CONDITION REPORT AND TREATMENT PROPOSAL

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1919.10

Millefiori Bowl, 1–100 CE. Italy, Roman. Glass; overall: 3.8 x 8.8 cm; diameter of foot: 4 cm. Weight: 57.69 grams. The Cleveland Museum of Art, General Income Fund, 1919.10

Examined by: Daisy Diamond, Objects Conservation Graduate Intern
Completed on: 11/25/2025

Important Notes

Please note that conditions not visible in images are noted on annotated digital image files stored in Piction, and indications of right or left notation are proper right and left.

Description

This millefiori bowl is composed of fused slices of caned glass. Each slice, ranging from 0.25 to 1 cm in diameter, is composed of 6 colors, listed from exterior to interior: dark blue-purple, white, red-orange, brown-yellow, green, and white. In transmitted light, the opaque dark blue-purple appears as translucent magenta, and the remainder of the colors remain opaque. The foot is composed of a dark blue-black band of glass. The wall has a 0.3-cm outsplayed rim with a rounded lip. The bowl was repaired from multiple fragments (refer to “Condition” for additional information).

Materials and Manufacture

These glassware patterns were created by heating a bundle of thin glass rods of different colors. Once fused, the bundle was pulled into thin strands that were sliced into cross sections. These cross sections were then arranged and fused as a flat plate. Once fused, they were either slumped over concave or convex forms or shaped in a two-part mold (Britannica Editors, 2012; Gedzevičiūtė et at. 2009). This final step cannot be conclusively identified, since the absence of mold seams indicates slumping; however, those mold seams may no longer be visible due to the condition of the bowl.

A 2009 study of twelve Roman millefiori glass fragments was performed with electron microprobe analysis and Raman spectroscopy on fragments in the Martin von Wagner Museum in Würzburg. This study further characterized the chemical composition and coloring agents of the glass: 11 of the 12 fragments had a Na_2O-rich sodium-calcium-silicate composition with substantial amounts of the stabilizer lime (CaO) and Al_2O_3, low alkali (K_2O), and low MgO and P_2O_5 contents. Additional colorants, opacifiers (crystallites), and fluxes could have been incorporated into the network structure of the glass matrix. For example, Pb was used as a flux and stabilizer for ionic colorants. These combinations are considered typical for the Roman period. The colors used to create this bowl may have had a similar composition

to those detected in the study: the opaque dark blue-purple may have been from Mn^{3+} or Co^{2+}, the white from calcium antimonates, the red-orange from cuprite (lead often added to make the red more intense and homogenous), the brown-yellow from Fe^{3+} (although this was noted to produce transparent colors) or Pb, and the green from a mixture. Pb was also used as a flux material and stabilizer for ionic colorants (Gedzevičiūtė et al., 2009).

Historical Context

Millefiori (Italian: "thousand flowers") glass was invented by ancient Egyptians, used by the Romans (figs. 1-2), and later revived in 15th–16th century Venice. Experimentation with the technique continued in the centuries that followed (fig. 3). Today, the technique is commonly used to create paperweights, beads, and marbles (Britannica Editors, 2012).

Figure 1. Mosaic glass fragments of Hellenistic (6, 2), Ptolemaic and Romano-Egyptian (78, 83, 87, and 93), and the early imperial period (7, 29, 33, 60, 102) types from the Martin von Wagner Museum. Image source: Gedzevičiūtė et at. 2009, 17.

Figure 2. “Glass Mosaic Bowl,” 1st century BCE – 1st century CE. Roman cast glass, H: 4.2 cm. The Metropolitan Museum of Art, 1972.118.178. Image source: The Met.

Figure 3. “Millefiori bowl,” ca. 1880. Vincenzo Moretti (Italian). Glass, overall: 3 ¼ x 5 inches. The Metropolitan Museum of Art, 81.8.212. Image source: The Met.

Previous Treatment

Prior to 1980, the bowl had previously been broken and repaired. It was noted that small losses were filled with white putty and inpainted. This bowl was treated again in 1980 by Bruce Christman at the CMA. At the time, he noted that the surface of the bowl was “deeply pitted due to weathering” and “covered with iridescent decomposition products and dirt.” Christman’s treatment and decision-making involved the following:

> “Initial cleaning to remove the surface dirt was done with distilled water. Ethyl alcohol was poured over the bowl to hasten the drying process. The alcohol undid some of the old glue joins. After drying, the object was glued back together with Randolph's glue. Additional cleaning with a weak (~10%) hydrochloric acid solution was done to remove the iridescent decomposition products. The acid was swabbed on the surface with a brush. The bowl was then thoroughly rinsed in tap water to remove the acid. The object was then dried using compressed air. The bowl was cleaned four more times with the acid solution. After the bowl was fully dry, it received two brush coatings of Acryloid B-72 (~7% in xylene, Rohm & Haas Co.). Excess old fill materials were carefully picked away with a scalpel. The fill material that could not be safely removed was inpainted with Magna colors (Bocour Co.)” (Christman 1980).

Due to evolving perspectives on weathering layers, the iridescent layer was interpreted as a priority for removal at the time of treatment. Today, weathering layers are more commonly understood as important parts of a glass object, as they arise from the separation of original layers, and they are usually retained to preserve the original dimension and profile of glass objects.

Examination and Analysis

FTIR: Based on characteristic IR absorption bands detected with Fourier transform infrared spectroscopy (FTIR), and comparison to spectral reference libraries, the clear adhesive used to reassemble the bowl was classified as cellulose nitrate (fig. 4). The sample had an 80.19% match to the Cellulose Nitrate sample from the IRUG Synthetic Resins 800 cm-1 database. Characteristic IR absorption bands for cellulose nitrate include: a 3600-3200 cm-1 O-H stretching band, 3100-2800 cm-1 C-H stretching bands, a 1660-1625 cm-1 N-O stretching band, a 1285-1270 cm-1 N-O stretching band, 1480-1300 cm-1 C-H bending band, 1300-900 cm-1 C-O bending bands, and a 890-800 cm-1 bending band. Based on the comparison with the reference library, molecular degradation may have resulted in varied spectral responses. However, additional research into the changes detected by FTIR caused by the degradation of cellulose nitrate would be required to investigate this hypothesis further.

The opaque fill material was determined to be a composite mixture, potentially containing gypsum (calcium sulfate dihydrate) and an acrylic binder (i.e. Paraloid B-72) (fig. 5). Characteristic IR absorption bands for gypsum include 1140-1080 cm-1 asymmetric SO_4^{2-} stretching band and a 3700-3200 cm-1 O-H stretching band (Derrick, Stulik, and Landry 1999, 190, 194). Characteristic IR absorption bands for Acryloid B-72 include 3100-2800 cm-1 C-H stretching bands, 1740-1640 cm-1 C=O stretching bands, 1480-1300 cm-1 C-H bending bands, and 1300-900 cm-1 C-O stretching bands. Due to the age of the fill and its composite nature, clean spectra were difficult to obtain.

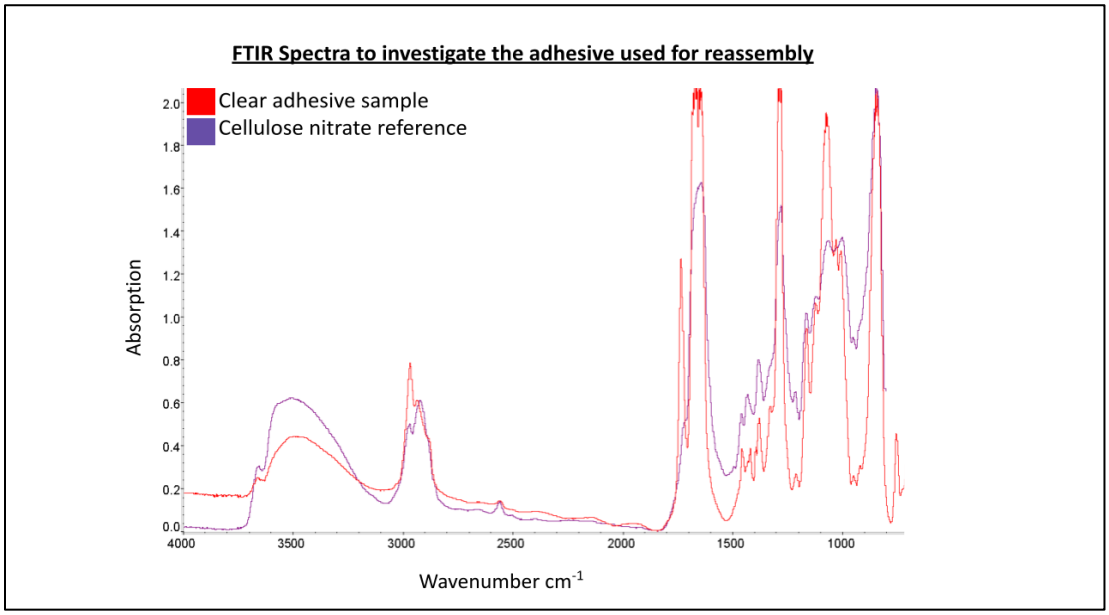

Figure 4. Sample and reference spectra suggesting cellulose nitrate adhesive composition.

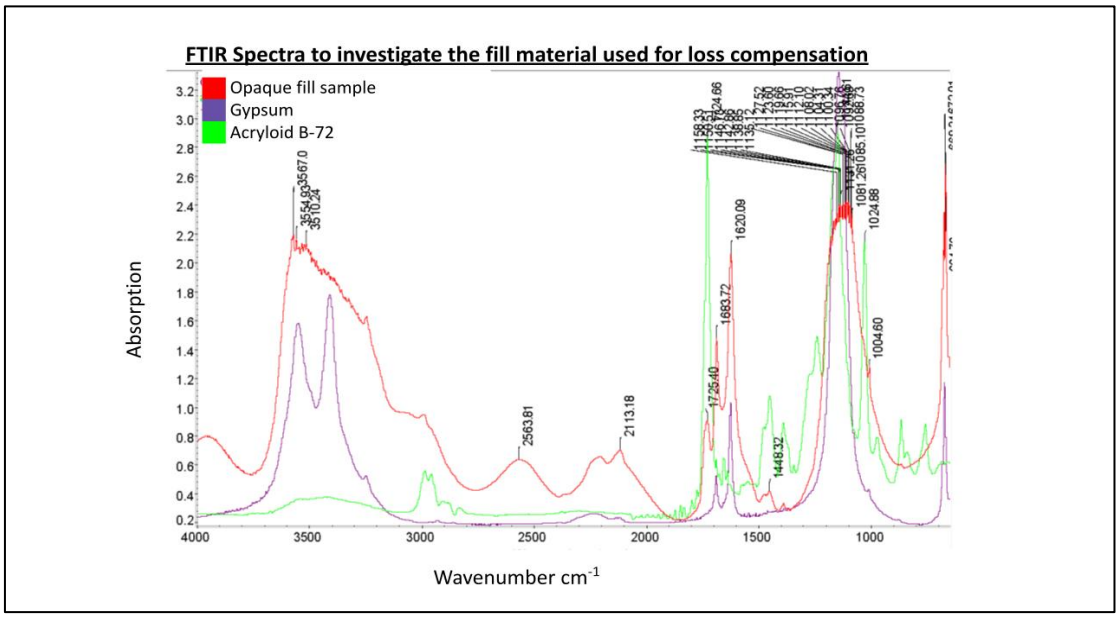

Figure 5. Sample and reference spectra suggesting gypsum and acrylic binder.

Ultraviolet examination: Under ultraviolet (UV) examination, the pale blue fluorescence of adhesive residue clearly indicates the reassembled break edges (figs. 6-7). Fills appear slightly pale green. There is a pale white swatch overlapping with the accession number, either indicating a barrier layer or sealant layer was applied. Weathering in pitting appears white, and has a similar fluorescence as the adhesive residue, although likely attributable to the

weathering optical characteristics, rather than evidence of a similar treatment material. As seen on the interior center and underside of the bowl, there is a pale orange cast to surfaces that were not as thoroughly etched during prior treatment.

Figure 6. UV examination with uvBeast V3 365nm lamp, interior (left) captured with an iPhone 15. Visible light comparison (right) captured by Gary Kirchenbauer in 2009.

Figure 7. UV examination with uvBeast V3 365nm lamp, exterior (left) captured with an iPhone 15. Visible light comparison (right) captured by Gary Kirchenbauer in 2009.

Condition

Structure: Overall, this reassembled bowl is in a relatively stable condition at present. However, the prior use of a cellulose nitrate-based adhesive (“Randolph's glue”) for reassembly significantly increases the risk of join failure during transit, handling, or in fluctuating environmental conditions (refer to “Examination and Analysis: FTIR” for additional information about adhesive identification). As the cellulose nitrate degrades, it exhibits brittleness,

shrinkage, and adhesive failure (American Institute for Conservation 2025). The former treatment methods resulted in unsightly adhesive squeeze out, and excess fill material and residues that are aesthetically distracting, disguising original material. The bowl is composed of approximately 25-35 (estimated) reassembled fragments ranging from 0.2 to 6 cm in length. The largest fragments are on the underside and the walls of the bowl. In most areas, the break edges are between fused cane elements. There is no record of when the bowl was broken. There are 8 losses that range from 0.2-0.8 cm. Two of these losses have an opaque fill material that has a wax-like appearance that was identified as a composite mixture, potentially containing gypsum (calcium sulfate dihydrate) and an acrylic binder (i.e. Paraloid B-72) with FTIR (figs. 8-9). There are multiple small losses and gaps <0.2 cm potentially due to misalignment during reassembly or loss along the break edges. The glass appears well-annealed from manufacturing, as discerned by the absence of internal crack networks.

Surface: The surface of the bowl is in fair aesthetic condition. Prior treatment resulted in significant surface etching and loss of original material, likely primarily composed of weathering layers. However, some areas of weathering do remain and cover approximately 5-10% of the surface, particularly on the underside of the bowl and on the base of the interior. The weathering is thin, with bright iridescent turquoise, indigo, and green with sparse flecks of golden yellow and orange. Overall, there is moderate pitting, and an opalescent weathering pattern is present within the surface pitting (fig. 10-11). Since the bowl is currently reassembled and the break edges are covered with adhesive and fill residue, it is not possible to see whether weathering extends to break edges. If the weathering extended to break edges, that would indicate the bowl was fragmented while in burial condition. The absence of weathering on break edges wouldn't necessarily rule this out, as the break edges could have also been overcleaned. On the underside of the bowl, there is one region of tunneling possibly due to root damage from burial conditions or cracks caused by mechanical impact (fig. 12). The surface is stable and is unlikely to worsen in controlled environmental conditions. The glass is not crizzled and there is not a notable accumulation of dust or debris on the interior or exterior of the vessel. An accession number is inscribed ("CMA 19.10") on the underside of the base on the interior of the rim with a red crazing and flaking paint, likely acrylic with either a clear barrier layer or sealant layer that fluoresces under UV.

Figure 8. Losses, adhesive residue, and varied weathering layers on the underside of the bowl.[1]

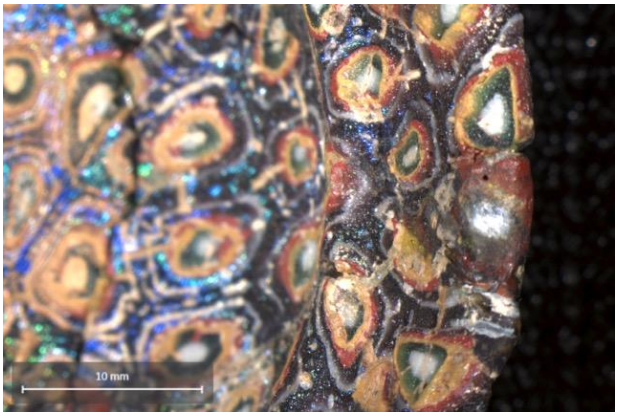

Figure 9. Fill on the rim of the bowl, right side of image.

[1] Micrographs were collected with the Leica DMC 5400 and LAS X microscope software program.

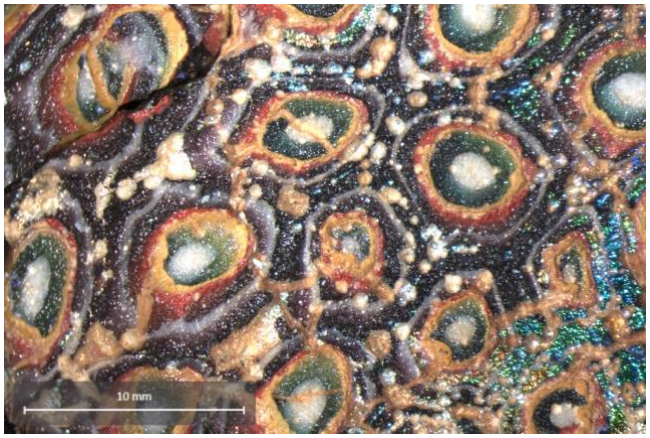

Figure 10. Surface pitting on the interior base.

Figure 11. Surface pitting on the rim of the bowl.

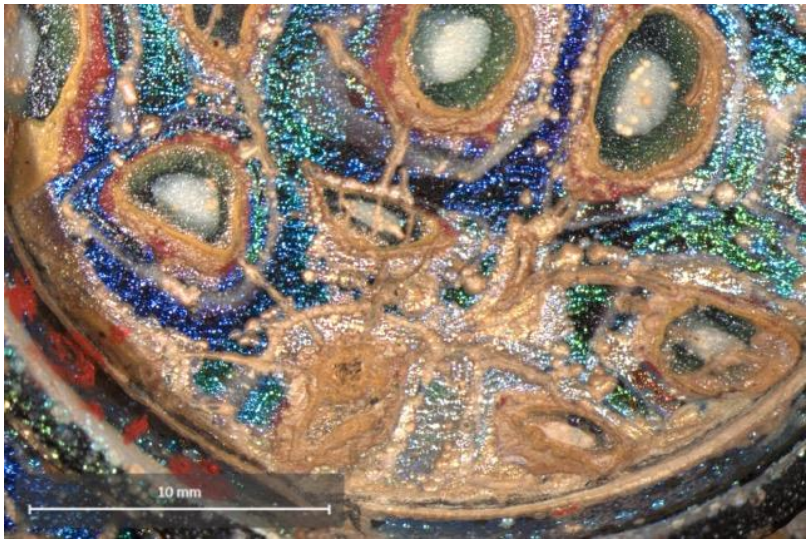

Figure 12. Varied weathering and tunnelling pattern on the underside of the bowl.

Treatment Proposal

The purpose of this treatment is to stabilize the bowl for loan to the Kelsey Museum of Archaeology at the University of Michigan in Ann Arbor.

Treatment Proposal

1. **Complete before treatment photo documentation and condition examination** (completed, 3 hours).

2. **Reverse prior joins while the object is well supported in a solvent chamber** (2 hours).
    - Assemble support materials under and around the object to maintain the arrangement of fragments for reassembly, as well as protect the pieces from damage once the adhesive softens.
    - To create the solvent chamber, the bowl will be placed inside of a polyethylene bag with a small amount of acetone, which readily reverses cellulose nitrate adhesives. Within one hour, the fragments can typically be separated (Koob 2006, 113-114).
    - If additional adhesives were used for other joins, further testing may be required.

3. **Clean break edges with acetone and mechanically. Reduce prior fill materials with solvent and mechanical action, following testing** (10 hours).

4. **Once disassembled and cleaned, document the break edges and fragments for future research or inquiry with photography and/or microscopy** (1 hour).

5. **Determine reassembly order** (1 hour).

6. **Reassemble fragments** (4 hours).
    - Apply a consolidation layer of ~5% Paraloid B-72 in 1:1 acetone.
    - Reassemble fragments with 50% Paraloid B-72 in acetone.

7. **Depending on curatorial consultation and structural stability, evaluate necessity of loss compensation** (0-6 hours).
    - Loss compensation can include Paraloid B-72 with dyes or toned mulberry paper adhered in place with 20-50% Paraloid B-72 in acetone. Any necessary additional inpainting could be completed with Golden fluid acrylics.

8. **Reduce or remove and replace the accession number** (0.5 hours).

Total treatment time: 20.5-26.5 hours.

Analysis/Research
No further analysis/research is recommended at this time.

Handling/Environment
Handle with clean, dry hands to maintain grip on the object. Store/display in a clean and stable environment of 70°F +/- 2°F, 50% +/- 5% relative humidity, and 15-20 foot candles. The glass should be kept out of direct sunlight, as excess heat can soften the Paraloid B-72 joins and fill. The glass transition temperature (T_g) of Paraloid B-72 is 40°C/104°C (CAMEO 2025).

Exhibition/Installation
Exhibit the artwork in a display case made from safe and stable materials that have passed the Oddy test. If exhibited on the deck of display case no mount is necessary. A mylar barrier should be placed between the object and any painted surfaces.

Submitted by

Daisy Diamond, Graduate Intern in Objects Conservation — 11/25/2025 (Date)

Colleen Snyder, Conservator of Objects — 11/25/2025 (Date)

Approved by

Sarah Scaturro, Eric and Jane Nord Chief Conservator — 12/1/2025 (Date)

Seth Pevnick, Curator of Greek and Roman Art, Chair of Art of the Ancient Mediterranean, Africa, and Europe to 1800, and Decorative Art — 12/2/2025 (Date)

Andria Derstine, Virginia N. and Randall J. Barbato Deputy Director and Chief Curator — 12/3/25 (Date)

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Before Treatment Photodocumentation

Figure 13. Side view, BT. Image captured by Gary Kirchenbauer in 2009.

Figure 14. Side view, BT. Image captured by Gary Kirchenbauer in 2009.

Figure 15. Interior view, BT. Image captured by Gary Kirchenbauer in 2009.

Figure 16. Exterior view, BT. Image captured by Gary Kirchenbauer in 2009.