure 3).

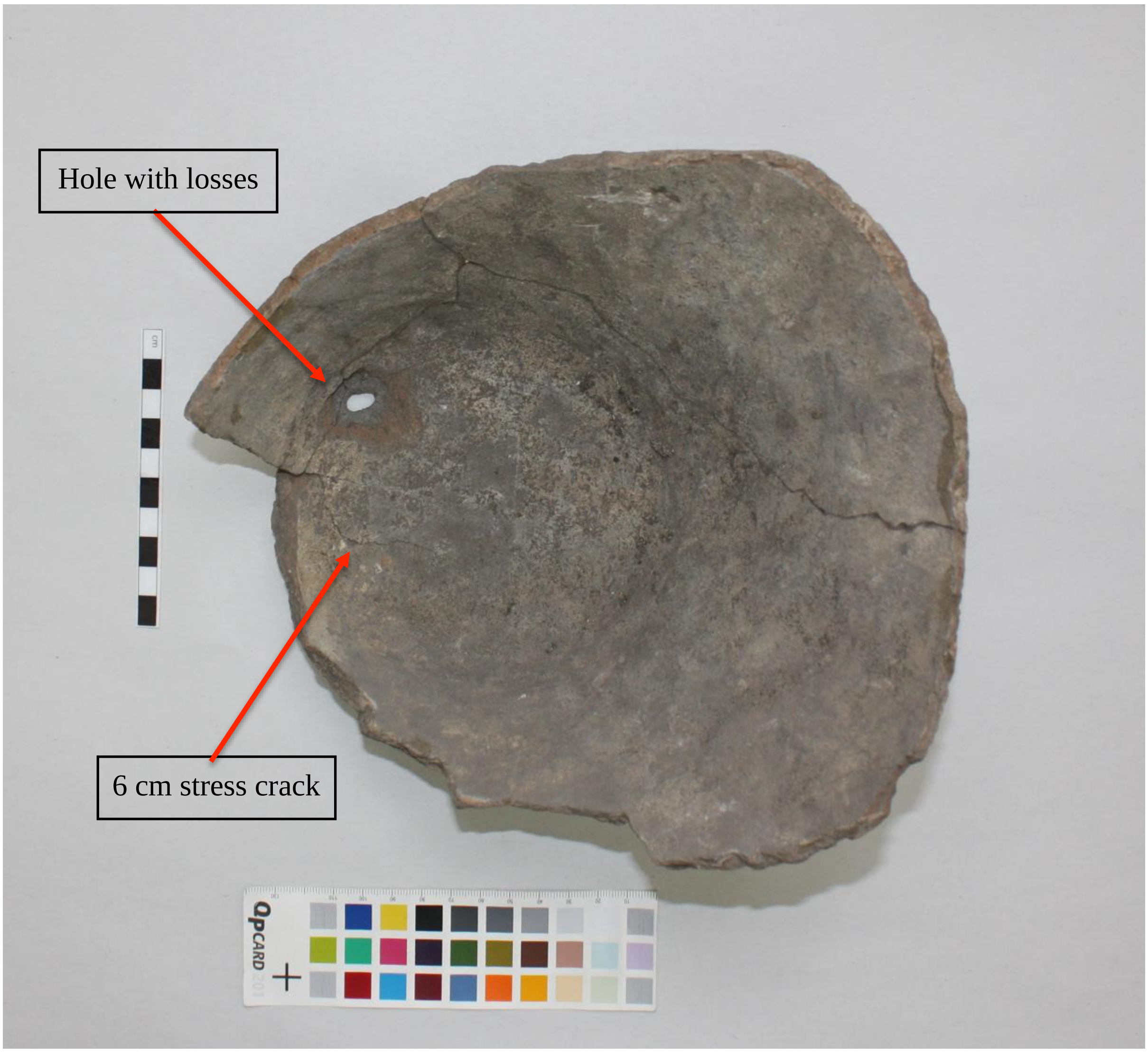

Figure 3, showing large hole with areas of loss and the 6cm stress fracture running from the wall of the urn through the base.

The outer surface of the urn is dirty and porous, and the interior has a thick layer of dirt. The sherds show significant amounts of old adhesive on the break edges with several areas where the adhesive extends beyond the break edge to the exterior surface of the urn (Figure 4).

Figure 4, Detail of break edge with excessive old repair.

The adhesive on the breaks is brown and very thick in some areas. Although the deposits are rigid, they are also brittle. Small pieces of adhesive were removed from the break edges with a scalpel for testing. Bench tests show the adhesive dissolves in acetone and fluoresces yellow under ultraviolet light (Figure 5), two indicators the adhesive might be cellulose nitrate (Neiro, 2003, p.239).

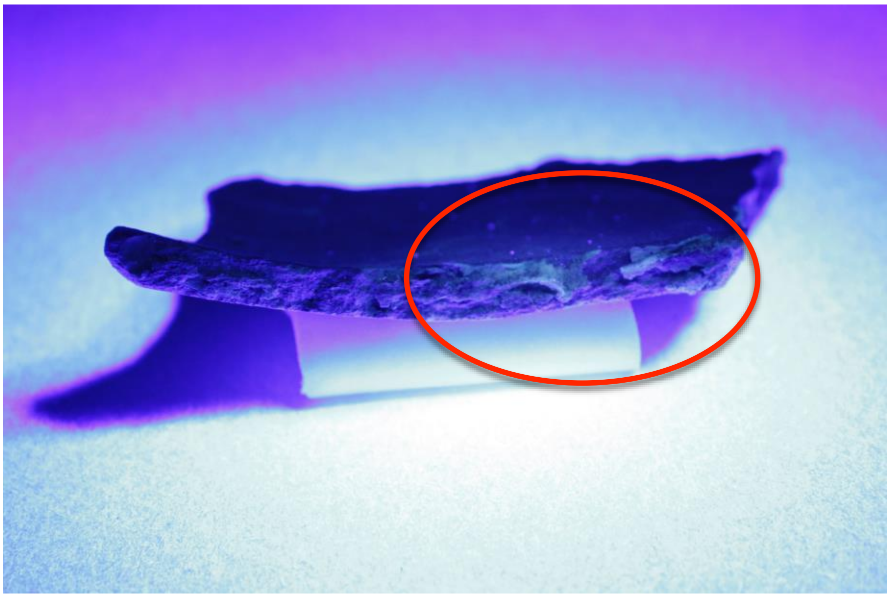

Figure 5, Detail of break edge with possible cellulose nitrate adhesive fluorescing yellow in ultraviolet light.

Further testing with infrared spectroscopy (FTIR) confirms the likelihood the adhesive is cellulose nitrate. The test sample from the urn closely aligns with a sample of HMG cellulose nitrate in the West Dean database of tested materials (Figure 6).

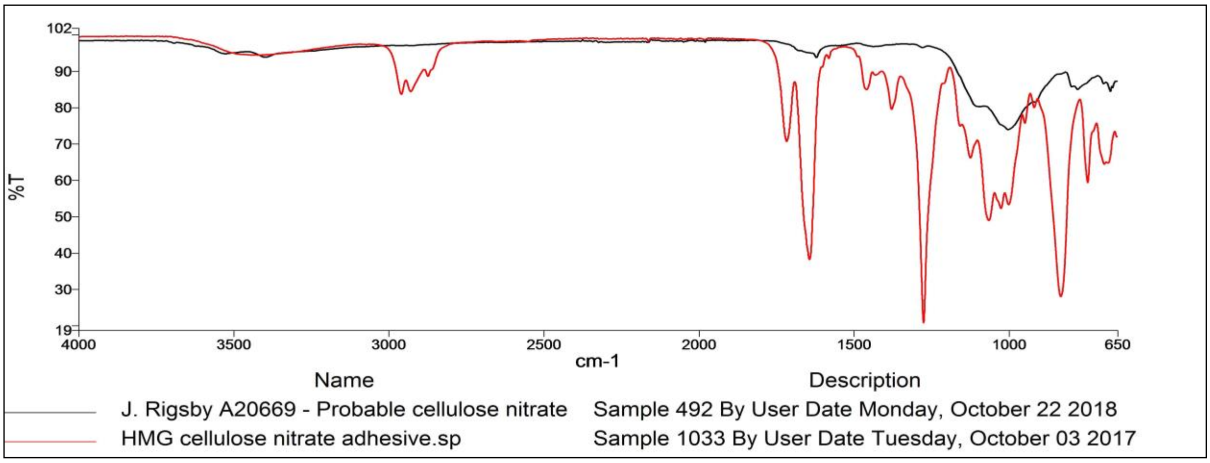

Figure 6, Reading of sample from FTIR PerkinElmer Spectrum Version 10.03.09.

Testing on archaeological ceramics that were repaired at the British Museum showed cellulose nitrate had a working life of at least 30 years, maybe more if HMG cellulose nitrate was used and the storage conditions were stable (Shashoua, 1992, p.113). In this case, if the urn had been repaired in the 1960s-1970s, then it is possible to conclude the cellulose nitrate is most likely to have aged beyond its usefulness and has simply failed. Although some bonds are intact, it is reasonable to suspect these joins would eventually fail as well and are unstable for the purposes of reconstruction.

Treatment Options

A 'dry' reconstruction without adhesive could be performed to determine whether the urn is structurally sound, but tape or secondary support measures would need to be tested for suitability to be in contact with the surface. If the urn is stable enough to withstand reconstruction, the exterior surface could be cleaned with a soft brush to remove dust.

Because the old adhesive obscures the surface of the break edges, it must be removed for treatment to continue. The bond between the adhesive and the clay body is strong in some places. The excess adhesive makes it difficult to see weaknesses in the ceramic. If there are small fractures under the adhesive, manually removing it with tools could break the clay. Due to this possibility, manual removal of the cellulose nitrate with tools alone is not recommended.

Since the adhesive breaks down in acetone, it could be used to soften the old repairs and remove them manually, lessening the possibility of damage to the underlying clay, but the matte surface could be negatively affected by direct application of a liquid. Because the previous contents of the urn are unknown, the dirt caking the interior surface could offer clues on its use. It is recommended that the interior surface be brushed downward, starting from the top, and then collected to stay with the piece if future testing is ever warranted.

Due to these constraints, an enclosed vapour chamber of acetone to dissolve the cellulose nitrate could be used to remove the adhesive. Proper care must be taken to ensure that the liquid does not come into contact with the sherds and the pieces are sufficiently supported to avoid more damage when the bonds release. Once removed from the vapour chamber, each sherd would be manually cleaned to remove softened adhesive (Neiro, 2003, p.238). Because acetone evaporates quickly, the sherds might need multiple exposures to the vapour to remove all the adhesive. Additionally, the sherds would need time to dry and allow the acetone vapour in the clay body to evaporate before any treatment could continue.

Examination of the sherds indicates there is likely enough connecting surface area to most of the breaks to 'key' into place, providing stable bonds. The walls of the urn vary in thickness, but the clay body is rigid and does not show inherent weakness in the fabric. If the urn can be reconstructed, considerations must be made into how the urn would structurally be supported during the process, either through the use of tape or non-adhesive materials such as elastic bands, or using gravity and exterior supports, such as beanbags, to build the urn one piece at a time. The sherds could be mapped and numbered in the order in which they would be reconstructed.

Concerning the choice of adhesive for the urn, several references were consulted regarding best practices for reconstructing archaeological pottery. Current research and methodology indicates that Paraloid B-72[1] is the most widely accepted choice for reconstructing archaeological ceramics and would be the adhesive of choice to reconstruct the urn. In this instance, the Paraloid B-72 would be mixed with acetone in a 50% solution. Acetone evaporates faster than solvents such as ethanol, lessening the length of time liquids would be present on the break edges and the chance that drips could damage the surface or that a bond could slip while curing (Koob, 1986, p.8). Additionally, Paraloid B-72 is viscous enough to avoid being deeply absorbed into the clay body, is clear, non-yellowing, and excesses can be removed with a sharp blade rather than a solvent, reducing risk to the surface of the urn. The solution would be applied to break edges with a brush and the sherds attached in a predetermined order with appropriate supports, such as tape or elastic bands.

Once the urn was reconstructed, it could be evaluated for areas of potential weakness, such as large areas of loss. Per the wishes of the client, the fillwork would be kept to a minimum and applied only in areas where it could provide structural support to the urn. Fills would be similar in tone and texture to the body of the urn to maintain visual focus on the object as a whole but allows the viewer to understand it is not original material. If necessary, removable fills made of plaster[2] could be made to support any weak areas. The fills could be touched in with gouache[3] paint to match the matte surfaces.

Treatment Report

FTIR results indicated the adhesive on the urn was cellulose nitrate, which breaks down in acetone. Due to the matte surface and friability of the pottery, a vapour bath was used to dissolve the glue rather than direct poultices. The sherds were placed in sealed containers with glass beakers filled with acetone and cotton wool. The cotton wool was added to absorb the liquid in the event the beaker was overturned to minimize spillage near the sherds. Where needed, cotton wool padding was added underneath sherds so that the sherds were supported when the adhesive dissolved.

Because acetone evaporates quickly and cellulose nitrate solidifies in the absence of the solvent, the sherds were processed one at a time. After approximately 24 hours, each sherd was removed from the vapour chamber and excess adhesive was cleared with a scalpel where possible. Due to the softness of the clay, it was not possible to remove all the adhesive in the deeper recesses without abrading the break edges. There was also an excessive amount of dirt caked on the break edges that would impede bonding. The edges were cleaned with cotton wool swabs dipped in deionized water and rolled across the break edges to remove loose dirt. Care was taken not to scrub the surface which would cause the cotton fibres to snag on the clay and dry on the break edges.

Once cleaned, the sherds were allowed to dry, and various tapes were tested on the surface. Fabric medical was tested because of its flexibility and adherence, but it proved to be too strong and pulled original material from the surface. Masking tape was also tested, and though it did not have a strong hold on the surface, it did hold well enough to secure pieces without leaving residue or damaging the surface.

Two reconstruction strategies were considered: building from the base up and turning the urn upside down, building from the rim up. The rim up option did not work as a large section of the rim is missing and the contact point of the rim pieces did not provide adequate support for reconstruction. It was decided to reconstruct the urn from the base upwards. The sherds were laid out in the order and placement in which they would be reconstructed. The decision was made to consolidate the break edges that would be bonded in order to seal the edges and provide a stable surface for bonding, and also to slow the evaporation of the adhesive when it was applied. The edges were consolidated with three coats of 10% Paraloid B-72 in acetone and allowed to dry. The first two sherds were added to the base and allowed to dry. After sherds 3-8 were added to the base structure, it became apparent that the urn would be very unbalanced during reconstruction (see Figure 7).

Figure 7, showing the imbalance of the urn during the beginning stages of reconstruction

The urn was placed inside two cork rings atop a 30cm^2 piece of wood and taped across the break edges that had no adjoining pieces and extending to the bottom of the wooden base to hold the urn in place during reconstruction *(see Figure 8)*.

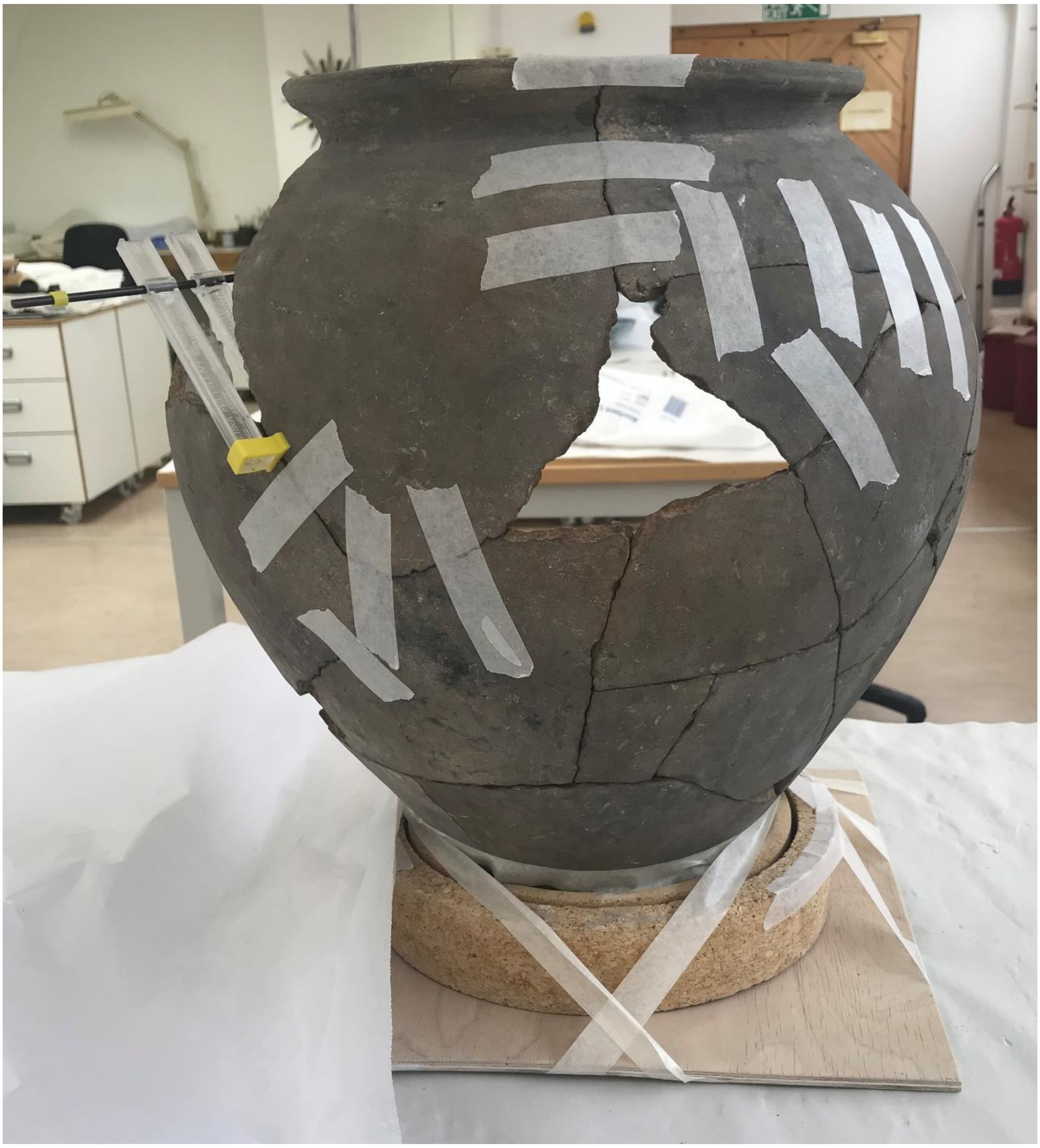

Figure 8, showing the support apparatus for the urn during reconstruction

The sherds were consolidated and reconstructed in small sections and left to cure for at least 24 hours before the next section was added. In this way, the cured sections provided a secure foundation from which to build the next section, and it ensured that the tape would only be closely adhered to the surface for 24 hours or less, further minimizing the chance that it could damage the surface of the urn.

Most of the urn was reconstructed in the upright position; however, there were several pieces missing at the base that would have provided support for large sections of the urn that belonged directly above the voids. Because the rim pieces for that area were present, the decision was made to turn the urn upside down and place it on the rim to continue reconstruction. The urn was kept on the piece of wood to facilitate movement without having to put pressure on the walls of the urn to turn it. Even in this position, the urn could not stand on its own, so a retort stand was placed behind the urn. Foam padding was added where the arm of the stand touched the urn, and masking tape was added to secure the urn to the stand. The added support was sufficient to stabilize the urn so that the final pieces of the rim and body could be reconstructed. See Figures 9 and 10 for complete reconstruction.

Figure 9, During treatment, fully reconstructed, front, showing large area of loss from base to rim.

Figure 10, during treatment, fully reconstructed, verso

A large section of the urn was missing from the base all the way to the rim, nearly 21cm across at the widest point. In addition to the large area missing to the front of the urn, the urn had a large, heavy section of the side wall extending out into space without any attachment or support from the base. Though the sherds bonded well and had strong adherence, the weight of the rim pieces and the length and load of the section were not supported and would eventually weaken the strength of the bond and could possibly break (see Figure 11).

Figure 11, during treatment, fully reconstructed, the red outline indicates the large missing area to the lower proper left area of the urn.

Communication with the client indicated that they were mostly concerned with structural fills rather than aesthetic fills. It was decided that the void would need a partial fill to bridge the gap between the base and the outermost part of the top sherd (Figure 12). Because the urn was very unbalanced, it was thought that doing a partial fill in this area rather than completely filling the lost area would help to bring more weight towards the front of the urn rather than adding more weight to the unbalanced side of the urn. It was also decided that an additional fill to the missing area near the base to tie the two sides of the front together would help stabilize the base. These fills are removable, rather than in situ.

Figure 12, showing the area of loss with structural instability

To make the fills, Parafilm[4] was placed over exposed break edges of the area to be filled. Dental wax[5] was placed on the interior of the urn to provide support for the fillwork. Prestia plaster was mixed and spatulated onto the wax and allowed to cure. Once dry, the plaster fill, Parafilm, and wax was removed. The fill was refined using scalpel blades and sandpaper. The fills were inpainted using a mixture of gouache paints and powdered pigments[6] to match the matte, mottled surface of the surrounding areas. The top layer of the inpainting was also done with a mixture of gouache and powdered pigments, but glass microbubbles[7] were added to give the final surface a more textured surface. The fills were inpainted before bonding them to the urn to minimize the chance of getting paint on the original surface of the urn (Figure 13).

Figure 13, Large loss with structural, removeable fills added

The removable fills were bonded to the urn using a 50% solution of Paraloid-B72 in acetone. Any visible Paraloid-B-72 was removed from the surface with a scalpel or a cotton wool swab dampened with acetone. It was attempted to remove the excess cellulose nitrate that had penetrated the outer surface of the urn during the previous treatment, but testing of the surface revealed that the amount of solvent and abrasion with cotton wool swabs necessary to remove the ingrained adhesive was more damaging and visually impairing than leaving it. The decision was made to leave the previous adhesive on the surface.

It is suggested that the urn be stored upside down on its rim for purposes of stability. A box with a drop front and bottom panel that can be slid out is recommended. The handling of the urn generally requires two people and it's best to handle the urn just below the belly, on either side of the large loss. The comparably small base in contrast to the voluminous body causes a certain amount of inherent imbalance in the urn and it is recommended that it not be displayed without an external support of some kind.

See Figures 14-17 for final after treatment photographs.

Figure 14, after treatment, front

Figure 15, after treatment, verso

Figure 16, after treatment, proper left

Figure 17, after treatment, proper right side

[1] *Paraloid® B-72:* Ethyl methacrylate (70%) and Methyl acrylate (30%) copolymer; Tg 40C; IR 1.479-1.489; manufactured by Rohm & Haas. Glass transition temperature: 40 C. Soluble in toluene, xylene, acetone, carbon tetrachloride, MEK, others.

[2] *Plaster*: A fine white powder composed a calcium sulfate hemihydrate mixed with water.

[3] *Gouache paint*: Matte, opaque watercolor paint. Chalk and other white fillers are often added.

[4] *Parafilm® M*: a stretchable plastic film composed primarily of polyolefins and paraffin wax without any added plasticizers. It is used as a liquid and moisture barrier film for short term storage.

[5] *Anutex Dental Wax*: Dental Modelling Baseplate Wax made of paraffin mixture, Microcrystalline wax 30-40%, various non hazardous pigments, beeswax, and Carnauba wax.

[6] *Powder Pigments:* Insoluble, dry solid that is pulverized to a fine powder.

[7] *Glass Bubbles:* Microscopic hollow glass spheres generally used as a lightweight filler. Glass bubbles are made from a soda-lime borosilicate glass that softens above 715C. The tiny, transparent bubbles, also called microballoons, visually appear as a free-flowing white powder.

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