

A mummy in Venice: Preliminary report about a work in progress

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Abstract

Mummies are the most interesting discovery from ancient Egypt, and like the hieroglyphs, they have become a symbol of the civilization of the pharaohs. Interest grows even stronger when science and technology allow us to learn about what the ancient Egyptians carefully embalmed and prepared for the afterlife. For archaeologists and conservators, studying mummies is like traveling through history between the iconography of the outer container of the body to the interior of the body itself. Our research in an Egyptian mummy at the National Museum of Archaeology in Venice includes the analysis of the stucco layer of the wood sarcophagus, the masque and linen bandages, chemistry, and CT scanning. We offer data regarding materials, pigments, and the conservation of the body.

The mummy C54 ARBIB in Museo Archeologico Nazionale at Venice: a specimen for a special mummy's restoration protocol

The mummy of the restoration project between the Museo Archeologico Nazionale at Venice (MAVe): and the Egyptian Museum of Turin (MET) have been donated in 1899 by Salvatore Arbib to the Civici Musei.

The body is wrapped in linen cloths and bandages and a funerary mask in polychrome stucco, in a precarious conservation state, had been realized in correspondence of the face. An ear-ring and a bead-necklace are the special ornaments of the afterlife. The mummy date to II A.D. particularly for the kind of bendage used, that we can compare to the one belonging to Cleopatra II mummy in Soter tomb in Thebes (Walker and Bierbrier 1997). The same

period confirm the kind of bead necklace and ear-ring of the goodness Nut in the sarcophagus of Petamenophis in Egyptian Museum of Turin (Donadoni Roveri 1988).

The mask conservation state is precarious: microfractures and *cracquelures* damaged the stucco-linen structure with a subsequent flatten of the originally tridimensional surface. Check of the head internal support means. The head is raised and supported by a modern bracket on which technical analysis is under way.

The body is covered by a stratum explained like *Nilus slime* and without cohesion (Fig. 1).

Textiles are precarious

Laceration in correspondence of the knees are of presumably traumatic nature

Subsequent dust deposits are due to:

- residual *slime* (?) stratus
- bandages and mask fragments
- pigments Remains of the back surface of the original wood sarcophagus are on the back of the mummy.

A funerary papyrus in correspondence of the right hip is adherent through horizontal bandages and taken out in Spring 1951. This papyrus, unrolled and restored in the "Gabinetto restauro papiri" of the "Soprintendenza Antichità Egittoлогия Torino II (1951)", is now exhibited by the Museo Archeologico Nazionale di Venezia.

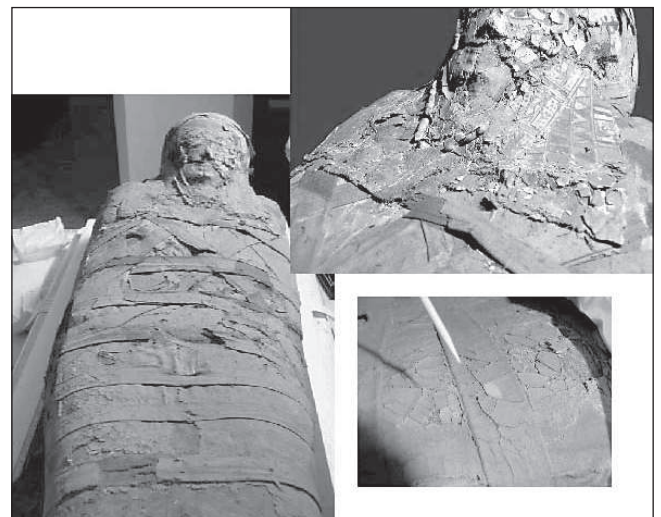


Fig. 1 - The Mummy Arbib MAVeC54: the body, the mask and the Nile lime (?) stratum.

Another peculiarity is represented by the bandage that related to sudarium impressions gives useful details on comparative chronology with reference to Coptic textiles like this sudarium from Antinoe recently found in a private collection and to be studying for to publish. On the hips we still can see the hand painted with the arms laying along the body
The complexity and peculiarity of the object lead to DEFINE a special PROTOCOLS on which are based mummies Restoring and Conservation procedures (RC card), to be applied also to mummies of Egyptian Museum of Turin.

ProtMETOSiris2004:A-B-C-D-E-PHASES

RC card - ProtMETOSiris2004:A-B-C-D-E PHASE (*)

- A. Grawing up of the conservative report and of the restore project
- B. Disinfestation intervention and casing packaging (if necessary and always recommended)
- C. Withdrawing of material microsamples Intervention layer after layer from highest to lowest- care and method used for archeological excavations
 - a. survey (es.TAC)
 - b. delimitation of the intervention areas
 - c. intervention areas etc.
- E. Storeroom or museum's open room to public.

* Materials and techniques used documented in all phases

ProtMETOSiris2004 - Mummia Arbib MAVeC54-A Phase/ Grawing up of the conservative report and of the restore project - File of the mummy before the conservation activities.

ProtMETOSiris 2004 - Mummia Arbib MAVeC54- B Phase / Disinfestation intervention and casing packaging (with the subtraction of Oxygen from the atmosphere with the introduction of Nitrogen):

- Casing with Aluminium support structure (technical details regarding soldering materials and techniques are to be declared in the protocol);
- Nitrogen generator that supplies a constant nitrogen flow;
- Atmosphere data monitoring inside the case; Monitoring of the environment conditions;-
- Decrease of O₂ concentration;
- Use of Nitrogen generator Nitrox to reach the right oxigen concentration;
- Disinfestation from insects (eggs, larvae, pupae, adults) (21 days and constant flow of 750 cc/min humidified Nitrogen).

ProtMETOSiris 2004 - Mummia Arbib MAVeC54- C phase Withdrawing of material microsamples 28 samples of pigments and Nilus slime, which could this external cover be a stucco layer instead of the white linen cloth used as sudarium (Fig. 2).

Analysis SEM-EDS

ProtMETOSiris 2004 - Mummia Arbib MAVeC54- D Phase Intervention start-up with same care and method used for archaeological excavations

Layer after layer from highest to lowest
The survey = D/a Phase
where TAC is the technique used today

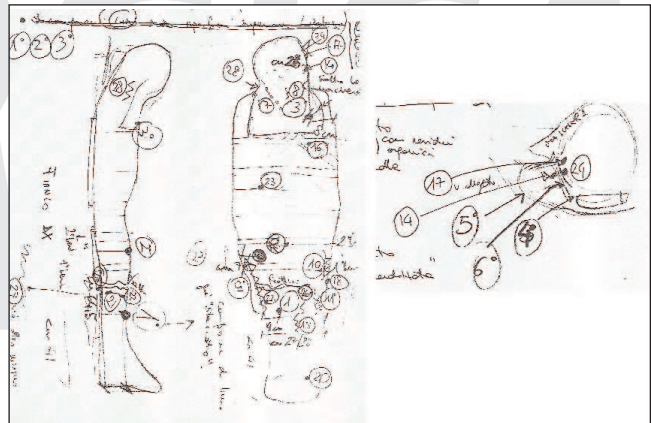


Fig. 2 Drawing of the mummy with the reference about the pigments and Nile lime (?) samples to be analysed.

To check what?

- Conservation state of the body mummified
 - The body position and possible traumas
 - Possible objects and materials inside and outside the body.
- Of course the same technique is useful also for anthropological studies carried on during another phase of the project.

Principal results from the TAC with reference conservation and iconography of the mummy:

- The arms laying along the body like the hands paintings (Fig. 3)
- Linen bundle supports the head maybe replacing the old tradition of the headrest. The funerary masks dated II century A.D. show the same head position.
- Fracture in correspondence of the knees where there was fracture in the bandage

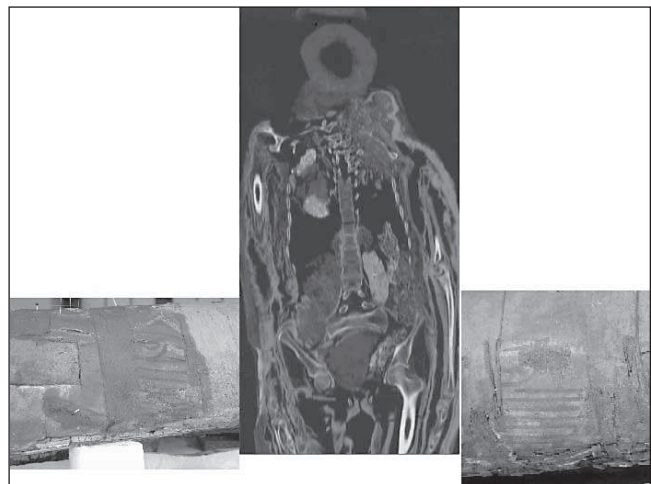


Fig.3 The position of the hand of the mummy and external paintings.

After the survey (D/a Phase), here you are the first layer and the delimitation of the intervention areas with D/b Phase I- mask- Fragments placement and fixing (Materials and techniques are to be declared in the protocol) and D/b Phase I- linen body, hand paintings ecc.

A complete file will be published at the end of restorations activities.

Multidetector Computed Tomography (MDCT), tridimensional reconstruction (3D)

1) For over a century, mummies were evaluated by radiological techniques, to avoid alterations of physical constitution and of the position of body parts, primary by conventional radiography, secondary by Computed Tomography (CT). With the advent of new generation of CT (multidetector CT, MDCT) and of new software of bidimensional (2D) and tridimensional (3D) reconstructions the mummies can be evaluated not only on the axial scan plan, but also on other plans (like frontal or sagittal ones) and by volume rendering techniques for tridimensional visualization, like well described in studies by Hoffmann (2002), Cesarani (2003) et al. (Recheis et al. 1999; Sigmund and Minas 2002).

The 18th of march 2003 we evaluated "54-Correr" mummy in the Radiology Institute of University of Udine (Italy) by a MDCT scanner, Aquilion model (Toshiba, Japan), using a protocol divided in three phases: 1) evaluation of the skull, 2) evaluation of body (including the skull), 3) evaluation of inferior extremities, with these scanning parameters:

- 2) x-ray collimation of 1 mm; image thickness of 2 mm; reconstruction interval of 0.5 mm, 120 kV; 300 mA.
- 2-3) x-ray collimation of 3 mm; image thickness of 3 mm; reconstruction interval of 2 mm, 120 kV; 300 mA.

After scanning, we sended data acquired to post-processing consolle (Anet, Toshiba, Tokyo, Japan) for reconstructions, that provide a more complete visualization of anatomical structure.

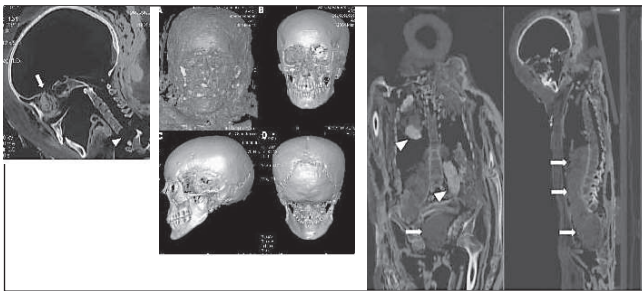


Fig. 4a Sagittal multiplanar reconstruction of the middle line of the head. It's well visualized the presence of the interruption of the ethmoid bone for excerebration with the presence of a cap (arrow). It's also well represented the interruption of alignment of vertebral column at level of the sixth vertebra (arrowhead). Disposition and shape of wrapping can be well evaluated around the head.

Fig. 4b Coronal (left) and sagittal (right) multiplanar reconstructions of the body, including the skull. Filling materials can be well evaluated. The materials in the chest (arrowhead) presents higher density than those ones in the abdomen (arrows). The conservation of vertebral column, except for the cervical tract, is well demonstrated on the sagittal plan. Fig. 4c Volume Rendering 3D reconstructions of the skull: a) frontal view with partial segmentation of wrappings, b-c-d) frontal, left lateral and posterior views with total segmentation of wrappings and cervical tract of vertebral column. In c) the two left developep wisdom teeth (third molars) are well represented. The images demonstrate the perfect state of conservation of the skull.

We executed post-processing by 2D-multiplanar reconstructions on sagittal and coronal plans (Fig. 4 a-b), and Volume Rendering (VR) 3D reconstructions (Fig. 4 c).

We evaluated on the images the next findings: conservation conditions, body position, embalming procedures, thickness of the wrappings, sex and age assessment, presence of foreign bodies and their spatial localization respect to external wrappings, anatomic abnormalities or pathologic findings of the skull and its contents, the spine, chest, abdomen, pelvis and proximal and distal extremities.

The mummified body appears in a good state of preservation, particularly the skull. Some bones results to be displaced: some rib bones, the sternum. There is also an interruption of vertebral column between the sixth and the seventh cervical vertebra.

Except for the ribs, sternum and cervical vertebral column, there aren't no other significant articular dislocations.

The skull results to be perfectly conserved. There is the presence of the interruption of ethmoid bone for excerebration, with evidence of pad. The petrosal bones containing the vestibulocochlear organ are completely preserved. About the teeth, there is a complete set of an adult person, suggesting an age of 25 years or more at the time of death.

The alignment and position of extremities is also well conserved, but post-mortem traumatic fracture of mummy, involving wrappings and distal epiphysis of femurs, is present. The pubic arch is obtuse angled, typical for a female pelvis.

We identified a metal foreign body at level of left hand; within the limits of some metal artifact occurred in the images, in relation to its morphology and location (finger) it seems to be a ring.

In the chest and abdomen there is the presence of filling materials. The material in the abdomen is less dense than those visible in the chest.

Literature Cited

- Cesarani F, Martina MC, Gandini G et al. 2003. Whole-Body Three-Dimensional Multidetector CT of 13 Egyptian Human Mummies. *AJR*; 180:597-606.
- Donadoni Roveri. 1988. The same period confirm the kind of bead necklace and ear-ring of the goodness Nut in the sarcophagus of Petamenophis in Egyptian Museum of Turin.
- Donadoni Roveri AM (a cura di). 1988. *La Civiltà degli Egizi. II. Le tradizioni religiose*. Milano: Electa Spa: fig. 322, p. 232
- Hoffman H, Hudgins PA, Head and skull base features of nine egyptian mummies: evaluation with high-resolution CT and reformation techniques. *AJR* 2002; 178:1367-1376
- Hoffman H, Torres WE, Ernst RD. 2002. PAleoradiology: advanced CT in the evaluation of nine egyptian mummies. *Radiographics*; 22:377-385
- Recheis W, Weber GW, Nedden D et al. 1999. Virtual reality and anthropology. *EJR*; 31:88-96.
- Sigmund G, Minas M, The Trier mummy Pa-es-tjau-em-aui-nu: radiological and histological findings. *Eur Radiol* 2002; 12:1854-1862
- Walker S, and Bierbrier M. 1997. *Ancient Faces. Mummy Portraits from Roman Egypt*. London British Museum Press