Conservation Fellows Evaluate Cypriot Artifacts

BY TESSA DE ALARCÓN & SARA LEVIN

Sara Levin reconstructing vessel #69-35-36, which had been previously restored with shellac and cellulose nitrate.

Excavations sponsored by the University of Pennsylvania unearthed an array of important finds in Cyprus beginning in the 1930s. After division of artifacts with the government of Cyprus, the Penn Museum accessioned more than 5,000 objects. Although most of the objects have been published and some are on display, the majority of the collection has been in Museum storerooms for several decades. With plans to display more of the collection in the future and make it more accessible to researchers, the Museum has begun a systematic effort to assess the condition of these collections.

Beginning in 2012, Tessa de Alarcón, McFadden Family Fellow in Conservation, conducted a year-long condition survey of approximately 2,000 artifacts from Kourion. The following year, Sara Levin, Kress Fellow in Conservation, began to survey finds from Lapithos and examined approximately half of the collection of nearly 3,000 artifacts. Many objects from both collections had no photographs in the Museum database, so digital documentation was integral to these projects. Images of objects from the Museum's Kourion collection are now available on a webpage devoted to the site: http://www.penn.museum/sites/kourion.

Penn excavations at the city kingdom of Kourion, led by George H. McFadden, began in 1934 and uncovered material dating from *ca.* 5000 BCE to *ca.* 300 CE. The Bronze and Iron Age tombs of Lapithos, which date to *ca.* 2000–500 BCE, were excavated, starting in 1931, under the leadership of Bert Hodge Hill, former director of the American School of Classical Studies at Athens. While ceramics predominate in both the Lapithos and Kourion collections, many other materials, including metals,

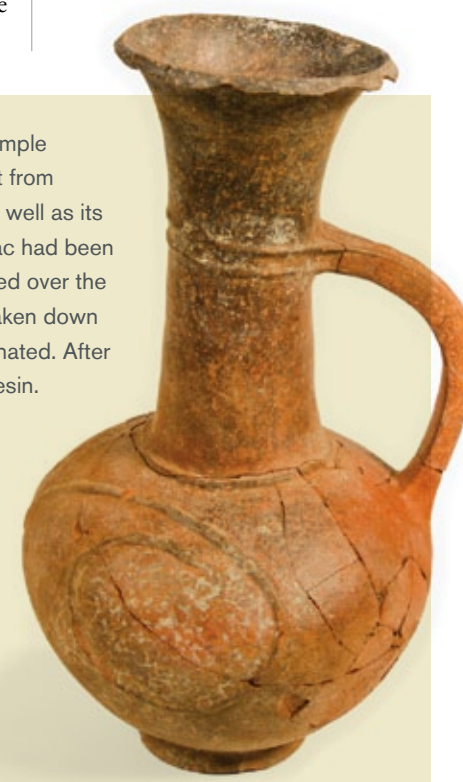
bone/ivory, glass, and stone, are represented among the small finds.

PROBLEM #1: SOLUBLE SALTS

Ceramics were deemed to be in the greatest need of conservation during both surveys. The major condition issues identified were soluble salts and failing joins from previous treatments. Soluble salts can be present from ground water in the burial environment. They can cause damage to pottery due to the material's hygroscopic nature (its ability to pull moisture from the air). In high humidity the soluble salts will dissolve and move into the pores of the ceramic. When the climate becomes dry, the salts crystallize within the ceramic fabric, and this may cause damage. Because this type of deterioration is cyclic, the objects with soluble salts were treated first.

Soluble salts can be removed by soaking the object in deionized water. As the object soaks, conductivity measurements taken at intervals are used to determine the treatment's end point. However, soluble salt deterioration and failing joins are not mutually exclusive problems, and

The Bronze Age jug from Bamboula at Kourion shown at right is a good example of the soluble salts problem, as two adhesives were observed on this object from previous treatments. One was identified as shellac based on its solubility as well as its characteristic orange appearance under ultraviolet radiation (UV). The shellac had been used for the initial treatment, and a second, unidentified adhesive was applied over the joins, likely as they began to fail. Before desalination, these old joins were taken down and the break edges cleaned. The object was then consolidated and desalinated. After desalination, the object was joined using Paraloid B-72, a stable adhesive resin.

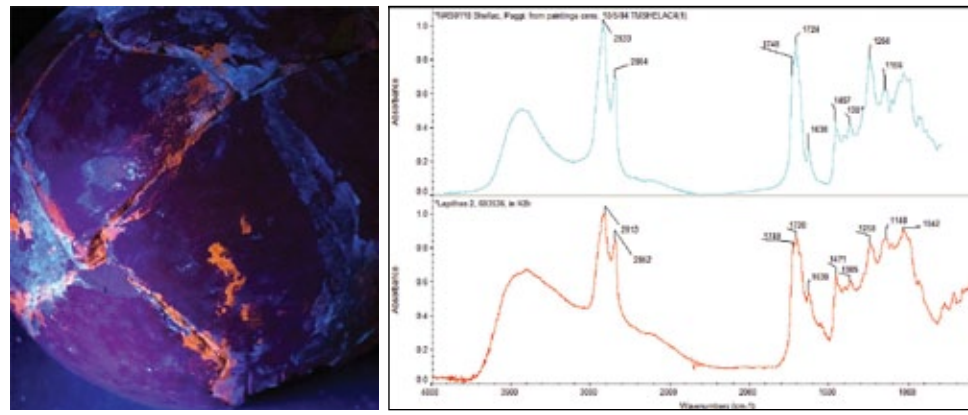


The jug (Museum object #49-12-154) appears as sherds and reconstructed after treatment.

Fragments of the jug are shown representing each stage of cleaning under normal illumination (left) and under UV radiation (right). The UV images show the presence of two adhesives on the uncleaned fragment: an adhesive with yellow green fluorescence (adhesive 2) over an adhesive with orange fluorescence characteristic of shellac (adhesive 1).

many of the objects with soluble salts also showed failing joins. These objects could not be desalinated without first dealing with the previous treatments.

There are no records for most previous treatments as they predate the formation of the Conservation Department at the Penn Museum, and some of the work might have been done in the field. Many of the ceramics from Kourion and Lapithos show evidence of more than one treatment phase based on the presence of multiple adhesives.



LEFT: The side of vessel #69-35-36 is pictured in UV showing shellac, which appears orange, and cellulose nitrate, which appears white/blue. RIGHT: The FTIR spectrum of one of the adhesive samples (below) matches a known spectrum for shellac (above).

TECHNOLOGICAL ANALYSES

Because of the prevalence of past restorations to the Cypriot ceramics, survey adhesive samples were analyzed with Fourier transform infrared spectroscopy (FTIR) as part of the Lapithos survey. FTIR characterizes organic materials based on how bonds between atoms absorb energy. Gretchen Hall, Consulting Scholar at the Museum, performed FTIR, which confirmed the presence of shellac, as well as cellulose nitrate, on a vessel from Lapithos. FTIR also indicated the presence of a third adhesive that is likely polyvinyl acetate (PVAc). Like shellac and cellulose nitrate, PVAc was once commonly used to join ceramics. However, these adhesives have aged poorly, causing ceramic joins to come apart, and preventing the objects from being handled or exhibited.

In addition to characterizing restoration media, several objects in the Lapithos collection were analyzed using portable X-ray fluorescence (pXRF) to better define their composition. XRF is a non-destructive surface analysis technique that identifies elements based on x-ray energy. Metal objects—which represent a range of Bronze Age types including pins, rings, tweezers, and a dagger—were selected to identify the alloying components. These objects had been previously labeled as bronze, an alloy of copper with tin or arsenic. However, analysis revealed that these objects were in fact non-alloyed copper. Rings previously labeled as "silver, lead" were shown to be lead, and one labeled as silver was confirmed to be primarily silver.

XRF also confirmed that copper is present on the surface of Bronze Age paste beads. These beads were described as having traces of green glaze when they were excavated. As the beads have deteriorated over time, such traces are now barely detectable. The copper identified with XRF would have been used as a colorant for such a glaze layer.

The identification of the materials, such as the metals from Lapithos, is important for understanding ancient technology, and also affects how objects are treated and stored. Similarly, the identification of the adhesives is being used in conjunction with other treatment projects to build a library of past conservation materials used at the Penn Museum. This deepens the understanding of the history of restoration at the Museum and informs the conservation approaches used on other previously treated ceramics.

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