

The Lisbon Mummy Project: The employment of non-destructive methods in mummy studies

Álvaro Figueiredo

Introduction

During research in Lisbon for a PhD (Institute of Archaeology, University College London) on the palaeoepidemiology of Roman Period populations in Portugal and Egypt, I became aware of the fact that the Egyptian mummies in the Museu Nacional de Arqueologia (MNA) had never been the subject of a comprehensive study. Although their present display in the mummification section of the Egyptian Rooms of the Museum had resulted in the study of the objects associated with them (*i.e.* cartonnage coffin and linen shrouds), a basic scientific examination of the specimens, such as standard X-ray analysis, was never carried out. This situation called for the urgent creation of a research project to study the mummies. Following the example of similar studies (David and Tapp 1992; Harris and Wente 1980; Melcher *et al.* 1997; Taylor 1995), and inspired by the pioneering work carried out by the team of the Manchester Mummy Project (David 1979), such a project has been created. The Lisbon Mummy Project will have a multidisciplinary approach in the study of the human and animal mummies, and their associated artefacts, and will employ non-destructive analytical methods. The Project will include international specialists from the Museu Nacional de Arqueologia, the Institute of Archaeology (University College London), Instituto Português de Arqueologia (Lisbon), the British Museum (London), the American University in Cairo and the University of L' Aquila (Italy).

Methods and aims of the project

The research methodologies to be employed in this study will be non-destructive and will rely primarily on the radiographic examination of the specimens. This will be achieved through the use of conventional flat plate radiography and computed axial tomography to derive the maximum possible information concerning sex, age, stature, biological affinity, dietary reconstruction and palaeopathology. Radiography will allow visual access to the interior of the mummies without the need to unwrap or dissect them and the restricted use of endoscopy will permit sampling of human tissue and embalming materials from the interior of the bodies. These will then be prepared for histological, genetic, palaeobotanical and radiocarbon analyses. The cultural context of human and animal mummification will be addressed, whilst conservation and stabilisation of the mummies and associated artefacts will also take place. Finally, the project aims to promote the understanding of the bioarchaeology of ancient Egypt amongst the scientific community and the wider public. To achieve this we hope to present the results of the Lisbon Mummy Project in a series of research articles and through the organisation of a conference and exhibition.

The historical background of the collection

The Museu Nacional de Arqueologia houses an important collection of Egyptian antiquities collected by various travellers to Egypt during the 19th and early 20th centuries (Araújo 1987; 1990–1992; 1993–1994; Guedes 1993–1994). In 1909, the Museum director, Leite de Vasconcelos, attended the World Archaeological Congress in Cairo, and returned with various artefacts (including prehistoric stone tools and Graeco-Roman ceramics) presented to him by Evaristo Breccia (Dawson and Uphill 1995, 63), the director of the Graeco Roman Museum in Alexandria. These objects formed the beginnings of the Egyptian Collection, which was subsequently greatly enlarged with the addition of objects acquired by Queen Amelia of Portugal during her visit to Egypt (Figure 1) and Palestine in 1903.



Figure 1. The Portuguese Royal party at Giza, 1903. Queen Amelia can be seen in the centre of the group, seated on a camel. The men in uniform are staff of the Portuguese Consulate in Cairo (Photograph courtesy of the Museu Nacional de Arqueologia).

Whilst in Cairo, she was the guest of Khedive Abbas Hilmi II, who presented the royal party with a gift of Egyptian antiquities for the King of Portugal's private collection. With the declaration of the Portuguese Republic in October 1910, ownership of this collection reverted to the state, eventually finding its way to the MNA. Gifts from private collections – especially those belonging to the last Duke of Palmela – added considerably to the Museum's collection of Egyptian antiquities.

At present, the Museum has 560 artefacts of Egyptian provenance, representing all the (Araújo 1993). main phases of ancient Egyptian civilisation. Of these, around 300 objects are exhibited in the Egyptian Rooms of the Museum, making it the largest collection of its kind in Portugal. The exhibition, arranged according to subject (*i.e.* sculpture, daily life, funerary), displays objects of a highly diverse nature, ranging in time from the Prehistoric to the Coptic Periods. Whilst flint tools represent the Mesolithic, objects such as plectrums, pottery, mace heads and flint knives illustrate the Predynastic Period (c. 5000–3050 B.C.E.). There are also a number of stone vases, pottery and objects of daily use, such as footwear, combs and jewellery dating from the Old Kingdom (2663–2195 B.C.E.) to the New Kingdom (1550–1069 B.C.E.). Funerary relief sculpture and various pieces of statuary dating from the Middle Kingdom (2066–1650 B.C.E.) to the New Kingdom are also exhibited, together with some interesting examples of wooden funerary models dated to the First Intermediate Period (2195–2066 B.C.E.) and Middle Kingdom (2066–1650 B.C.E.), as well as wooden funerary statuettes dating from the Late Period (525–323 B.C.E.) and Ptolemaic Period (304–30 B.C.E.). Coffins, coffin fragments, canopic equipment, inscribed funerary cones, scarabs, ushabtis and amulets, together with the mummies, complete the section on funerary practices.

A number of Late Period bronzes also form part of the collection. The Graeco-Roman Period (332 B.C.E.–395 C.E.) is represented by objects such as votive stelae, terracotta figurines, pottery, glass and coins. The exhibition of the collection ends with the Coptic Period (after 395 C.E.) pottery, ostraca, papyri and textiles.

Materials of study

As for the focus of the Lisbon Mummy Project it will examine the Museum's entire collection of ancient Egyptian mummified remains which comprises of two human and six animal mummies, as well as a sandstone canopic vessel containing organic matter. One of the human mummies (MNA 217, Figure 2), is enclosed in a painted cartonnage coffin characteristic of the Third Intermediate Period (1070–712 B.C.E.), probably belonging to the 22nd Dynasty (948–743 B.C.E.). The deceased is identified by the name *Irtierw*, at the end of an *htp di nsw* inscription painted vertically along the front of the coffin, between its legs. The head of the anthropoid coffin wears a large black wig, framing the face which is painted red-brown and once wore a false beard (now lost). A large floral pectoral is depicted on the chest and shoulders. The body of the coffin is covered with representations of funerary deities arranged horizontally and painted on a white background. The upper portion shows a stylised representation of the Osiris sanctuary at Abydos surmounted by the winged solar disc, crowned by two *kachuti* plumes. On both sides of the sanctuary are represented, in two registers, the deities responsible for the protection of the body and its internal organs. In the upper register to the left are Isis and Selqet, and on the opposite side, Nephthys and Neith. Thoth is represented in the second register to the left, followed by Imseti and Duamutef, and opposite Horus who is followed by Hapy and Qebehsenuef. They all face towards the sanctuary in adoration. In the middle of the coffin is a large representation of a falcon without stretched wings. The vertical inscription that stretches



Figure 2. The cartonnage mummy of Irtierw. 22nd Dynasty (948–743 B.C.E.), Third Intermediate Period, Provenance unknown (Photograph courtesy of the Museu Nacional de Arqueologia).



Figure 3. Ptolemaic Period (304–30 B.C.E.) mummy. Provenance unknown (Photograph courtesy of the Museu Nacional de Arqueologia).

from this point down to the area between the feet of the coffin is surrounded on either side by large winged figures of Isis and Nephthys, first in human and then in bird form. The foot base of the coffin was closed by a wooden board with a painted representation of the Apis bull in its centre. This has now been removed and is undergoing restoration. The back of the coffin is almost entirely covered by a large *djed* pillar painted on a white background and surmounted by the upper portion of the body of Osiris. The hieroglyphic inscription identifies him as ‘Osiris, Lord of Busiris’.

The second mummy (MNA 215, Figure 3) is an unnamed individual bearing a cartonnage mask and dates to the Ptolemaic Period. It is still fully wrapped in linen bandages with a painted linen shroud decorated with a short *htp di nsw* inscription and representations of Isis, Nephthys and the Four Sons of Horus. The external wrappings are unfortunately damaged in the area of the right shoulder and feet.

The canopic vase (MNA 221–222, Figure 4), made of sandstone with traces of black paint, dates to the early Late Period. Its human-headed lid represents Imseti, one of the Four Sons of Horus. With the lid, it measures approximately 26.5 cm in height; the middle of the vessel is about 13 cm in width. Organic material of a black appearance, probably the remains of internal organs, is still preserved in the interior of the vessel.

The animal specimens consist of four juvenile crocodile mummies and two bird mummies. One of the crocodile specimens (MNA 231) still has some of its resin-impregnated linen bandages intact, while the other three (MNA 232, 233 and 234) appear to have been unwrapped in the recent past. They date to the Graeco-Roman Period (332 B.C.E.–395 C.E.) and may have come from Kom Ombo, a cult centre dedicated to the crocodile god Sobek.

The bird mummies include a wrapped falcon (MNA 230, Figure 5), and a sealed pottery coffin (MNA 235) that probably contains an ibis. The falcon mummy, which dates from the Late or Ptolemaic Period has lost part of its outer wrappings and seems to have been mummified in a standing position, in a manner resembling representations of Horus and other bird deities. The pottery coffin resembles specimens from the catacombs at Tuna el-Gebel (Hermopolis), which—like the ibis itself—were sacred to the god Thoth (El-Mahdy 1989, 162; Ikram and Dodson 1998, 135–136).

Radiographic analysis

Petrie (1898, pl. 37) was the first Egyptologist to examine Egyptian mummies using radiography. This approach became more common from the 1960s onwards (Dawson and Gray 1968; Gray 1973), culminating in the work on the royal mummies in the Egyptian Museum, Cairo (Harris and Wente 1980), and the Manchester Mummy Project (David 1979; Isherwood *et al.* 1979; 1984). Radiography allows for the examination of the interior of a mummy without the need to unwrap or dissect it and usually provides valuable bioarchaeological and cultural information about the specimen. The first step of the Lisbon Mummy Project involves the X-raying (conventional flat plate radiography) of the human and animal mummies. Since both human mummies are still fully wrapped, the X-ray plates will reveal the bodies’ internal arrangements, state of preservation and the presence of objects – such as amulets and pectoral ornaments – located within the wrappings or the body cavity. Computed axial tomography (CT) will then be used to obtain detailed information about the mummies’ interior. These images will give detailed information on

the nature of the cartonnage, linen bandaging, body packing, embalming substances (such as resin), amulets, soft tissue, organ packages (if present) and the skeleton (Brown and Wood 1999; Filer 1997; 1998; 2002; Melcher *et al.* 1997; Pickering *et al.* 1990; Ruhli and Boni 2000; Stanworth *et al.* 1986). Information on the presence of embalmer's incisions, subcutaneous packing, removal of the brain, position of the arms, the use of artificial eyes (Gray 1971; 1972; Ikram and Dodson 1998) and organ packages inside the body will also be investigated. This information is important as mummy preparation methods can provide valuable data on the social status of the individuals as well as their age and date.



Figure 4. Sandstone canopic vessel (7th/6th century B.C.E.). Provenance unknown (Photograph courtesy of the Museu Nacional de Arqueologia).

Past CT studies have also been able to determine if a body was restored in antiquity, as was sometimes necessary after damage due to disturbances such as tomb robbing (David 1979; Tapp 1979). Individuals will be sexed on the basis of pelvic and cranial morphology (Buikstra and Ubelaker 1994, although if genitalia are preserved, these will be clearly visible in CT scans. Age estimates will be determined using standard methods (Buikstra and Ubelaker 1994), while stature will also be estimated from the X-rays and CT scans. CT scans also permit the study of dental pathology, developmental disorders, bone trauma, parasite infestation, physical abnormalities and other indicators of health or disease.



Figure 5. Falcon mummy. Late Period (525 –332 BCE) or Ptolemaic (304 –30 BCE). Provenance unknown (Photograph courtesy of the Museu Nacional de Arqueologia).

It is anticipated that the high resolution of CT images (Brown and Wood 1999) will permit the detection of parasites, such as *Schistosoma haematobium* which has been identified in the kidneys (Ruffer 1910) and bladder (Isherwood *et al.* 1979) of mummified remains and skeletal lesions caused by certain diseases (Sandison and Tapp 1998); all without the need to unwrap or dissect the remains.

Endoscopic examination and contents of the canopic vessel

The interior of a mummified body may also be examined using endoscopes (Tapp *et al.* 1984; Tapp and Wildsmith 1986; 1992), which can be inserted into a body through natural orifices and *post-mortem* damage (*i.e.* embalmer's incisions), although this is only possible if such openings are exposed and accessible. This technique is inappropriate for the mummy of Irtierw as it is still fully wrapped and encased in cartonnage (Figure 2). Endoscopy will therefore only be used for the Ptolemaic mummy (Figure 3), as access to the thorax and possibly the abdomen can be obtained through a breach in the wrappings over the right shoulder. In addition to providing an opportunity to examine the body's interior, endoscopic techniques also permit the removal of small tissue samples for further analysis (Tapp 1992; Tapp and Wildsmith 1986). Mummified tissue can be re-hydrated and stained for detailed analysis by both light and scanning electron microscopy (Curry *et al.* 1979; Lewin and Cutz 1976), while immunological tests may also reveal the presence of specific antigens such as those responsible for schistosomiasis and malaria (Deelder *et al.* 1990; Miller *et al.* 1993; Taylor 1995). Samples of embalming agents (such as resin) and packing materials (such as sawdust, linen and mud) may also be retrieved for further study. Insects may also be present, such as the remains of carrion beetles (*Dermestes frischii* and *Dermestes ater*) found in previous studies (Curry 1979; Taylor 1995), which may provide information on the duration of exposure before mummification. Finally, the analysis of pollen samples and plant remains may assist in determining the season of the individual's death.

Histological (Tapp 1992) and chemical techniques will be employed in identifying the contents of the canopic jar (Figure 4). According to the iconography of the lid (representing the human-headed Imseti), remains of a mummified liver package should be found inside. However, while the four organ packages – placed in canopic vessels or inside the body – ought to contain the remains of the liver, lungs, stomach and intestines, previous research indicates that the contents do not always correspond to the correct organ package. For example, of the four packages found within a mummy (PUM II) in the University of Pennsylvania Museum of Archaeology and Anthropology (Cockburn *et al.* 1998), three contained pieces of lung, while the fourth contained a mixture of intestine and spleen.

The animal mummies

While there were numerous motives for ancient Egyptian animal mummification (Ikram and Dodson 1998, 131–136), the animal remains in the Lisbon collection seem to have been mummified as votive offerings. From the Late Period onwards several animal species were mummified at special cult centres and bought by pilgrims who offered the mummies to the gods. These were buried in catacomb-like structures sacred to the deity with whom they

were associated, the practice becoming especially popular during the Ptolemaic and Roman Periods. It has been estimated that around 10,000 birds were buried annually in the bird catacombs at Saqqara (Aufderheide 2003, 399-400; Ikram and Dodson 1998, 135), while the catacombs at Tuna el-Gebel are thought to contain over four million bird burials (El Mahdy 1989, 162).

The animal mummies in the Lisbon collection will also be studied using the same range of techniques applied to the human specimens in order to accurately determine species, as well as additional information such as age, pathology and cause of death (Filer 1995). The latter is especially important since it is now generally accepted that some of the animal species that were presented as votive offerings, were reared, killed and mummified especially to serve that ritual purpose.

Mummification techniques will also be addressed, with particular attention being paid to the bird mummies as previous studies have shown some of these to be 'fakes', containing only a few bones, feathers, reeds, wood, or even pottery (Ikram and Dodson 1998, 135-136). In such cases, the elaborate external wrappings were made up to look like the mummy of a bird.

Conservation

One of the main aims of the project entails the stabilisation and conservation of the mummified tissues and associated materials. Intervention will take place only where it is deemed necessary by the team of conservators, and consideration will be given to the reversibility of any process carried out. Work will begin with a general assessment of the state of preservation of the materials before handling by the team. Both human mummies, although stable at present, will require conservation before being returned to their exhibition cases. The cartonnage coffin of Irtierw needs particular attention. In the recent past a cut was made along the sides and across the back of the coffin in order to gain access to the mummy in its interior. The wooden board covering the foot end of the coffin has also become separated and, as mentioned above, has already been removed for conservation. Once the radiographic study is complete, the board will be returned to its original position. The Ptolemaic mummy also needs urgent conservation to its outer wrappings, which have suffered damage around the area of the right shoulder and feet. Some elements – the tarsals – of the latter have become detached and have been stored separately. During the work of conservation they will be returned to their original position in the mummy. The condition of the textiles will be assessed, and where there are areas of deterioration that may suffer further damage, these may be repaired with a supportive textile backing.

Conclusion

Outlined in the present paper are the main research objectives of the Lisbon Mummy Project. By employing a combination of non-destructive analytical techniques, coupled with a limited range of invasive techniques, the project will provide the maximum possible information concerning each individual's life history, as well as the cultural aspects surrounding the practice of human and animal mummification in ancient Egypt. Although not original (this work is inspired by and closely follows previous research projects in the field of mummy studies), the project is innovative in the sense that it is the first of its kind ever to be carried out in Portugal, and will provide a framework for future research projects

on mummy studies. The results of the Lisbon Mummy Project will be made available to the scientific community and wider public, and through them we hope to make a valuable contribution to the understanding of the bioarchaeology of ancient Egypt.

Institute of Archaeology, UCL

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