

The Egyptian Mummy "Hori": A Conservation Assessment of Brazil's Museu Nacional's Egyptian Mummy "Hori" for Exhibition

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Abstract

Mummies are often excavated from dry tombs in xeric countries and transported to humid exhibits in mesic countries. When this happens, specific changes are likely to occur that threaten the long-term stability on mummies. We review our experiences in the University of Nebraska State Museum in the USA and the Museu Nacional in Brazil with regard to Andean mummies. We have observed several types of change that damages mummies. In some cases moisture is absorbed by the mummy and weakens brittle tissues. In other cases, moisture exudes from the mummies. In a few cases, decomposition occurs and necessitates intervention. The threats of humid museums are summarized and recommendations made for preserving mummies.

Introduction

In 2001, the exhibition department at the Museu Nacional in Rio de Janeiro was preparing new displays utilizing the Museum's Egyptian mummy collection. One of the featured mummies was to be the mummy "Hori." This mummy had a unique history and conservation work which caused some concern about its stability for exhibition. Thus, we were invited to examine the mummy to recommendation whether or not it should be included in the exhibit.

The Egyptian Mummy "Hori" was accessioned into the Museu Nacional's archaeological collection in Rio de Janeiro during the 1880s. The mummy consists of a body still wrapped in linen. The wrapped body arrived in the collection housed in a sarcophagus but was removed soon after it was

accessioned. The mummy dates to the 20th Dynasty.

To get an understanding of the extent of the concerns, Simone Mesquita, restoration coordinator at the Museu Nacional in Rio de Janeiro, described the unique history and previous conservation procedures used on the mummy "Hori" to us.

What is unique about the history of the mummy is that it was inundated with water. In August 1995, the mummy "Hori" was soaked with rainwater due to a failure in the covering of the Museu Nacional's roof repair during a large rainstorm. In addition to the Egyptian mummy "Hori;" a child mummy, a cat mummy, and other Egyptian funerary objects all housed within the same case had become soaked from the water. Scientists and restorers set up a White Martins vacuuming system to suck out the water from the mummy. This was set up five days after the wet mummy was found and was utilized for two days and then discontinued. As a result, the top of the mummy was dry but its underside was still wet. The Biology Department at the University was contacted for assistance in assessing the condition of the mummy "Hori" at that point. A mycologist examined the mummy, found mold, and recommended that all persons working with the mummy wear masks and gloves.

Two to three weeks into the treatment process of "Hori," the French chemist and restorer, Marie Odile Kleitz, from the Museu de França, arrived to assist with the treatment of "Hori." Her recommendations were to place "Hori" on a nylon sling mounted in a sealed case in which the relative humidity could be monitored and controlled. The case was constructed out of wood and covered with two pieces of clear acrylic that were taped together. Silica gel pillows were placed under the head and foot region of the mummy and relative humidity cards were placed nearby. Subsequently, bags of silica gel were added and monitored through cut out portions of the top acrylic. Both ends of the cover had cutout portions. This wooden box was to be only a temporary case until a permanent one made out of acrylic could be constructed. For a full year after the mummy "Hori" was soaked with rainwater the relative humidity within its temporary case was monitored. Marie Odile Kleitz prepared a hand written report in 1995, but a copy of this report was not available for us to review before our examinations.

Methods and material

Visual Exam with the cover on: On May 3, 2001, we made an initial visual exam of the mummy "Hori" at the request of Dr. Tania Lima, Chairman of Archaeology at the Museu Nacional, Rio de Janeiro. The mummy, inside of the covered wooden case constructed in 1995, was brought down from on top of a collection cabinet in the Archaeology collections room to an examination table in the work area. The clear acrylic cover was not removed for the exam. The window shutters were opened to provide additional lighting in the room.

Visual Exam without the cover on: On May 7, 2001, we performed the second visual exam of the mummy "Hori." The case containing the mummy was still located on a table in the examination room of the Archaeology Division. The clear acrylic cover was removed after the team put on protective masks and gloves. Digital photographs were taken throughout the exam.

Collection of Samples:

1. Samples were collected of the white specks found on top of the textile wrapping. They were examined under a dissecting microscope in the Restoration Laboratory at Museu Nacional and determined to be paint flecks.
2. Samples were taken of the textile debris systematically down the length of the mummy. In the foot region a small centimeter square of textile was collected from the debris. A separate vile of the dark brown resin powder was also collected in this region. These samples were taken to FIOCRUZ for fungal and pollen analysis. The textile square and powder were also examined through a dissecting microscope at the Restoration Laboratory of the Museu Nacional. Insect parts were observed in the powder. These were identified by Dr. Adriano Kury to belong to insects from the Order: Psocoptera, Family: Liposcelidae. Verification and behavior patterns of the insects were obtained from Dr. Denise Pamplona at the Museu Nacional. The textile square contained cut fibers and a small piece of cut nylon from the sling mount. This would be consistent with the insect damage that occurs with the identified insects. These insects feed on mold.
3. Samples were also collected of fragments that appeared to be cotton fibers.
4. A final sample was taken of a gray velvety appearing substance on the top surface of the mummy. This sample was taken to FIOCRUZ for analysis.

Results

Observations made with the cover on:

1. Small white specks lay on the top surface wrapping of the mummy.
2. The mummy's textile wrapping varied in color from dark brown almost black along the underside to medium light tan on top.
3. Tiny round holes were visible on the wrappings that covered the head region of the mummy.

4. A large amount of dark brown debris that included textile fibers and a powder residue was present at the foot end of the case. All of it lay on the white pillow underneath the feet of the mummy. The textile wrapping on the feet has an extensive amount of deterioration compared to the rest of the wrapping that is visible from on top. The appearance of the textile in some of this region looks like it was cut.
5. The white pillow under the head region of the mummy also showed to have an accumulation of dark brown debris. The amount was less, by approximately one half, of that that was observed in the feet region. No visible debris was seen on the bottom of the case in the middle region of the mummy.
6. The case and mount support construction consisted of unsealed wood.
7. The foot region of the mummy rested against the wooden support of its mount.

We made the following initial recommendations based off of the first visual exam:

1. A new case made from inert, stable materials should be constructed as soon as possible.
2. The custom nylon sling mount should be a closer fit in length to the length of the mummy with padded ends to help prevent movement of the mummy.
3. Use thick ethafoam as an alternative support material for the sling mount.
4. Collect samples of the white specks, and brown debris and analyze for signs of fungus (mould) and/or insect activity.
5. Check and monitor relative humidity inside of the case for several days to make sure it is still stable.
6. A thorough visual exam of the underneath side of the mummy should be performed in the near future.

These initial findings and recommendations were verbally discussed with Dr. Tania Lima on May 3, 2001. We suggested that another exam be performed, but without the acrylic cover. Dr. Lima agreed that this additional exam could be performed along with fulfilling any or all recommendations made from the initial exam.

Observations made without the cover on:

1. The white specks appeared to be hard edged and flat.
2. There were water stains on the top surface of the textile wrappings. The darkest brown areas of the textile wrappings were along the underneath edge of the mummy with some continuing up the cross straps.
3. The small round holes on the left side of the head region where distinct holes. They were left from insects. The insect holes on the right and backside of the head region are less distinct. Additional deterioration of the textile in this region has occurred connecting the insect holes. Few if any true insect holes were noted throughout the body portion of the mummy.
4. The debris that was discovered on pulling the white pillows out from underneath the foot region was a very fine dark brown powder. This same powder was not found on the pillow area directly under the head region.

5. The deterioration was most prominent on the foot portion of the textile wrappings. There was also deterioration along the underneath edge of the mummy, primarily where the textile was dark brown in color.
6. It appeared that a portion of the left leg bone was exposed through the textile, but on closer exam it proved to be a folded portion of the inside textile layer.
7. Two small turquoise or copper green colored cylindrical objects were noticed lying under the cross strap wrapping on the topside of the mummy.
8. A pile of the thin cross strap wrapping lay on top of the mummy.

Previous Treatment: The only evidence of a previous conservation treatment is the presence of silica gel, a relative humidity/temperature card at each end of the wooden box, and the nylon sling mount. The white pillows that lay under the nylon sling at both ends contain what feels to be silica gel. There are two small clear plastic bags filled with silica gel also within the box. One is at each end near the RH/temperature card [1]. Because the clear acrylic top has a portion cut out at each end, the assumption was made that the silica gel was replaced when needed to keep a constant RH in the box. What the constant RH% being maintained was couldn't be determined from the card.

Padded Supports: The foot and head cross supports of the sling mount were padded with ethafoam. The plan was also to carefully center the mummy between the two cross supports in hopes that the padding would keep it from moving down the nylon sling. It would also have removed the foot area of the mummy from direct contact with the cross support. The mummy doesn't move easily along the nylon sling and therefore, to prevent unnecessary damage to it by physically picking it up and moving it down the sling, the mummy was left in the same position on the sling.

New Case: We recommended that a new case out of inert materials be constructed. We also recommended that a CT-scan be done to assess the mummy's condition. At the time of the mummy's move to the new case, a new sling mount can also be put into effect that will cushion and stabilize movement. Marie Odile Kleitz had recommended the new case be made out of plexiglass. We also believed that this was a good recommendation to follow with the possible addition of mirrored plexiglass for the bottom.

Narrative summary of scientific observations

Two visual exams of the mummy "Hori" were done in the first two weeks of May 2001. The mummy, still housed in the wooden case that was built in 1995 after an episode of being soaked from rainwater, initially appeared to be in stable condition within the case. The surface textile wrappings were medium tan in color with some water stains. There was not a large portion of the textile covering the top portion of the mummy that displayed deterioration. However, along the bottom edge of the wrappings, where it met the nylon sling, there appeared to be a more extensive amount of deterioration present. This was especially evident where the textile has turned a dark brown. The foot region was also extremely darkened in color with an extensive amount of

textile deterioration. Only the head region had actual bone or skin of the mummy visible through the wrappings. The bone of the eye socket region was exposed on the left side of the skull.

There was some insect damage that was noted on the head region of the mummy but the rest of the upper visible surface of the textile didn't contain distinct holes that would be clues to insect activity. The case bottom didn't contain any visible insect carcasses or live insects leading one to assume that the insect damage seen in the head region is old and now inactive.

There was only one spot of possible mold on the surface of the textile wrappings. It was gray and velvety in appearance. The other samples that were tested for mold were from the textile debris separate from the mummy itself.

The major initial concern was the unsealed wood that had been used for the construction of the case and sling supports. Wood can produce gases that contribute to deterioration of organic materials. With a closed environment, as this case has been since 1995, there was a potential build up of these gases that produced some of the deterioration of the materials that is present. None of the wood in the box construction or the sling mount had been sealed to prevent gas seepage. Through the time period that the mummy had been in this case it had also worked its way down the nylon sling so that its foot area rested directly against one of the sling's wooden cross supports. This would allow the foot region to have direct contact with the wood and associated gasses. This could be part of the reason that the foot region of the mummy has the most extensive deterioration.

The presence of the silica gel pillows indicated that the relative humidity had been high at one time. No one present at the time of the exam could determine, however, what the present RH was in the case based off of the RH/temperature cards.

The cover of the wooden case was sealed with tape that is also in a state of deterioration and not secure along the entire perimeter. The two cut out portions were sealed over with a laminated material that was taped to the cover and sides of the case. The tape used in this portion was also loose in several places allowing a broken seal in which insects or mold spores could enter.

Upon examination of the mummy and the inside of the case without the cover, it was thought after closer inspection of the white specks on the upper surface of the textile that the specks were dry paint flecks. This was confirmed from a closer exam of the collected sample under a dissecting microscope. They are not providing a conservation concern for the mummy. This does however, indicate that at some point in the mummy's immediate past, it was left open in a room environment where flecks of paint then fell on it. It is evident that part of the supporting cross straps in the original wrapping of the mummy are no longer part of the support in that they lay piled on top of the surface wrapping in the body region of the mummy.

As the systematic sampling of the mummy's textile debris came to the point of taking a sample of the debris on the silica gel pillow under the foot region, a large amount of very

fine dark brown powder was discovered. This fine powder was not present on the pillow under the head region and because the mummy remained in the case throughout the exam, the bottom of the case directly under the body of the mummy could not be seen.

The initial examination of the samples at FIOCRUZ revealed potential mold in one. In examining the fine dark powder residue under a dissecting microscope at the Restoration Laboratory at the Museu Nacional, insect parts identified as belonging to the Family: Liposcelidae were found. As stated earlier these insects feed on mold. This would indicate a mold infestation had occurred at least in the underside region in the foot area where the powder was discovered. An infestation of insects was also present. This is the only side of the mummy not visible to the exam team since the mummy was left in its case during the exam. This is also the portion of the textile wrappings that seem to be the darkest in color. We are still supporting the recommendation to have a closer exam of the underside of the mummy.

Conclusions

These findings from the samples and the narrative obtained from Simone Mesquita on the condition of "Hori" during the 1995 water episode, led us to the opinion that the mummy "Hori" was not in a stable enough condition to be mounted on display in the Museu Nacional. Without a clear idea of the internal integrity of the mummy and the structural integrity of the textile wrappings on the underside of the mummy, there is potential risk of permanent damage to the mummy in the physical move and the constant vibrations from the visitors as they walk through the exhibit space. We strongly recommended constructing a new case and a more custom fitting sling mount out of inert material now. Plexiglass (clear acrylic), the material originally recommended by Marie Odile Kleitz, would still be a first choice for the construction material. A mirrored plexiglass could be used as the bottom piece to assist in monitoring the underside of the mummy. Plexiglass, however, would not be as durable as wood over time if the case is moved occasionally unless 1/2 inch material is used. Wood could be used as long as all of the surfaces were sealed with inert material such as acrylic paint, moisture-cured polyurethane varnish, or Formica. If a wooden case is made, a liner bag of Marvalseal would be recommended to help ensure the microenvironment being produced is safe for the mummy. A clear acrylic top is still recommended to help in visually monitoring the mummy without having to open the case every time. The microenvironment should try to maintain a relative humidity of 50% through the use of silica gel. The addition of a screw-in porthole with security cover in the side of the case for access to the silica gel would be advisable over cutting a hole in the cover and taping it shut.

A piece of monitoring equipment should be placed inside of the case so that its reading is always visible during the monitoring sessions of the case. A microenvironment case design was recommended for consideration in designing the new case.

The nylon sling can still be used to support the mummy since it allows for air circulation to the underside of the textile wrappings. The length should be more of a custom fit to prevent any moving of the mummy. The wooden supports either need to be made out of completely sealed wood or from acrylic dowels or a powdered-coated metal. The supports that the sling mount rests on can be made out of thick ethafoam. L-shaped pieces can be cut out of 2-inch thick sheets.

We also recommended that once the new case and sling mount were finished the removal of the mummy from its old case to its new case needed to be done in a very methodical way. Cutting loose the old nylon mesh from its supports and carefully lifting the mummy on the old mesh and placing the old mesh and the mummy onto the new sling would be a method to consider. Several people will need to be used in the transfer to ensure the mummy has the lift stress spread evenly all of the way around the body. Once the transfer has been made, the relative humidity needs to be stabilized inside of the new case through constant monitoring of the effectiveness of the silica gel. Equipment that monitors for temperature would also be useful inside the case to fully ensure a constant microenvironment. Once the microenvironment is stable a visual monitoring of the case through the cover should be done once a month. A more thorough examination of the mummy should be done without the cover if a new mold or insect infestation is suspected. Since the mummy hasn't been treated for insects or mold, keeping the relative humidity below 65% will reduce further mold activity. An anoxic treatment of the mummy would be recommended if an active insect infestation was suspected.

The final recommendation for the continued preventive conservation of the mummy "Hori" would be to have a CT scan done in the Museum when this equipment becomes portable. In the mean time having a portable X-ray machine brought in to view the internal articulation integrity of the mummy should be considered.

Subsequent to our examination, our general recommendations were followed. The mummy is not on exhibition. The CT-scanning and construction of a new storage case are subjects of future, independent papers.

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