Mummies at Manchester

CREATURES OF EARTH, WATER, AND SKY

ESSAYS ON ANIMALS IN ANCIENT EGYPT AND NUBIA

edited by
Stéphanie Porcier, Salima Ikram
& Stéphane Pasquali

CREATURES OF EARTH, WATER, AND SKY

ESSAYS ON ANIMALS IN ANCIENT EGYPT AND NUBIA

edited by
Stéphanie Porcier, Salima Ikram
& Stéphane Pasquali

Published by Sidestone Press, Leiden
www.sidestone.com

Lay-out & cover design: Sidestone Press

Photographs cover: Relief of Merymery and Apis statuette (photographs by K. Wentink)

ISBN 978-90-8890-772-2 (softcover)
ISBN 978-90-8890-771-5 (hardcover)
ISBN 978-90-8890-773-9 (PDF e-book)

Contents

Mummies at Manchester

Applying the Manchester Methodology to the Study of Mummified Animal Remains from Ancient Egypt

Lidija McKnight & Stephanie Woolham[1]

Introduction

Manchester Museum, part of The University of Manchester, is home to a world-renowned Egyptology collection, comprising some 18,000 objects, including seventeen complete and numerous partial human mummies, and 45 mummified animals. The University has a long association with mummy studies spanning over a century, with research attention in recent years concentrating on the practice of animal mummification, an area of mummy studies which has traditionally been neglected in favour of human remains. This paper describes the study protocol, known as the Manchester Methodology, which has arisen from interdisciplinary research conducted at the University on mummified animals since 2000.

Mummy Studies at The University of Manchester

In May 1908, Margaret Murray, lent by University College London to catalogue the Manchester Museum's collection, performed autopsies of two human mummies, believed to be brothers, excavated from a single tomb the previous year at Rifeh by Flinders Petrie. Manchester Museum was fortunate to receive the entire assemblage of grave goods partly through the benefaction of Jesse Haworth, a local cotton magnate who sponsored Petrie's excavations in Egypt and donated his share of the finds, alongside funds to build an extension to the Museum building. The autopsy, performed before a crowd of 500 assembled guests was, at least in part, a scientific procedure, rather than a public spectacle, through the involvement of anatomists and chemists (Murray 1910).

In 1975, the then-Assistant Keeper of Archaeology at Manchester Museum, Rosalie David, conducted the autopsy of an adolescent female (Tapp 1979). The poorly-preserved mummy, referred to simply by her museum accession number, 1770, had been excavated by

In: Porcier, S., S. Ikram & S. Pasquali. Eds. Creatures of Earth, Water and Sky. Essays on Animals in Ancient Egypt and Nubia. – Leiden, Sidestone Press: 243-250.

1 The authors would like to thank all the museums who have participated in the Bio Bank project to date, particularly Manchester Museum, Tyne and Wear Museum Services and Plymouth Museum and Art Gallery whose objects are described in this paper. Special thanks are extended to Prof. Judith Adams, Susan Crimmins and the radiographers at the Central Manchester Foundation Trust, Prof. Richard Bibb, Loughborough Design School, and to Dr. Tristan Lowe, Manchester X-Ray Imaging Facility for their technical assistance with this research.

Petrie at Hawara. The autopsy included collaborators from numerous academic departments, including radiologists, dentists, pathologists and bio-chemists. Care was taken to record and document the unwrapping in great detail, including every layer of linen wrapping – a phase often neglected during autopsies. The process revealed that little soft tissue remained on the body, perhaps indicating that decomposition was advanced at the time of embalming.

In 1995, David established the International Mummy Tissue Bank to catalogue samples removed from human mummies (Lambert-Zazulak *et al.* 1995). Since then, samples from the Tissue Bank have been used in a wide range of research projects, to study techniques and ingredients used in the mummification process, and disease pathways in antiquity such as schistosomiasis (Contis & David 1996, Lambert-Zazulak *et al.* 2003), anthracosis, arteriosclerosis and cancer (David & Zimmerman 2010).

Radiography of the Manchester Collection, the Bio Bank and the Manchester Method

Radiography was first applied to Manchester's mummies in 1972. Seventeen human mummies and 30 mummified animals were X-rayed and two of the human mummies, Asru and Khary, were CT scanned (Isherwood *et al.* 1979). Since then, the mummies have undergone an extensive programme of study using non-invasive clinical and industrial imaging methods. This continuing research, now entering its fourth decade, provides an unparalleled opportunity to document the history of mummy imaging (McKnight & Atherton-Woolham 2016).

Targeted study of the animal mummies within the Manchester collection began in 2000, and since 2010 they have been the focus of a large-scale, interdisciplinary research project, the Ancient Egyptian Animal Bio Bank (McKnight *et al.* 2011). The Bio Bank project aims to locate, catalogue and study mummified animal remains from ancient Egypt by virtually uniting disparate collections around the world. The project began with modest ambitions; to bring together mummies in collections in the north of England, but the Bio Bank currently contains records for over 900 animal mummies in 57 museum collections worldwide, many from small, regional museums with no designated Egyptology collection, and often with limited resources. All the mummies in the Bio Bank are believed to belong to the votive category, manufactured and deposited as gifts to the gods (Ikram 2001; Ikram & Iskander 2002; Atherton-Woolham & McKnight 2015). Participating in the Bio Bank provides museums with an opportunity to contribute to an academic research project, providing access to state-of-the imaging facilities, specialist interpretation and advice on conservation, curation and display.

Bio Bank research has led to the formation of a best-practice protocol for the study of mummified remains, known as the Manchester Methodology. This protocol was developed to encourage museum professionals and researchers to work on this largely-unstudied body of material whilst ensuring comparable data standards (McKnight *et al.* 2015a), building on the work of earlier scholars (Ikram & Iskander 2002). The protocol prioritises non-destructive methods where possible, but considers the importance of damaged mummies which, although not suitable for museum display, can provide crucial evidence on the practice of mummification (Fig. 1). In the first instance, museums holding collections of animal mummies are visited to undertake a preliminary assessment of the material. During the visit, mummies are assessed macroscopically, photographed, and details relating to their provenance and acquisition are recorded. With guidance from museum staff, a decision is reached on the suitability of the remains for transportation to Manchester for radiographic study. If the mummies are too fragile to be moved, it is sometimes possible to collect small samples which can be studied microscopically and chemically to identify materials used in their construction. When radiographic study is possible, mummies are studied using multiple clinical imaging modalities (X-ray and CT scanning). Post-processing of the clinical data aims to assess the nature of their contents and provide identifications to species level. Industrial imaging (micro-CT) and 3D replication techniques are used to improve identification of anomalous material where appropriate. All data obtained through the study forms part of the Bio Bank database, with copies provided to the holding museum for their records.

Many factors influence the way in which mummified remains are studied. When conducting research for the Bio Bank, the authors have been fortunate to establish excellent working relationships with museums which is integral to the success of a large-scale project. Non-invasive investigations which yield much information about artefacts is a tempting prospect for museums with limited resources, particularly when the imaging costs are covered by the project.

The following section of this paper investigates how the methodology has been applied to two votive artefacts – an animal mummy and a bronze statuette containing a mummified package. Both artefacts have been chosen for discussion here due to the unique research challenges they presented.

Case study 1 – 'Jackal' Mummy, Tyne and Wear Museum Service, TWCMS:2001.406

This unprovenanced artefact, described in museum records as a 'jackal mummy', demonstrated an unusual, stylised external appearance, decorated with four ribbon-like bands applied concentrically. Due to the nature of the artefact, sampling was not permitted in this case.

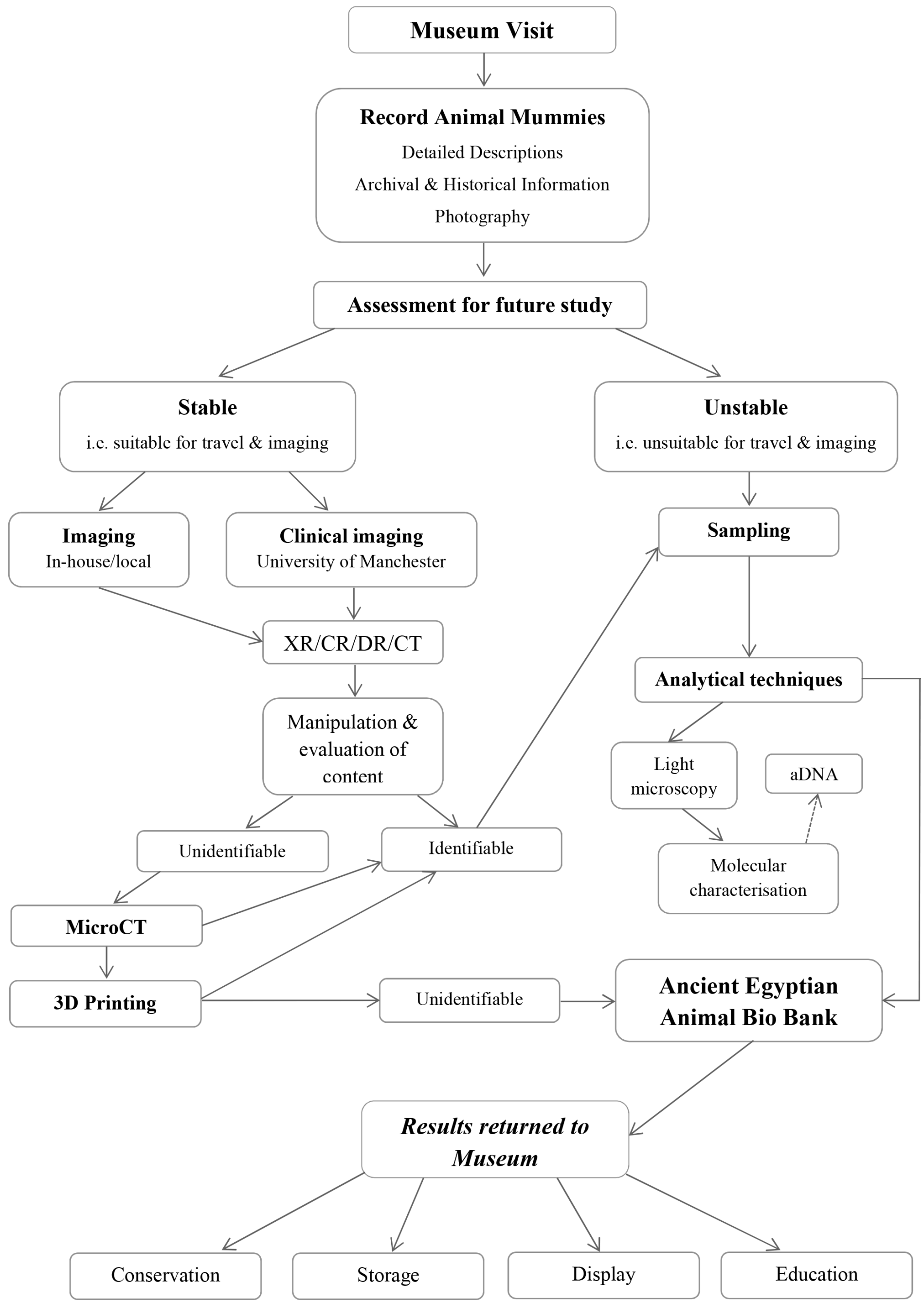

Fig. 1: Diagram showing the Manchester Methodology for the study of mummified remains. Reproduced courtesy of the Ancient Egyptian Animal Bio Bank.

Imaging took place in Manchester in 2001,[2] where initial results indicated that the bundle contained incomplete skeletal remains, inconsistent in size and shape with those of a canid (McKnight *et al.* 2015b). Initially, the authors suggested that the artefact might be a modern forgery, based on its unusual appearance; however, the imaging process confirmed the multi-phase wrapping process commonly witnessed in ancient mummies. The bundle contained three skeletal elements: the primary element, which had lost both epiphyseal regions, filled the length of the bundle, with two smaller fragments of bone used either side of this to create the 'snout'. A positive identification using the radiographic data alone proved difficult, so isolated animal and human bones belonging to a range of species were scanned to provide comparative datasets.

2 Digital radiography (DR) was performed on Siemens YSIO Fluorospot Compact equipment (Siemens Healthcare, Erlangen, Germany) with an exposure of 57 kV, 1 mA s and a focal spot size of 0.6 mm. CT was performed using a General Electric LightSpeed 64-row spiral multi-detector (MDCT) scanner (GE, Milwaukee, USA) using 120 kV p, 200 mA s with a pitch of 0.969:1.

The CT data for the comparative bones suggested that the primary skeletal element was a human left humerus with the size consistent with that of an adolescent female individual, identified through the position and appearance of the intertubercular sulcus (McKnight *et al.* 2015b). 3D printing technology was used to produce a replica of the skeletal elements to enable 'bone in hand' comparison with skeletal reference collections. The replica, produced at Loughborough Design School, was shown to osteologists and zooarchaeologists, who confirmed the identification, highlighting the important role which 3D technologies can play in research of this nature, when imaging data alone proves insufficient.

Case Study 2 – Sekhmet Statuette, Plymouth Museum and Art Gallery, No Known Accession Number

Votive artefacts were produced in their millions to satisfy the enormous demand, particularly during the Late to Graeco-Roman periods. Votives, whether a mummified animal, or artefacts created in stone, ceramic, faience or metal, are believed to have served the same ritual function, acting as a physical emissary, to convey a message between the donor and the gods. Some artefacts recorded in museum records as coffins or coffinettes, can be seen to act as composite votives, combining statuary with mummified remains (Price 2015).

The collection at Plymouth Museum and Art Gallery contains one such example; an unprovenanced bronze statuette depicting a leonine goddess, perhaps Sekhmet or Wadjet, in anthropomorphic form, presented in a seated position. The seat is damaged revealing an opening in the metal and the presence of a linen bundle within (Ikram 2016).

Composite artefacts combining organic and inorganic materials present many challenges for conservation and investigation. Macroscopic analysis and recording of the artefact was conducted during a museum visit in 2014, at which point the artefact was allocated a Bio Bank number and entered into the database. At the time, there were no plans to conduct further study on the artefact or the other mummified remains within the collection; however, an opportunity for study arose in Summer 2015 when the artefact was transported to Manchester for display in the exhibition 'Gifts for the Gods: Animal mummies revealed'. Upon submission of a research proposal to Plymouth Museum, permission was granted to study the artefact using radiographic techniques to attempt to establish the nature of the mummified bundle and whether any skeletal remains were present. Due to the nature of the artefact, sampling was not permitted in this case.

The statuette was transported to the Royal Manchester Children's Hospital in September 2015 where it was investigated using digital radiography (DR) and computed tomography (CT).[3] At the time of scanning, the team were unsure as to how successful the technique would be when applied to a metallic object of this nature; however, the results were encouraging. DR provided important information on the extent of the hollow areas within the statuette which extended to the head of the goddess. The presence of impurities in the metal of the crown was clearly visible. Interpretation of the CT scan data proved difficult due to the streak artefact produced by the sharp corners of the metal (McKnight & Bibb 2015; 85). However, manipulation of the CT data confirmed, to the authors' surprise, the parameters of the linen bundle and the presence of small bones within it, which were clearly visible in the axial images, although it was not possible at this time to identify them to species level.

Industrial imaging of the statuette was conducted to determine whether further information could be obtained non-invasively using high resolution technology. This study was conducted at the Manchester X-Ray Imaging Facility, the University of Manchester, in April 2016 using a Nikon XTH 225 with the artefact safely secured to the scanning platform using conservation-grade tissue paper and masking tape to prevent damage (Fig. 2). The objective of the study was to isolate the skeletal remains and, if possible, obtain 3D printed replicas for comparison with skeletal reference collections to enable a positive identification. Although the industrial imaging process enabled clearer data for the object to be obtained, the artefact's metallic composition and the fragmentary nature of the remains within the linen bundle meant that a positive identification was not possible. The authors suggest that the leonine imagery of the artefact, coupled with the small size of the skeletal remains, could indicate that they belong to a kitten, which would reinforce the feline associations of the goddess.

Experimental Mummification[4]

Research at Manchester for the Bio Bank project continues to raise questions as more ancient mummies are investigated. In order to further investigate the practice of animal mummification in ancient Egypt, the authors embarked upon a programme of experimental mummification, attempting to answer some of these questions, particularly regarding the practical and logistical concerns surrounding votive mummy production (Fig. 3). Since 2014, animal cadavers donated by the Natural History Museum's Bird

3 Radiographic specification for DR was conducted using Philips Eleve Digital Diagnostic equipment (Philips Medical systems, Best, Netherlands) with an exposure of 57 kV, 1 mAs and a focal spot size of 0.6 mm. CT scans using a Siemens Somatom Definition AS + 128-row MDCT scanner (Siemens Healthcare, Erlangen, Germany) at a slice thickness of 0.625 mm and pitch of 0.969:1.

4 For previous work, see Garner (1979), Ikram (2005; 2015) and Clifford & Wetherbee (2004).

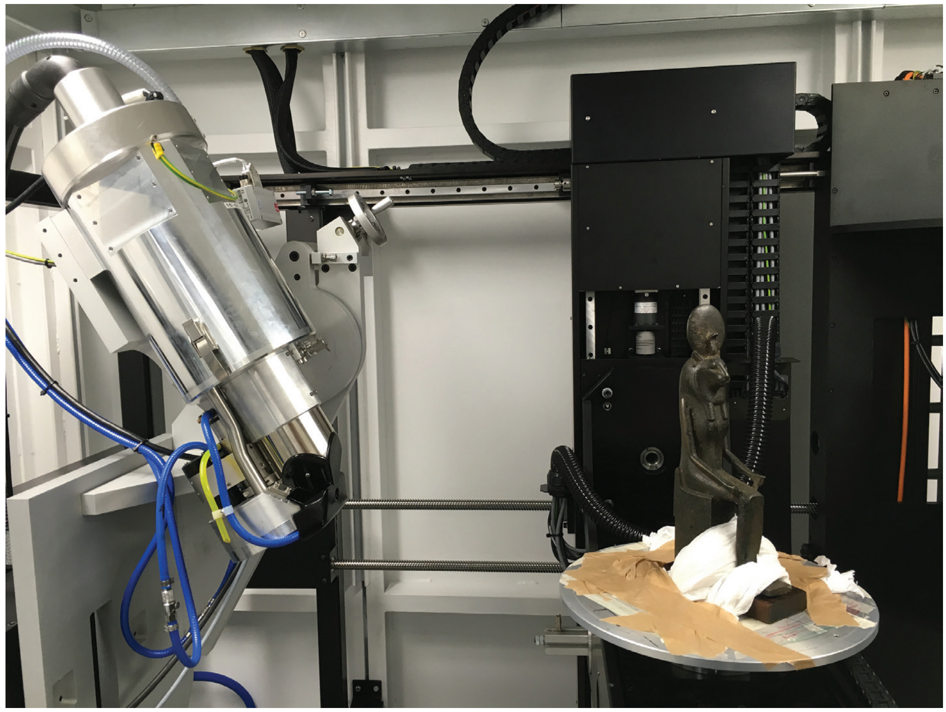

Fig. 2: Photograph showing the Sekhmet statuette secured to the scanner platform. Reproduced courtesy of the Ancient Egyptian Animal Bio Bank.

Group, Tring, have been mummified at the University of Manchester to establish whether it is possible to preserve small animal bodies in a laboratory environment using techniques witnessed in archaeological specimens (Atherton-Woolham & McKnight 2014).

Whereas some previous experimental attempts used animal cadavers to simulate human mummification techniques (Garner 1979), the Manchester experiments, like the work of more recent scholars (Ikram 2005; 2015; Clifford & Wetherbee 2004), targeted the practice of votive animal mummification using species identified from the archaeological mummy record. Radiography suggests that evisceration and excerebration were not commonly practised, probably due to the hasty production methods in place and the small size of the cadavers being preserved. Chemical analysis of small samples removed from damaged mummies provides evidence of the ingredients used in the mummification process, an 80:20 emulsion of pine resin and beeswax (Buckley & Evershed 2001; Brettell *et al.* 2017; Buckley *et al.* 2004) which acted as an antimicrobial coating over the cadaver and an adhesive substance with which to fix the linen bandages in place. No evidence to suggest that natron was employed as a dehydrating agent in the mummies has been identified, indicating that the rather simple mummification process was sufficient to achieve complete desiccation of the cadaver. The mummies were produced in laboratory conditions under a fume hood to prevent the hazardous effects of the molten resin emulsion and no attempts were made to simulate the Egyptian climate. Once produced, the mummies were kept inside the fume cupboard to ensure steady ventilation and to reduce any malodour which may occur. The temperature and humidity was monitored during this phase, but was not controlled in any way.

To date 21 mummies have been produced, including birds, rodents and snakes, the majority belonging to species identified in the archaeological mummy record. Regular macroscopic and radiographic assessments record the effects of the mummification process on the body. Radiography and regular weighing of the mummies evidences a steady loss of mass as the body desiccates, leading to mummies which show remarkable similarity to their ancient counterparts.

A major concern with the radiographic study of wrapped mummies surrounds our ability to identify structures or anomalies with certainty. This is particularly noticeable in the case of animal mummies, where the range of taxa represented is extensive, yet the morphological variation between them is slight. Coupled with the high percentage of mummies which contain fragmentary, disarticulated or incomplete skeletal remains, sometimes of multiple individuals, attempting to gain a positive identification can be virtually impossible, particularly when diagnostic features are not present. With these concerns in mind, the authors decided to conduct a series of 'blind' experiments to investigate the accuracy of the identification process using avian remains. Working in collaboration with the Natural History Museum's Bird Group, Tring, six bags of unidentified, partial avian cadavers, identified only by number, were mummified using the experimental

Fig. 3: Photograph showing the experimental mummification of a Sparrowhawk. Reproduced courtesy of the Ancient Egyptian Animal Bio Bank.

Fig. 4: Photograph showing the desiccated state of one of the assorted bags of bird remains six months after experimental mummification was conducted. Reproduced courtesy of the Ancient Egyptian Animal Bio Bank.

Fig. 5: Photograph showing the mummy 're-rolling' Event which took place in February 2016 at Manchester Museum. Reproduced courtesy of Manchester Museum.

technique. After six months, the bundles were taken to the Royal Manchester Children's Hospital for radiographic study using DR and CT.[5] The resulting imaging data was sent to an avian expert who had no prior knowledge of the identity of the original remains. Initial results suggested that identifying partial, disarticulated remains of multiple species wrapped together was virtually impossible unless diagnostic elements could be clearly visualised. This result, although disappointing, was not totally unsurprising given the nature of skeletal remains contained within ancient mummy bundles.

The second phase of the experiment was to obtain the skeletal remains from the modern mummies. Six months after the mummification was performed, the bulk of the linen and resinous substances were removed by hand using scissors, bone cutters and scalpels (Fig. 4). The mummies had completely desiccated in this period, leading to brittle soft tissue and dry bones. The remains

5 The same radiographic study protocol was used (see n. 2).

were macerated in cold water, changing the liquid as often as necessary until the bones were clean. The cleaned bones are currently being studied by the avian specialist who is working to establish positive identifications through manual comparison with skeletal reference collections. The results of this experimental work are forthcoming.

Aside from providing important insights into how animals were mummified in ancient times, the experimental programme has revealed surprising details which only came to light though the practical experience of attempting the technique ourselves. For example, some ancient examples show orientation anomalies where skeletal remains appear to have been wrapped in non-standard alignments within bundles, either obliquely or in completely the opposite presentation to the expected within the wrappings. This phenomenon was duplicated accidentally during the experimental process when it became increasingly difficult to remember the orientation of the remains within the bundle as more and more linen layers were applied. This might conceivably have become a bigger issue when embalming was conducted by multiple individuals using a 'conveyor belt' approach with each responsible for a different stage in the process. Another concern raised by the experimental programme was the exposure of the embalmers to hazardous materials, particularly the molten resin and wax emulsion, which was very strong-smelling and the handling of which caused severe skin irritations and burning. This raised the question of how the individuals involved in the process protected themselves against these hazards, either through the use of protective clothing and ventilation of the production area.

The experimental programme continues at Manchester with all of the experimental mummies produced to date in a stable condition and appearing to desiccate at a constant rate. Once a successful production technique which produced convincingly similar mummies had been perfected, the authors were keen to establish how easy (or difficult) it was to produce a decorative outer layer. Visual assessment of damaged mummies yielded important information on the various stages employed in the process, including the qualities of the linen employed, the density of their application, and the intricate details of how decorative features were constructed. This information is virtually impossible to determine using radiographic data alone. Armed with this knowledge, the authors, along with colleague Campbell Price, Curator of Egypt and Sudan at Manchester Museum, embarked on an experimental journey to recreate the elaborate wrappings as shown on an ibis mummy from Saqqara. An evening event was held at Manchester Museum; a public spectacle, not of a mummy being unwrapped, but 're-rolled' (Fig. 5). During the event, the team were able to replicate the bi-coloured herringbone design displayed on the ancient mummy, which was then completed with an applique depicting the god Thoth, seated on a throne. A local ceramicist produced a coiled ibis pot during the event, modelled on those discovered in huge numbers at the animal necropolis at Saqqara (see Nicholson, this volume).

Conclusion

The Manchester Methodology has been tried, tested and adapted over recent years and provides a robust protocol for the study of mummified remains. Every mummy is different and there is no single approach to their study; however, adopting the methodology will ensure a systematic and logical research pathway and provide consistency in results. The Bio Bank continues to evolve, highlighting areas for new research which can only truly be addressed through large, multi-collection collaborations. The authors look forward to continuing to work on this material, enthusing other researchers to study animal mummies, and most importantly, to continue to share the results of the project with the heritage sector and the general public.

Bibliography

Atherton-Woolham, S.D. & L.M. McKnight. 2014. The Mummification of Votive Birds: Past and Present. – Experimental Archaeology 2014, 1. Available online at http://openarchaeology.info/issue-2014-1/ea/mummification-votive-birds-past-and-present. Accessed 10/07/2018.

Atherton-Woolham, S. & L.M. McKnight. 2015. Animals as Votive Offerings in Ancient Egypt. In: McKnight, L.M. & S.D. Atherton-Woolham. Eds. Gifts for the Gods: Ancient Egyptian Animal Mummies and the British. – Liverpool, Liverpool University Press: 23-24.

Buckley, S.A. & R.P. Evershed. 2001. Organic Chemistry of Embalming Agents in Pharaonic and Graeco-Roman Mummies. – Nature 413: 837-841.

Buckley, S.A., K.A. Clark & R.P. Evershed. 2004. Complex Organic Chemical Balms of Pharaonic Animal Mummies. – Nature 431: 294-299.

Brettell, R., W. Martin, S. Atherton-Woolham, B. Stern, B & L. McKnight. 2017. Organic Residue Analysis of Egyptian Votive Mummies and Their Research Potential. – Studies in Conservation 62, 2: 68-82.

Clifford, W. & M. Wetherbee. 2004. Piecing Together the Secrets of Mummification. – KMT 15, 2: 64-65.

Contis, G. A.R. David. 1996. The Epidemiology of Bilharzia in Ancient Egypt: 5000 Years of Schistosomiasis. – Parasitology Today 12, 7: 133.

Cooke, A. 2015. Auctions and Air Raids: Liverpool's Animal Mummy Collection. In: McKnight, L.M. & S.D. Atherton-Woolham. Eds. Gifts for the Gods:

Ancient Egyptian Animal Mummies and the British. – Liverpool, Liverpool University Press: 48-53.
David, A.R. & M.R. Zimmerman. 2010. Cancer: An Old Disease, a New Disease or Something in Between? – Nature Reviews Cancer 10: 728-733.
Garner, R. 1979. Experimental Mummification. In: David, R. Ed. The Manchester Museum Mummy Project: Multidisciplinary Research on Ancient Egyptian Mummified Remains. – Manchester, Manchester Museum: 19-24.
Ikram, S. 2001. The Animal Mummy Project at the Egyptian Museum, Cairo. – KMT 12, 4: 18-25.
Ikram, S. 2005. Manufacturing Divinity: The Technology of Mummification. In: Ikram, S. Ed. Divine Creatures: Animal Mummies in Ancient Egypt. – Cairo, American University in Cairo Press: 16-43.
Ikram, S. 2015. Experimental Archaeology: From Meadow to Em-baa-lming Table. In: Graves-Brown, C. Ed. Experiment and Experience. – Cardiff, University of Wales Press: 53-74.
Ikram, S. 2016. A Mini-Menagerie: Animal Mummies at Plymouth City Museum and Art Gallery. – KMT 27, 1:68-73.
Ikram, S. & N. Iskander. 2002. Catalogue Général of the Egyptian Museum: Non-Human Mummies. – Cairo, Supreme Council of Antiquities Press.
Isherwood, I., H. Jarvis & R.A. Fawcett. 1975. Radiology of the Manchester Mummies. In: David, R. Ed. The Manchester Museum Mummy Project: Multidisciplinary Research on Ancient Egyptian Mummified Remains. – Manchester, Manchester Museum: 25-64.
Lambert-Zazulak, P.I., P. Rutherford & A.R. David. 2003. The International Ancient Egyptian Mummy Tissue Bank at the Manchester Museum as a Resource for the Palaeoepidemiological Study of Schistosomiasis. – World Archaeology 35, 2: 223-240.
Lambert-Zazulak, P. 2000. The International Ancient Egyptian Mummy Tissue Bank at the Manchester Museum. – Antiquity 74, 283: 44-48.
McKnight, L.M., S.D. Atherton & R. David. 2011. Introducing the Ancient Egyptian Animal Bio Bank at the KNH Centre for Biomedical Egyptology, University of Manchester. – Antiquity Project Gallery 329. Accessible at http://www.antiquity.ac.uk/projgall/mcknight329/.
McKnight, L.M., S.D. Atherton-Woolham & J.E. Adams. 2015a. Imaging of Ancient Egyptian Animal Mummies. – RadioGraphics 35: 2108-2120.
McKnight, L.M, J.E. Adams, A. Chamberlain, S.D. Atherton-Woolham & R. Bibb. 2015b. Application of Clinical Imaging and 3D Printing to the Identification of Anomalies in an Ancient Egyptian Animal Mummy. – Journal of Archaeological Science: Reports 3: 328-332.
McKnight, L.M. & C. Price. 2015. Early British fascination with Egypt. In: McKnight, L.M. & S.D. Atherton-Woolham. Eds. Gifts for the Gods: Ancient Egyptian Animal Mummies and the British. – Liverpool, Liverpool University Press: 26-30.
McKnight, L.M. & R. Bibb. 2015. Industrial imaging. In: McKnight, L.M. & S.D. Atherton-Woolham. Eds. Gifts for the Gods: Ancient Egyptian Animal Mummies and the British. – Liverpool, Liverpool University Press: 82-85.
McKnight, L.M. & S.D. Atherton-Woolham. 2016. The Evolution of Imaging Ancient Egyptian Animal Mummies at the University of Manchester, 1972-2014. In: Price, C., R. Forshaw, A. Chamberlain & P. Nicholson. Eds. Mummies, Magic and Medicine in Ancient Egypt: Multidisciplinary Essays for Rosalie David. – Manchester, Manchester University Press: 345-354.
Murray, M. A. 1910. The Tomb of Two Brothers. – Manchester, Sherratt & Hughes.
Price, C. 2015. Votive Practice in Ancient Egypt. In: McKnight, L.M. & S.D. Atherton-Woolham. Eds. Gifts for the Gods: Ancient Egyptian Animal Mummies and the British. – Liverpool, Liverpool University Press: 21-22.
Tapp, E. 1979. The Unwrapping of a Mummy. In: David, A.R. Ed. The Manchester Museum Mummy Project. – Manchester, Manchester Museum Press: 83-94.