

# Mummies, Modern Sciences, and Technology



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**A** MUMMY IS PRIMARILY AN ANCIENT EGYPTIAN CORPSE WHICH HAS been embalmed to preserve its personal and physical features. A lot of information about mummification has come down to us through classical writers such as Herodotus (2, 86–88) and Diodorus (19,6) and also through Egyptological pioneers such as Mariette and Petrie. The discovery of the New Kingdom royal mummies at the end of the last century encouraged numerous medical and scientific studies, using x-rays, ultrasound, computerized tomography, and other technical non-destructive techniques.

In 1912, after intensive study of the royal mummies, the physician Elliot Smith suggested x-raying them.<sup>1</sup> This suggestion was realized by Dr. Douglas Derry, who, for the first time, x-rayed a mummy in 1930, with the help of Dr. Khayat.<sup>2</sup> We must also mention here the efforts of the scientist Alfred Lucas,<sup>3</sup> the physician Ahmed El-Batrawy,<sup>4</sup> and the chemist Zaki Iskander.<sup>5</sup>

Since such experiments have given us a great deal of information and provided impressive results, I shall refer here to three projects that

<sup>1</sup> E. Smith, *The Royal Mummies*, Catalogue général des antiquités égyptiennes du Musée du Caire (Cairo, 1912).

<sup>2</sup> D.E. Derry, "Report upon the examination of Tut-Ankh-Amen's mummy," in Howard Carter, *The Tomb of Tut-Ankh-Amen, discovered by the late Earl of Carnarvon and Howard Carter 2* (London, 1927), pp. 143–61; idem, "An x-ray examination of the mummy of King Amenophis I," *ASAE* 34 (1934), pp. 47–48; R. Engelbach and D.E. Derry, "Mummification," *ASAE* 41 (1941), pp. 233–65.

<sup>3</sup> A. Lucas, *Ancient Egyptian Materials and Industries*, rev. ed. by J.R. Harris (London, 1962).

<sup>4</sup> A. Batrawi, "The Pyramid studies: Anatomical reports," *ASAE* 47 (1947), pp. 97–111; idem, G.M. Morant, "A Study of a First Dynasty series of Egyptian skulls from Sakkara and of an Eleventh Dynasty series from Thebes," *Biometrika* 34 (1947), pp. 18–27.

<sup>5</sup> A. Zaki, Z. Iskander, "Materials and method used for mummifying the body of Amn-*tefnekht*, Saqqara 1941," *ASAE* 42 (1943), pp. 223–560; J.-P. Lauer, Z. Iskander, "Données nouvelles sur la momification dans l'Égypte ancienne," *ASAE* 53 (1956), pp. 167–94; Z. Iskander, A. Shaheen, "Temporary stuffing materials used in the process of mummification in Ancient Egypt," *ASAE* 58 (1964), pp. 197–208.

took place in the years 1965 and 1978, when I was responsible for Egyptian antiquities.

The first project dealt with the bones found inside the tomb of Queen Tiye, in a coffin inscribed with the name of King Smenkhare, who might have ruled Egypt for a short time between Akhenaten and Tutankhamen. The relation between those three kings is not yet certain, and even Smenkhare's personality and role are still to be definitively identified.

Two professors of anatomy, Dr. Harrison and Dr. Abdula, x-rayed, investigated, and studied both the bones thought to belong to Smenkhare, and the mummy of Tutankhamen. They hoped mainly to find any genetic relations between the two kings. As they had found distinctive similarity of skulls, some inheritable defects in the skeletal remains, and the same blood group, they suggested that they may have been brothers, a supposition which needs to be confirmed.

They also found through this x-ray examination traces of wounds in Tutankhamen's skull, which, in their opinion, had been caused by falling down from a high place or through a mortal attack. This may have been the reason for his death at such an early age.<sup>6</sup> Dr. F.F. Leek, a dentist who shared in the research, confirmed, after a study of the wisdom teeth, that Tutankhamen had died approximately at the age of eighteen.<sup>7</sup>

As there were doubts concerning the sex of the person whose bones were found in Queen Tiye's tomb, and due to the debate about the existence of a male king named Smenkhare, a joint team of researchers composed of J. Harris, I. El Nawawy, N. Iskander, and others began an experiment to solve that problem. After scientific and anthropological research, they concluded through an unpublished report that the bones belonged to a male. This strengthens the identification of Smenkhare as a male king, who was most probably married to Meritaten, Akhenaten's eldest daughter.

The second research was achieved by a team from the University of Michigan, which since 1967 has conducted a complete x-ray survey of the royal mummy collection at the Cairo Museum. The study of the radiographs has provided archaeologists and historians with vast and

<sup>6</sup> R.G. Harrison, R.C. Connolly, A.B. Abdalla, "Kingship of Semenkhare and Tutankhamun demonstrated serologically," *Nature* 224 (1965), pp. 325–36; R.G. Harrison, A.B. Abdalla, "The remains of Tutankhamun," *Antiquity* 46 (1972), pp. 8–14; R.G. Harrison, R.C. Connolly, Sohair Ahmed, "Serological evidence for the parentage of Tut'ankhamun and Smenkhkarē," *JEA* 62 (1946), pp. 184–86.

<sup>7</sup> F.F. Leek, *The Human Remains from the Tomb of Tut'ankhamun*, Tut'ankhamun's Tomb Series 5 (Oxford, 1972).

useful data, especially in the fields of chronology, racial diversity, family relationships and ages at death of the kings.

An interesting problem which this team solved concerned the mummy of Makare who died at a relatively early age, and the small mummy buried with her and thought to be her daughter. Everyone was astonished when the radiography of the small mummy showed without doubt that it belonged to a female baboon.<sup>8</sup>

The third project in that field dealt with the treatment of the mummy of Ramses II, which relied completely on advanced science and state of the art technology. The idea began when a prominent French physician applied in 1975 to x-ray the mummy of King Merenptah after unwrapping it, aiming to discover his relation to the events of the Exodus. A group of Egyptian and French scientists and Egyptologists who were gathered to attend the experiment, were shocked to discover the serious decay of Merenptah's mummy (subsequent to its unwrapping). The group was also worried about the conditions of his family's mummies, especially that of his father Ramses II, and asked to unwrap it too. Fortunately, his mummy was in a better condition in spite of the cavities and grooves which had damaged it. While it seemed impossible to restore the mummy of Merenptah, it looked possible to treat the mummy of his farther after difficult scientific investigations and research. The French proposed to conduct the entire study and treatment in Paris, and Egypt accepted this beneficent proposal.

The Musée de l'homme in Paris took responsibility for the task, assisted by the Musée d'Histoire Naturelle. Many other institutions, such as the Pasteur Institute, I.G.N. (National Geographic Institute), C.N.R.S. (National Center for Scientific Research), the Commission of Atomic Energy, the General Company of Radiography, and the Institute of Human Paleontology all participated in the various aspects of the project. In all, the public and private organizations that sponsored the work numbered about twenty-one, and the work team was composed of 105 scientists, specialists, and technicians headed by Dean L. Balout.

On September 26, 1976, the mummy of Ramses II was transported to Paris in an official ceremony and on a French military plane. It was settled in a well equipped laboratory at the Musée de l'homme, where daily information was recorded. A thematic program of research and

<sup>8</sup> W.M. Whitouse, J.E. Harris, P.V. Ponitz, A.T. Storey, K.R. Weeks, J.W. Russell, "Radiology in Archaeology; a study of the pharaohs," paper and exhibit presented at the annual meeting of the American Roentgen Ray Society (Boston, 1971); James E. Harris, K.R. Weeks, *X-Raying the Pharaohs* (New York, 1973); James E. Harris, Edward F. Wente (ed.), *An X-Ray Atlas of the Royal Mummies* (Chicago, 1980).

treatment was planned and well executed, composed of the following items:

- a full physical examination of the mummy, especially its skeleton, skull, hair, teeth, and registration of the different defects
- radiographical investigations and studies
- bacteriological, microbiological and entomological studies

All these examinations and other researches on the mummified body confirmed the existence of several recent fungal infections, with the most serious foci located on the back left side and the abdominal cavity.

- restoration of the cracks and filling of the cavities with suitable natural products
- irradiation of the mummy and the coffin with gamma rays from cobalt 60 to destroy the fungi which populated more than 370 colonies
- museological presentation of the mummy with a stereo photogrammetric survey
- placement of the mummy inside its ancient wooden coffin which, was restored, strengthened and sterilized
- preparation of the mummy for transportation back to Cairo after histopathological investigation, physicochemical assay, microscopic examinations and neutron activation. The coffin was outfitted with a special device to maintain sterile conditions during its journey back to Egypt
- transportation of the mummy on May 10, 1977 from Paris to Cairo and the final installation in the Cairo Museum
- publication of the entire project in a valuable monograph in French, which contained more than 550 pages and 500 plates and figures, along with summaries in English and Arabic<sup>9</sup>

Despite of the serious damage to the royal mummies through the plunder of the tombs, scientific studies have resulted in valuable information concerning especially the following fields:

- general health conditions in ancient Egypt
- diseases and ailments during the pharaonic period
- ancient medical and surgical techniques
- ancient Egyptian diet
- Egyptian origins and racial diversity
- pharaonic chronology
- genetic relationships between members of royal families
- the approximate age of certain kings at time of death
- mummification techniques and embalming materials
- religious, cultural, and social information
- discovery of objects and religious amulets and jewelry hidden within the mummified bandages and bodies

Nevertheless, we must be cautious concerning some of these scientific results, especially if the research is not serious, the method is not

<sup>9</sup> *La momie de Ramses II* (Paris, 1985).

scientifically accepted, the reports not academic, or if the researcher's primary interest lies in fame or financial reward.

