OBJECTS TECHNICAL RECORD OF TREATMENT

DEPARTMENT OF CONSERVATION
The Nelson-Atkins Museum of Art
4525 Oak Street, Kansas City, Missouri 64111

ACCESSION NO.: 56-52/1 A,B & 56-52/2

ARTIST: Unknown (English), c. 1760

TITLE: Teapot & Stand for Teapot

DIMENSIONS (IN): Teapot with lid (HxWxD), 4" x 6 ½" x 3 ¼"
Stand (Diameter x H), 5 3/8" x 1 ½"

MATERIAL: Earthenware with tin glaze

REASON FOR EXAMINATION: Treatment

CURATOR: Stefanie Dlugosz-Acton
Catherine Futter

TREATMENT COMPLETED ON: 12/04/2019

EXAMINED BY: Kasey Hamilton, Intern

Condition summary:
The object was in fair condition overall, with some cracks extending through the clay body, minor chip losses, and losses to the glaze layer. Extensive and poorly matched overpainting was present on the handle and the rim of the teapot, as well as a large fill on the stand. No previous conservation records detailing these treatments were found. All three components had paper labels with original Burnap catalogue numbers adhered to the underside, as well as NAMA accession numbers painted in red without an adhesive barrier layer. The teapot had an additional pressure sensitive tape label reading "C2D" adhered to the underside of the vessel.

Treatment summary:
Treatment focused on improving the appearance of inpainted areas at the handle, rim of the teapot, and area of loss on the stand. Previous inpainting was reversed and revealed fill material as well as concealed breaks around the teapot rim. Poorly aligned fragments at the rim were reversed and reattached. The large fill on the stand was removed and replaced with an easily reversible, long-term conservation material. The same material was used to fill small losses on the rim of the teapot associated with the previously concealed break. Areas of loss on the handle, rim, and stand were painted to match surrounding areas in color, decoration, texture, and gloss.

Analysis & Testing:
Solubility testing

Solubility tests were conducted on inpainting and fill materials present on teapot and stand. The inpainting was found to be insoluble in water but soluble in acetone. Removal of inpainting at the teapot's handle, rim, and near the bottom of the stand revealed a yellowish white fill material underneath. Solubility testing on the fill material indicated that the fill was insoluble in water, ethanol and acetone. The fact that this material is not easily dissolved in any of these solvents suggest that it may be a plaster/gypsum (calcium sulfate) or lime plaster (calcium carbonate) fill.

A small powder sample was obtained using a microscalpel from the surface of the fill on the stand. This sample was dispersed in deionized water and tested using QUANTOFIX® Sulfate test strips.[1] The test strips indicated the presence of sulfate ions in solution, confirming that the fill material contains calcium sulfate.

[1] QUANTOFIX® Sulfate test strips: semi-quantitative tests strips to detect sulfate ions in solution. (Macherey-Nagel, Reference Number 91329)

Plaster of paris has been used extensively as a fill material for ceramics. It is typically sold as a dry powder of calcium sulfate hemihydrate ($CaSO_4 \cdot ½ H2O$). When mixed with water, the powder rehydrates to form a workable paste. An exothermic reaction occurs (wherein heat is generated due to the release of energy) and the plaster then sets as a solid (calcium sulfate dihydrate, or gypsum) (Seck et al. 2015). Plaster is widely used in the conservation of ceramics as it is affordable, easy to obtain, and easy to resurface once dry. In some instances, plaster has been reported to cause ghosting on porous materials including earthenware ceramics, or potentially introduce soluble salts into the clay body (Buys & Oakley 1993). Soluble salts in the plaster fill may become deliquescent at certain humidity levels (this varies depending on the salt) and enter the clay body. When relative humidity drops, salts can recrystallize within the pores of clay body, causing physical damage to the ceramic. In order to prevent ion exchange between the plaster fill and ceramic body, break edges should be sealed using an adhesive barrier layer (Sigel & Koob 1997). Because no conservation documentation was found related to these objects, it is unknown whether a barrier layer was used.

Investigation of crack around teapot base

Initial UV examination did not easily indicate whether the crack around the base of the teapot had been previously repaired. Under UV illumination, the cracks appeared to fluoresce a yellow-green color. It was difficult to discern whether this was due to the presence of an adhesive, as the fluorescence is similar to that observed on unglazed areas of the clay body. In an attempt to reverse the join (assuming the teapot had been previously repaired with a similar adhesive to that found elsewhere) a cotton poultice wet with acetone was applied around the circumference of the teapot, following the crack. The poultice was covered with cling film in order to slow the evaporation rate of acetone, increasing the amount of time for the solvent to soften any adhesive, if present. The poultice was monitored to ensure it remained damp, and if needed additional acetone was added to the poultice using a plastic pipette. After approximately 10 minutes, the poultice was removed and gentle pressure was applied to evaluate whether the ceramic would permit any movement along the crack. No movement was detected, and examination under magnification did not seem to indicate the presence of any adhesive.

The above information suggests that the crack had not been previously repaired or stabilized with an adhesive. The cracks are visible on the interior of the ceramic, indicating that they extend through the exterior glaze layer, ceramic body, and interior layer. Despite this, the fracture does not permit movement and appears stable. This may be an example of a sprung crack (due to internal physical stressors) or dunting (a fault resulting from thermally induced stress during the firing or cooling stage (ASTM International, 2019)). No additional treatment was carried out on the cracks around the base of the teapot, as they were determined to be stable and likely formed in order to relieve stress within the ceramic. Attempting to introduce adhesive or realign the cracks could potentially reintroduce stress into the form, leading to further damage.

Treatment steps and rationale:

Surface cleaning

The surface of the teapot and stand were cleaned overall with deionized water applied with cotton swabs. Areas that fluoresced during UV examination (indicating residual material from previous conservation treatment) were cleaned using a cotton swab dampened with acetone. Cleaning was conducted under UV illumination to ensure clearance.

Reversal of previous repairs

Areas of previous inpainting on both the teapot and stand were reversed using acetone applied with cotton swabs. Inpainting on the handle and rim of the teapot were poorly matched and distracting; inpainting on the stand was better color-matched but had a rough texture which could be improved. For large areas of inpainting, cotton was wet with acetone and applied to the surface allowing the paint to soften. Once soft, the paint was removed with cotton swabs dampened with acetone.

Removal of inpainting on the stand revealed a yellowish-white fill material (Figure 1), likely plaster of paris (gypsum, see Analysis & Testing). Due to plaster's low solubility in commonly used conservation solvents, the fill was primarily removed mechanically using a metal file and microscalpel. A cotton poultice wet

with warm water was applied to the fill prior to mechanical removal in order to minimize the amount of plaster dust generated. Once the majority of the fill had been filed down, a microscalpel was used to more carefully remove fill material from the exposed break edges under magnification. The clay body exposed during this process was much lighter than other areas where the clay body was visible around the rim (Figure 2). This may suggest that the darker areas around the rim of the stand are older losses that have become soiled or oxidized over time.

Figure 1. During treatment, inpainting reversed to reveal yellowish fill material.

Figure 2. During treatment, after mechanical removal of fill material. The clay body exposed after removing the fill is much lighter in color than areas of chip loss around the rim.

Fill material on the rim of the teapot was found to be water soluble, and was removed using cotton swabs dampened with distilled water. Removal of overpaint and fill material revealed two small fragments that had been reattached to the rim (Figure 4). The fragments were poorly aligned which may explain why fill material was applied over them, in an attempt to achieve a smooth surface. A cotton poultice wet with acetone was applied over the repair to soften the adhesive joining the fragments. Once the fragments were removed, break edges were cleaned with cotton swabs wet with acetone to remove residual adhesive.

Figure 3. Before treatment, area on the rim with overpaint and fill material to conceal damage.

Figure 4. During treatment, after removing overpaint and water soluble fill material.

Ultimately, the plaster repair on the handle was not reversed. Following discussions with the curator and evaluation of comparanda (Appendix I), it was determined that the shape of the handle is historically accurate. The initial proposal to remove the plaster fill material and replace it with a more easily reversible material was deemed to be unnecessary in this instance as the fill itself is stable. Although it is unclear whether a barrier layer was used between the ceramic clay body and the plaster fill material, the risk of soluble salts migrating into or recrystallizing within the clay body is low, due to the controlled climate in the galleries. Replacing the handle repair would have required mechanical removal of the plaster, taking a partial mold of the handle using silicone rubber, applying a barrier layer on the exposed clay body, casting the fill in place using an appropriate conservation material, resurfacing the fill, and inpainting. Considering the time it would take to carry out this treatment weighed against the likely imperceptible visual change, curatorial and conservation staff agreed to keep the plaster fill. Instead, treatment was targeted towards improving the appearance of inpainting on the handle in order to better disguise the repair.

Reassembly and loss compensation at rim

Prior to joining, break edges were consolidated with 5% B72[2] in acetone. The fragments were re-adhered into place using 30% B72 in acetone. Small losses around these fragments were filled with 30% Aquazol 200[3] bulked with 1:1 cellulose powder[4]:glass microballoons[5], toned with dry pigments. The fill material was resurfaced using dampened cotton swabs and bamboo skewer.

Loss compensation - stand

The large area of loss on the stand was filled with 30% Aquazol 200 bulked with 1:1 cellulose powder:glass microballoons, toned with dry pigments to a warm light yellow/beige color. The fill material was applied in layers and allowed to dry before subsequent layers were applied. The fill was sculpted using bamboo skewers, #15 microscalpel and gloved fingers wet with deionized water. The fill was formed until slightly inset. A top layer of fill material (mixed with QoR watercolors[6] to better match the blue-toned white glaze layer) was applied over the surface using a silicone tipped brush. A thin silicone rubber mold[7] taken from a nearby area of the rim (Figure 5) was smoothed over top of the fill while it was still slightly tacky. A sandbag was placed on top to apply even pressure during drying. This step helped to achieve a smooth finish and captured the detail of a small ridge present at the innermost portion of the fill. The fill was allowed to completely dry before removing the silicone rubber (approximately 24 hours). Any fill material that was proud of the surrounding ceramic was mechanically reduced using a microscalpel and 400 grit abrasive paper[8], taking care not to abrade the original glaze layer. Final resurfacing was completed using a heated spatula[9] set to 75 ºC; the glass transition temperature (T_g) of Aquazol is reported at 70 ºC (Horie 2010). A slightly higher temperature setting was used in order to adequately soften the adhesive. The heated spatula was pressed

Figure 5. Silicone rubber (indicated by red arrow) applied over nearby area of the rim.

[2] Paraloid B72: ethyl methacrylate (70%) / methyl acrylate (30%) copolymer (Conservation Resources Int'l. LLC, Item # SY 7-A)
[3] Aquazol 200: poly(2-ethyl-2-oxazoline) (Conservation Support Systems, Catalogue number AD-81200-0008)
[4] Cellulose powder: Sigmacell cellulose Type 20, 20 µm (Sigma –Aldrich, CAS number 9004-34-6)
[5] Glass microballoons: Scotchlite Glass Bubbles (microballoons), hallow sphere soda-lime-borosilicate glass, 30 µm average diameter (3M, Product number 5-0926-1812-01.)
[6] QoR® Modern Watercolors: pigments dispersed in a water-based Aquazol binder (Golden Acrylics)
[7] Silicone rubber mold: SILASTIC ™ RTV-3110 mold making base (Dow, Material Number 4107656) mixed with XIAMETER ™ RTV-3000 F catalyst (Dow, Material Number 4107676) in 20:1 ratio by weight.
[8] 400 Grit abrasive paper: PASCO U612 9x11 Coated Abrasive Sheet, Aluminum oxide "A" weight, Open coat stearated. (Pacific Abrasive, Part #919220)
[9] Heated spatula: Standard model Williard Control Unit paired with 1E heated spatula (Willard Conservation Ltd)

over a silicone release Mylar[10] barrier until the fill was smooth and level with the surrounding ceramic. Finally, the fill was sanded using Micro-mesh abrasive files[11] in 400, 600, 800, and 1200 grits.

Inpainting

Inpainting was originally attempted using QoR watercolors, however this was quickly discovered to be problematic due to the Aquazol-based fill material's propensity to solubilize in water. Attempts to reverse areas of QoR inpainting severely altered the surface of the fill material, requiring repeated resurfacing using the techniques described above. Additionally, if the QoR watercolors were too dilute when applied, the surface of the fill was easily altered. Other lab members have used QoR watercolors over Aquazol fill material with success, however the concentration of Aquazol was not recorded in these treatment reports. Perhaps a higher concentration of Aquazol (50% or more) would provide a more robust fill material, as the filler components should be more strongly bound. Despite this issue, the 30% Aquazol fill was otherwise pleasant to work with; it was easy to sand down and resurface, and bonded well with the ceramic. A 5% B72 barrier layer was attempted between the Aquazol fill and QoR watercolors, but did not sufficiently decrease sensitivity to water. Instead, acrylic paints were found to be much more compatible. If necessary, inpainting could be reversed with acetone applied on a cotton swab. Although Aquazol is reported to be soluble in acetone, the solubility rate appeared to be much lower than Aquazol in water.

Golden acrylic paints[12] were mixed to color match using a limited palette, primarily consisting of Cobalt Blue, Titan Buff and Titanium White. In areas where a warmer tone was required, Red Oxide was used in small amounts. In dark blue areas, particularly the design elements on the stand, Burnt Umber Light was added. These colors were mixed with Golden Porcelain Restoration Glaze[13] and applied with a brush. Inpainted areas were lightly sanded between coats using a 280 grit Micro-Mark abrasive file[14] in an attempt to maintain a smooth surface similar to surrounding glazed areas and to reduce brushstrokes. Decorative elements on the handle were painted in a dark blue to color match surviving dots on the handle. In an attempt to better visually integrate these elements, small dots of light blue acrylic paint were applied and dabbed using a gloved finger. This allowed for imitation of light colored spots existing throughout the blue oxide decorations. After inpainting, a final layer of Porcelain Restoration Glaze thinned with water was applied over the painted areas. Once dry, this glossy top layer was polished using small pieces of Micro-mesh abrasive cloth[15] in 4000, 6000, and 8000 grits.

Accession Numbering

Paper labels were present on the underside of the stand, teapot, and interior of the teapot lid. These paper labels appeared to be adhered with an adhesive which was found to soften in acetone. A pressure sensitive piece of tape was present on the underside of the teapot, labeled "C2D". Accession numbers painted in red were present as well; these were applied directly onto the surface of the ceramic without a barrier layer.

Red painted labels were reversed using a cotton swab dampened with acetone. A cotton poultice wet with acetone was applied over the paper labels. Once the adhesive had softened, a microspatula or microscapel was used to lift the paper label. The label present on the bottom of the teapot was much more difficult to remove than the others, and was slightly torn during removal. A cotton poultice wet with acetone was also used to attempt to soft the adhesive on the piece of pressure sensitive tape. A microscalpel was inserted between the tape and ceramic to lift the tape. Additional acetone was introduced as necessary on a cotton swab. Any residual

[10] Silicone release Mylar: colorless polyethylene terephthalate sheet coated with a silicone release agent (usually polydimethyl siloxane).
[11] Micro-mesh: Dual angle Micro-Mesh mesh® MX files, silicon carbide abrasive, 180 and 400 grit. (Micro-surface Finishing Products, Inc.)
[12] Golden acrylic paints: Fluid Acrylic paints (Golden Artist Colors, Inc.)
[13] Porcelain Restoration Glaze, Gloss: A clear, water-based coating available in matte and gloss finishes. (Golden Artist Colors, Inc.)
[14] Micro-Mark abrasive file: 280 grit abrasive file. (Micro-Mark)
[15] Micro-Mesh cloth: cushioned abrasive cloths composed of abrasive particles (silicon carbide for grits 1500-6000 or aluminum oxide for 8000-12000 grit) adhered to a cloth backing with cushioned interlayer. (Micro-surface Finishing Products, Inc.)

adhesive was cleared using acetone prior to re-labeling. The three paper labels and one tape label were bagged and returned to Registration.

Figures 6-8. Various labels present on the undersides of each individual component. *Left to right*: stand, teapot, teapot lid.

A small rectangular 5% B72 barrier layer was applied to the ceramic surface on the underside of the teapot, lid, and stand. Accession numbers were written over the barrier layer using a bamboo skewer dipped in red acrylic paint (Golden Acrylics Cadmium Red). A top layer of 5% Acryloid® B-67[16] in Stoddards solvent was applied as a protective coating over each label. If the labeling needs to be reversed or altered in the future, this can be done by removing the B-67 layer using non-polar solvents, and removing the accession number and barrier layer with acetone.

References

- Buys, Susan and Victoria Oakley. *The Conservation and Restoration of Ceramics.* Oxford: Butterworth-Heinemann, 1993.
- Seck, M. D., M. Van Landeghem, P. Faure, S. Rodts, R. Combes, P. Cavalié, E. Keita, and P. Coussot. 2015. "The mechanisms of plaster drying". *Journal of Materials Science.* 50 (6): 2491-2501.
- Sigel, Tony and Koob, Steven P. “Conservation and restoration under field conditions: Ceramics treatments at Sardis, Turkey.” Objects Specialty Group Postprints Volume Five (1997): 98-115
- *Standard Terminology of Ceramic Whitewares and Related Products*. 2019. Standard Terminology of Ceramic Whitewares and Related Products. ASTM International.
- Horie, Velson. *Materials for Conservation: Organic Consolidants, Adhesives and Coatings*. 2nd ed. Amsterdam: Butterworth-Heinemann, 2010.

[16] An isobutyl methacrylate polymer, now marketed under the name Paraloid® B-67. (Conservation Materials LTD)

After Treatment Documentation

Teapot (56-52/1), Side 1

Teapot (56-52/1), Side 2

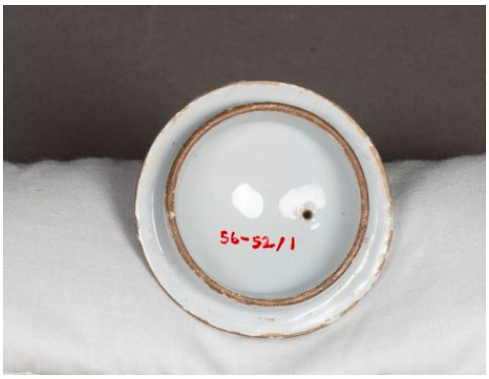
Teapot (56-52/1), Side 3

Teapot (56-52/1), Side 4

Teapot (56-52/1), Top view

Teapot (56-52/1), Bottom view

Teapot lid (56-52/1), Top view



Teapot lid (56-52/1), Bottom view

UV images after treatment show complete removal of yellow fluorescent material (indicating previous inpainting).

Stand (56-52/2), Side 1

Stand (56-52/2), Side 2

Stand (56-52/2), Side 3

Stand (56-52/2), Side 4

Stand (56-52/2), Top

Stand (56-52/2), Bottom

Appendix I. Comparanda

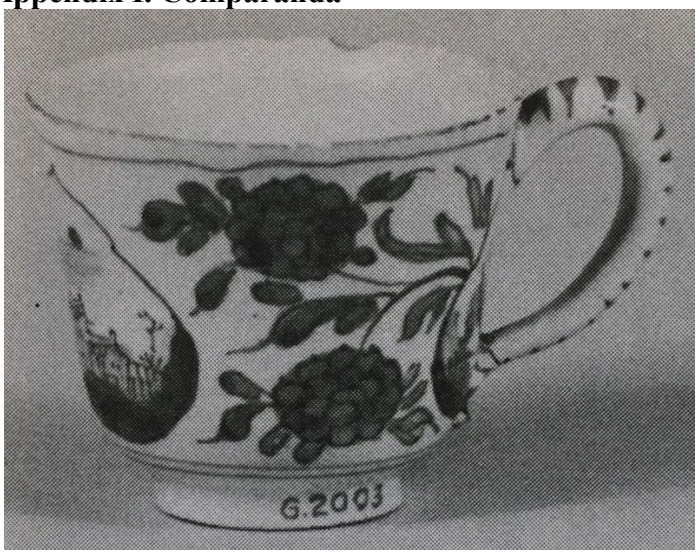


Figure I. "Teacup of conical shape curving in to footrim. Decorated in blue on a pale bluish glaze with two leaf-shaped panels, one containing houses, the other flowers behind a fence, and between the panels a spray of flowers. The handle blue-banded. Probably Liverpool c. 1730" (Plate 9.15, Britton 1982)

Figure II. "Teapot with a crabstock handle and stubby curved spout on a spherical bowl, decorated in blue with Chinese scenery, the lid with a button knop. Probably London second half eighteenth century." (Plate 146, Britton 1986)

Figure III. "Delftware with landscapes and figures, Tin-glazed stoneware teapot – Liverpool: c. 1755-70" (Plate 50, Ray 1968)

Figure IV. "Delftware with oriental decoration, Teapot – probably Liverpool: c. 1750-60" (Plate 86, Ray 1968)

Sources

- Britton, Frank, and City of Bristol Museum Art Gallery. *English Delftware in the Bristol Collection / Frank Britton ; Foreword by Arnold Wilson ; Preface by Michael Archer.* London : Totowa, N.J.: Sotheby Publications, Biblio Distribution Centre, 1982.
- Britton, Frank. *London Delftware / Frank Britton ; Preface by Rosemary Weinstein.* London: Jonathan Horne, 1987.
- Ray, Anthony. *English Delftware Pottery: In the Robert Hall Warren Collection*, *Ashmolean Museum, Oxford / by Anthony Ray ; with a Preface by Nigel Warren.* Faber Monographs on Pottery and Porcelain. London: Faber, 1968.