The Life of the Egyptian Coffin: Preliminary Report

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ONE OF THE GREATEST benefits of working in the Interdepartmental Program in the Cotsen Institute of Archaeology is the opportunity to work with a diverse group of scholars with a wide range of specialties. This collaboration allows students and professors alike to complete multidisciplinary projects that attempt to tackle research questions from as many angles as possible. Recently, a group of Egyptologists and archaeologists from the Cotsen Institute and the department of Near Eastern Languages and Cultures (NELC) decided to put together a project to come to a richer understanding of the life of the Egyptian coffin. Coffins were one of the most vital components of Egyptian burials and can be found from every era of ancient Egyptian history, from the Early Dynastic period (beginning circa 3100 B.C.E.) to the Roman period (ending circa 640 C.E.). Coffins are social documents. Individuals from many levels of society, and certainly those with disposable income, ensured that their tombs were equipped with coffins. Coffins thus reflect changes in economic resources, religious practices, artistic tastes, and trade. A greater understanding of these objects has the potential to provide broad insight in Egyptian society.

The Life of the Egyptian Coffin Project is closely related to Cotsen graduate student Caroline Arbuckle MacLeod’s dissertation, in which she explores the steps necessary to create a coffin, as well as Professor Kara Cooney’s research on the reuse of coffins from ancient Egypt. The work also involves a visiting expert on pigment sourcing and creation, historic paint conservator Elsbeth Geldhof, and NELC graduate student Marissa Stevens, who specializes in papyri, coffins, and questions related to the identities of their owners. By combining the study of ancient coffins, their construction materials, and painting techniques with scientific analyses of wood, pigments, and varnish, not to mention ethnoarchaeology and experimental archaeology, these experts hope to re-create a coffin using methods available to the ancient Egyptians. Working hands-on with real materials while attempting to replicate ancient techniques allows for a much better understanding of how Egyptian coffins were

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created and how the art of coffin making may have changed through time.

In the spring of 2016, Caroline, Kara, and Elsbeth put together a study day to launch the project and to show members and friends of the Cotsen Institute what questions they hoped to answer. The day began with talks, followed by practical sessions in the afternoon. Kara gave a talk about coffin reuse in which she emphasized how important it was for all research to focus on the social aspects of coffin construction while still being grounded in scientific, linguistic, and historical analyses. Caroline then spoke about evidence currently available for the study of the carpentry of Egyptian coffins and the lives, actions, and decisions of woodworkers, showing how ethnographic and experimental methods can greatly deepen our understanding. Next, Ioanna Kakoulli, chair of the Conservation IDP, spoke about the research she carried out on the creation and identification of Egyptian Blue, an anthropogenetic pigment often used to decorate coffins, tombs, and much more. Her research expands into the sources necessary to produce Egyptian Blue (such as leaded bronze and calcium-rich sand) and the use of the pigment to modify the hue of paints in Roman times. Finally, Elsbeth Geldhof spoke about the fibers, twigs, and reeds needed to create paintbrushes; pigments and materials used to layer decoration on coffins; and materials used as varnish. She emphasized the extensive gaps in our knowledge about processes that are often taken for granted. While the talks attempted to express how complex and challenging the creation and decoration of coffins would have been in the ancient world, the message was made all the more apparent when the audience was invited to try some simple woodworking techniques and to mix pigments with ancient binders. While the group of historians, linguists, archaeologists, and conservators had a fantastic time trying out different methods, it was very clear that there is much we still do not understand—from the basic steps of construction and wood modeling to the details of decoration and varnishing.

After the study day, the first few experiments were under way, and plans were put in motion to proceed with the long-term project. Understanding the complete coffin-making process means analyzing wooden materials, woodworking techniques, materials added to change the shape and texture of the finished object, pigments used for decoration, varnish, and how all of these aspects may have been altered throughout the life of the coffin if it was reused and redecorated after its initial interment or if it was placed in a museum display after extensive restoration.

**LIFE OF THE EGYPTIAN COFFIN**

**STEP 1: TIMBER**

In her dissertation, Caroline Arbuckle MacLeod examines the wood the ancient Egyptians used to create coffins and other objects. She looks at the origin of the trees, how timber was brought into Egypt, and the...
types of wood used by certain groups in society. She is particularly interested in how and why construction techniques and timber choices changed over time.

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STEP 2: TOOLS

Within the project, Caroline will carry out a number of woodworking experiments, working hands-on with modern carpenters. Using only hand tools similar to those available to the ancient Egyptians, Caroline has so far replicated a number of joint types used to construct coffins. One aspect of coffin construction revealed by these experiments is how frequently the tools would have had to be sharpened. Even modern carbon steel chisels have to be sharpened every few minutes when working with a hardwood similar to acacia or sycomore fig. The bronze and copper tools used in antiquity would have needed even more attention, and Caroline believes that assistants or even slaves, whose sole task was maintaining the tools of their masters, would have been required.

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STEP 3: WOODWORKING

If we replicate ancient woodworking techniques, the movements of carpenters can be better understood. Caroline is recording modern tool marks to compare them to marks left on ancient coffins. This will allow us to extrapolate which movements and tools may have been used for each coffin, providing a better understanding of the evolution of construction techniques and the different methods used to work with different types of wood. We will also explore whether certain joints or finishing methods were used in different levels of society. The ultimate goal of the project is to re-create a complete coffin, demonstrating each step needed for construction and providing insight into a wide range of craft movements and choices made by woodworkers. The results will be combined with additional experiments relating to pigments and coffin reuse to allow for a complete analysis of the coffin and its social and economic importance.

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STEP 4: APPLICATION OF PREPARATION LAYERS AND PAINT

For the analysis of pigments and decoration techniques, a number of test planks that replicated elements of authentic decoration were created under Elsbeth’s direction and supervision. Challenges included successful artistic paint application, maintaining a decent scribal hand, applying var-
nish to decorated surfaces before it solidified, and understanding how varnished pieces may have been redecorated, reinscribed, and reused. Elsbeth overcame the challenge of blending artistic image and text by employing several scribes to help her. Regardless of artistic ability, a draftsman who wanted to copy a text onto a coffin would have needed either to be literate or to have the help of a scribe. Being hieroglyphilliterate herself, Elsbeth utilized the help of Caroline, Marissa, and Cotsen graduate student Vera Rondano to copy texts onto prepared wooden boards. This simple action of reaching out for specialized help provided us with a small glimpse into the types of professional relationships that must have been forged and sustained between woodworkers, draftsmen, and scribes in formal and informal Egyptian workshops, as well as the possible existence of specialists in varnish application or the production of coffin elements such as ears and hands. Our chosen text was a Twenty-Second Dynasty title and name of an official that all three scribes copied onto a historically accurate prepared orpiment surface. This first writing experiment proved immediately what we already suspected: apart from knowing how to write, a scribe had to be able to handle largely unprocessed materials on a curved, irregular, large-scale, and unforgiving surface.

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STEP 5: VARNISH

Although we need a lot more experimentation to fully understand how coffin redecoration actually worked, we do know that varnish was an ally to the reuser, covering erasures and reinscriptions and joining different layers of paint into one. Of all the practical hurdles we faced, varnish was the most challenging for simple modern coffin makers like us. The main ingredient of varnish would have been resin from the *Pistacia lentiscus* tree. This resin, or mastic, is a semisolid substance that needs treatment to be brushed onto a coffin surface without it seizing or solidifying. Heating the mastic certainly softens it and turns the hard solid into a sticky, pliable substance that with a bit of imagination could be described as a liquid. We found during testing that the mastic alone solidifies so quickly that one does not have time to properly draw a brush or flat stick across a surface for a smooth application of the product. Heating the surface and continually heating the varnish as it is applied helps tremendously, but our use of a heat gun or hair dryer was, without question, not the process used in ancient times.

While it would seem logical to use some kind of solvent, numerous analyses of ancient varnishes show that no additives were used. We are currently working with a number of hypotheses: Perhaps the overbearing Egyptian sun was utilized to advantage, with the extreme heat of the Theban summer allowing varnish to be applied smoothly, albeit only seasonally. People certainly did not die only in summer, however, so there must have been other solutions. We considered the location of the varnishing. If it was done in an enclosed setting such as a tomb, with fires lit, would the ambient temperature increase sufficiently to allow for easier varnish application? This potential solution caused some argument among us. Finally we decided that we should not overlook the limitations of modern methods for analyzing organic materials such as bind-
ing media and varnishes. The resins in varnishes are highly unstable and are therefore heavily degraded by the time material scientists can do chemical analyses. Alternatively, the solvent could have been derived from the same, or very similar, resins that were used to make the varnish. The chemical signature would then be similar to the ancient varnish and thus undetectable by modern researchers.

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STEP 6: MODIFICATION AND REUSE

The three versions of the replicated ancient text not only were used to experiment with paint and varnish application but also allowed us to explore different methods for changing the name on a coffin, a popular practice that allowed coffins to be reused by subsequent owners. By trying to replicate the methods used in redecorating and reinscribing coffins, we can better understand not only the technique of the reuse process but also the motivations behind the reuse: What does it mean to erase a name on a particular coffin and add a new one? How did it feel to reappropriate a coffin in a workshop context? Were artisans instructed to keep an old name and add a new name alongside it or elsewhere on the coffin, or is the survival of two names a remnant of a messy and incomplete reuse process? Perhaps keeping an old name was one means of showing respect for or connection to the previous owner. By attempting reuse on actual wood, preparation layers, pigments, and varnish, we can better understand how these materials either lend themselves to the reuse process or restrict the act of reuse.

Another aspect of coffin reuse is gender modification by the alteration of typical gender markers such as wig decoration, the addition or removal of breasts, the change of hand positions from male (fisted) to female (flat), the removal of earrings, and/or the addition of ears—all gender markers integral to Egyptian anthropoid coffins. We made a start in investigating these processes by forming ears out of mud plaster. If a female coffin with only earlobes showing was reused and changed into a male coffin, ears needed to be added, and it was much easier to add ears of plaster than ears of wood. In our analyses, we found that the plaster was not necessarily made of mud, as often stated. It was more likely a clay-rich material with a brown or gray color made into a moldable substance by adding sand, plant fibers, and other materials.

Beforehand, we were skeptical of our abilities to form an ear, but despite being complete novices at clay sculpting, it took us a whole 20 seconds to produce an ear. This was a real eye-opener, and we cannot wait to explore the processes of fashioning human elements for coffin construction or coffin reuse. This will give us more insight into the skills needed for a variety of coffin redecoration methods, ranging from the skillful application of written language or the highly specialized use of tools and materials to the few techniques that even we were capable of doing quite easily.

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STEP 7: NEW FRONTIERS

Our experiments in coffin making constantly reveal new insights into the construction and decoration of coffins. We hope they will also contribute to new, noninvasive methodologies for analyzing such ancient objects. If we could penetrate the outer surface of decorations and see each underlying layer, the marks on the wood, and the construction elements, we could more confidently explain the steps of construction and the layers of reuse and could provide a more complete biography of each coffin. Conventional techniques such as the stratigraphic investigation of paint cross-sections are conclusive in establishing the paint layering topography of coffins, coffin lids, and mummy boards, but they are also destructive. Furthermore, because of the scale of a paint sample (less than...
stratigraphic paint analysis will provide accurate information for only a tiny area of a given coffin.

A UCLA Transdisciplinary Seed Grant, in combination with discretionary awards from the dean of humanities, has allowed us to combine our experimental archaeology coffin work with in situ imaging. We are in the process of making conventional visible light observations, analyzing UV-fluorescence and infrared photography, and capturing images with false-color infrared, visible-light induced luminescence, and a digital microscope. In the context of Kara’s research into the reuse of coffins, we have thus far concentrated mainly on possible markers of redecoration on a coffin surface in an attempt to understand new paint and varnish layers in relation to previous decoration.

To this end, we are grateful for the assistance of Adrian Tang of the High Speed Electronics Laboratory (UCLA) and a project leader at the Jet Propulsion Laboratory (NASA), who specializes in microwave spectroscopy and radiometry. Together with Remy Hiramoto, a microelectronics engineering specialist and Egyptology enthusiast, we are able to apply space mission experience to the research of redecoration processes of ancient Egyptian mummy coffins. Adrian is applying terahertz analysis techniques and infrared measurements to test boards with single pigment layers, as well as historically informed paint layering. Infrared, wavelengths just above visible red, and terahertz, with wavelengths between infrared and microwave, have the ability to penetrate a surface layer and are therefore possible vehicles to observe the behavior of layers located under the surface. The infrared measurements test the thermodynamic behavior of the paint materials as well as the substrate—which can be wood or textile—and their location in the stratigraphy. Terahertz analysis has been tried in the reflective mode as well as the time domain, the latter based on the time a paint layer takes to absorb, scatter, and reflect the signal.

These techniques, designed by Adrian specifically for NASA’s space missions to Jupiter and its moon Europa, have never been tried in another context. This fortunate and exciting collaboration introduces a host of new challenges. For instance, the irregular paint layers on a typical Egyptian coffin, which often do not exceed a thickness of a few microns, are not exactly comparable to the oceans of unknown matter on planets millions of miles away. While Egyptian coffins and the solar system are different foci of analysis, the journey to identify the unknown by means of methodological observation is the same. As with the experimental archaeology tests, we address this from a tabula rasa perspective; we are observing and learning how the materials behave without worrying too much about the extremely limited availability of these advanced, hypersensitive techniques.

The coffins from ancient Egypt have the potential to reveal a remarkable amount of information about ancient society, if only we can access the information. Although the Life of the Egyptian Coffin Project is still in its infancy, we have already made a number of exciting discoveries about construction and decoration techniques, and we have come up with a multitude of questions for future exploration. After all, we still have to build our coffin. In addition to the information we are uncovering about ancient society, we are also working on new methods for the scientific analysis of decorated wooden objects, ranging from simple observations about paint application and tool marks to complicated tests in layering and stratigraphy done with tools currently used for space exploration. It is remarkable what can be accomplished when a diverse range of experts with a common interest get together.

It is the type of exhilarating research that can be accomplished in places like the Cotsen Institute of Archaeology, where multidisciplinary approaches are possible, encouraged, and celebrated.