

Investigation of the Trento Cat Mummy

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Introduction

The cat mummy of the Egyptian Collection at the Trento Buonconsiglio Castle is part of the ancient findings, collected by Major Taddeo de Tonelli, officer of the Austrian Imperial Army (Levico 1778/79 - Vienna 14-06-1858), that he has left to the Trento town, under the condition that the town Council would give 500 florin to charity. The mummy is 39 cm's long and it is good preserved; it shows a beautifully done body bandage, with series of rhombus, made by a carefully overlapping of four bandage layers, underlined by the duotone (Fig. 1).



The muzzle details are put in evidence by means of an overpainting of black colour for the eyes, ears and nose, so to make the mummy really expressive.

It is dated of the Late Period, XXVI – XXX Dynasty, and we assume that it could have been well found in Beni Hassan, the necropolis of El Menya, as attested by a small label of the 19th century.

The mummy was the object of a deep medical examination, executed by a multidisciplinary team: they performed a spiral computed tomography (CT) investigation, so to be able to try understand whether the mummy was a real mummy or a fake one and, consequently, if it will be a votive offering or a domestic animal, that has been mummified, being a family member.

Materials and Methods

CT scanning was obtained with a third-generation multislice scanner (Philips Brilliance CT 64-channel, Philips MD S.p.A., Monza, Italy), according to the following protocol: thick/index 1/0.5 mm, Pitch 0.5, 120 kV, 90 mA, Scan Time 0.5 sec and bone convolution filters and reprocessed with soft tissues algorithm. The maximum viewing matrix is up to 512 x 512, if compressed. Slices have been obtained in spiral modality, from axial projections, perpendicular to mummy's major axis for the body (thorax and abdomen), from dorsal projections (oriented along frontal-occipital axis) for the head. All images were analyzed through Aycan Workstation OsiriX[®] Viewer.

Results

First of all, the mummy resulted not a fake, because under the bandages there was a real cat (Fig. 2). In all obtained images no soft tissues signs were detected, outside or inside the body. All the cat, head included, was covered by multiple layers of material, showing negative hounsfield units value, probably due to its consistent fat composition, or high presence of fat components within this one. The cat's skeleton was complete and the body position appeared the typical one of a feline seated on his rear paws, which its tail wrapped around, as we often see on relief or statues (Morant, 1937).

Fig. 1. The cat mummy of the Buonconsiglio Castle Collection, inv.n. 985.

Between the layers of bandages, located in front of the sternum, parallel to longitudinal axis of the body, there is a metallic element (Fig. 3), 32 mm. of length and 3.2 mm. of diameter, probably made by iron, partially visible on his back from the external. It was used to fix the bandages (Fig. 4 - 5). CT analysis of the mummy revealed different interesting aspects. For the skull (Fig. 6), the neurocranium appeared empty, even though in left occipital region, where was possible to appreciate small skeletal fragments. Furthermore,

there were areas of bone discontinuity defrayable to left and right frontal bone, located bilaterally in correspondence of orbital fossa; on the right side the lesion extended caudally, up to temporal bone. The right frontal sinus was fractured along the orbital side. A small bony interruption was also recognizable on the palatine process of left maxillary bone. In the left anterior fossa, material with negative density was appreciable, as well as in the left occipital fossa and in both temporal regions, especially on the right side.

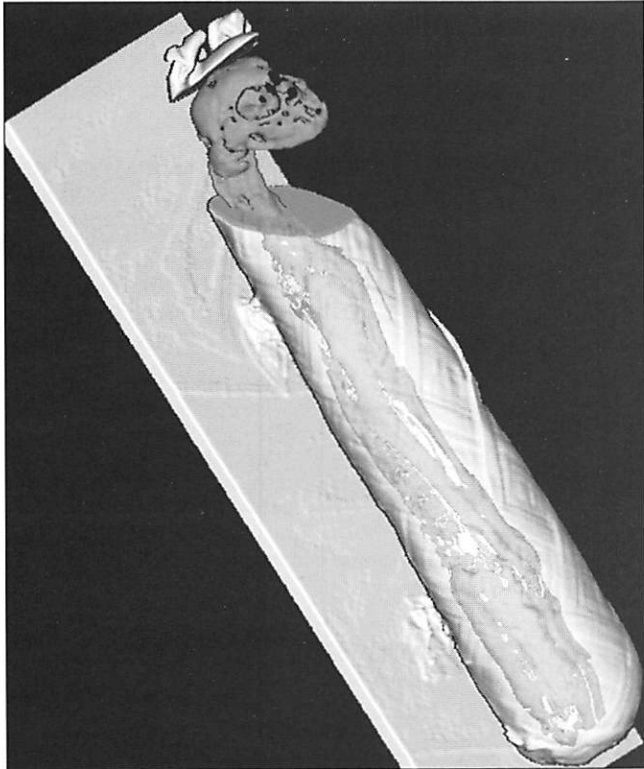


Fig. 2



Fig. 3

Fig. 2. 3D tomographic reconstruction.jpg.

Fig. 3. 3D tomographic reconstruction of the surface (A) and parasagittal MPR of the full body mummy cat (B). White arrow: metallic element at the level of shoulder joints.

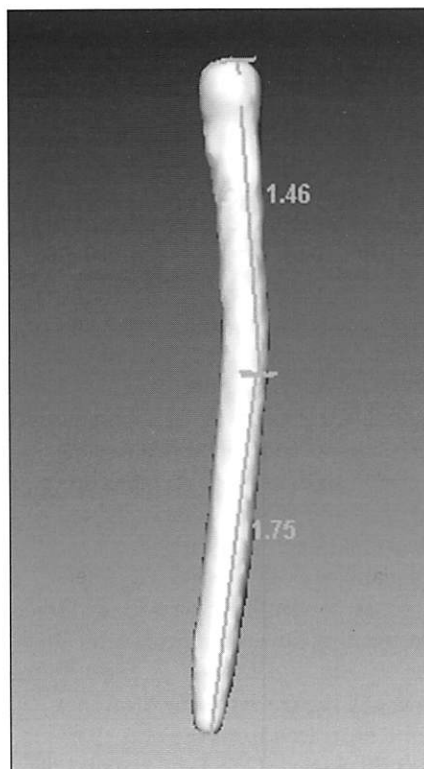


Fig. 5

Fig. 4. 3D tomographic reconstruction of the metallic element

Fig. 5. .3D tomographic reconstruction of the full skeleton.

In the left orbital fossa, almost completely empty, was appreciable a lenticular area (major diameter about 7 mm) with positive density, located in the context of negative density material, compatible with residues of the ocular adnexa. The right orbital fossa appeared empty.



Fig. 6. Dorsal slice of the mummy cat skull, obtained at orbital level: * right and left orbital fossa, x ocular adnexa, 'discontinuity on right temporal bone, "small skeletal fragments in left occipital region.

Tympanic bullae were normal and filled with air, cochlea was preserved as well as the ossicular chain, with particular reference to the hammer. The ear canal was not recognizable. Positive tissue density, compared to surrounding tissues, was observed around both tympanic bullae. Densitometric values may orient the diagnosis towards the presence of the ear folded over and adherent to the skull (Fig. 7D).

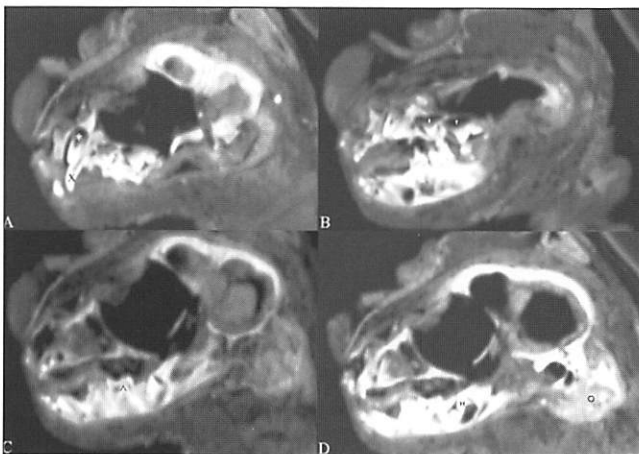


Fig. 7. Sagittal and parasagittal MPR of mummy cat skull, at the level of right maxillary (A, B) and mandibular (C, D) bone. x upper right deciduous canine, * upper right canine permanent bud, ' upper right molar bud, ^ lower right premolar, " lower right molar bud, ° right ear folded.

The temporomandibular joints were not well assessable, probably due to the position of the skull in the scanning

plane. However, the sagittal scans, obtained by Multi Planar Reconstruction (MPR), suggested that the joints will be normal.

The nasopharynx, oropharynx and cervical oesophagus appeared obliterated by material with thoroughly negative density.

Regarding the teeth (Fig. 7), the upper and lower canines were evident, as well as upper and lower premolars. Dental buds of lower molar and first upper molar were present, entirely contained in the alveoli, respectively in mandibular and maxillary ones. Normally, the eruption of molars occurred from 24 weeks of life.

The vertebral column presented some interruptions (Fig. 8 - 9): one at cervical level, between C5 and C6, one at

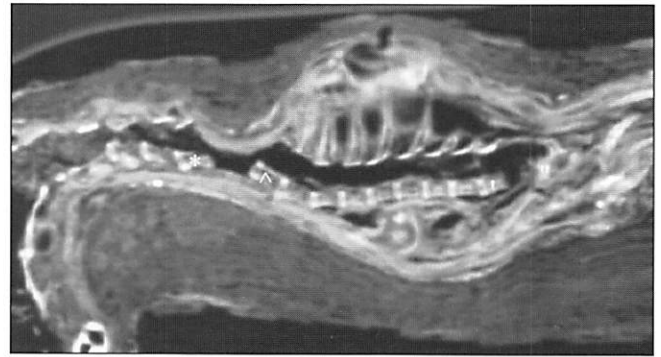


Fig. 8. Sagittal MPR of the cervical and thoracic spine. * C5 body, ^ C6 body, ' T7 body, " T8 body.

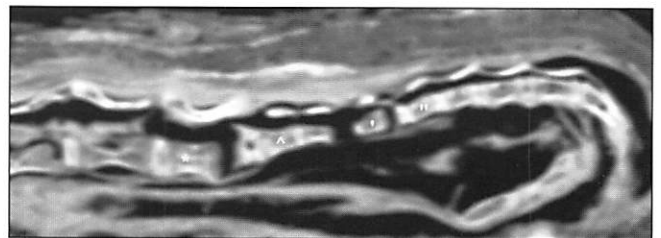


Fig. 9. Sagittal MPR of the lumbo-sacro-coccygeal spine. * L7 body, ^ Sacrum, ' Cd1 body, " Cd2 body.

thoracic level, between T7 and T8 (uncertain location), one at lumbar level, between L4 and L5, one at lumbar-sacro-coccygeal level, between VII lumbar vertebra and sacrum, sacrum and I caudal vertebra and I and II caudal vertebra. Cervical spinal canal was occluded by largely negative density material, that was not compatible with nervous tissue residues. Within spinal canal, at thoraco-lumbar spine level, were also recognizable traces of material: his amount was so small that was not possible to achieve a reliable densitometry. Starting from sixth cervical vertebra up to the sacrum, the spinal canal was almost empty.

The study of appendicular skeleton was carried out by MPR. Sagittal reconstruction of both humeri (Fig. 10) allowed physis bone reduction identification, with the start of the ossification process, that normally occurs after 46 weeks of life.

On the other hand, was still recognizable the olecranon tuberosity (Fig. 11) bone separated from the ulnar base: merge takes place after 28 weeks of life. Even radius and

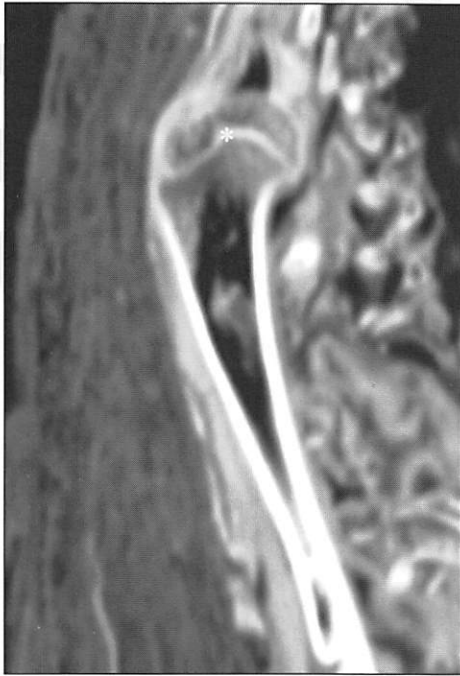


Fig. 10. *Sagittal MPR of the right Humerus.*
* Humeral proximal physis, with the start of the ossification process.



Fig. 11. *Sagittal MPR of the right Ulna.*
* Olecranon tuberosity bone is separated from the ulnar base, "olecranon physis.

ulna distal physis were very thin: like the humerus, the ossification process occurs after 46 weeks of life. Pelvis physeal scar (recent ossification sign, Fig. 12) was still recognizable: signs of ossification disappear from 32 weeks of life (at 24 weeks were still recognizable). Femoral cephalic nucleus (Fig. 13) was well visible: the ossification occurs from 32 weeks. The distal femoral physis was thin and mineralization process seems to be started (normal after 32 weeks). The proximal physis of the tibial crest (Fig. 12) was not yet fully united nor to the tibia or to the tibial plateau, although in the latter case the separation line was not well recognizable. The merge of the crest with the tibial plateau occurs after 32 weeks, while the proximal epiphysis merge is completed between 46 and 54 weeks.

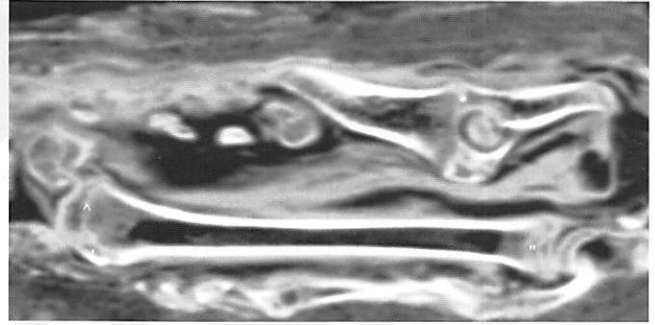


Fig. 12. *Parasagittal MPR of mummy cat right pelvis and parasagittal MPR of the right tibia.* * Right pelvis physeal scar, ^ proximal physis of the tibial plateau, "tibial crest nucleus, "distal tibial physis.

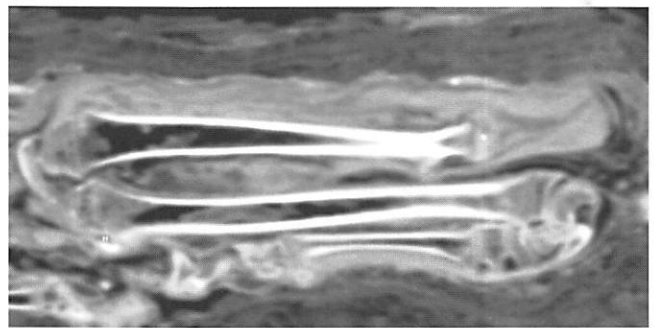


Fig. 13. *Parasagittal MPR of mummy cat right femur.* * Right femoral cephalic nucleus, "proximal physis of the tibial crest.

The distal tibial physis seems still opened; the fusion with the diaphyseal core was around 40 weeks. Also calcaneal tuberosity seems still opened: the merge process starts around 28 weeks and is completed within 36 weeks.

Discussion

In literature there are few reports about the development of cat cartilage growth plate, and the only available data were obtained by radiological studies (Coulson, 2002), achieved on a small number of animals and not by tomographic studies. For these reasons, establish the subject's age in young cat basing only on the skeletal growth plate is not so simple.

Nevertheless, it can be assumed that the animal has not less than 24 weeks and not more 46 weeks. Most of the observed elements would reduce the gap from 24 to 32 weeks.

The incongruity of some data may lie in the fact that all the considerations made on the growth plates and/or physeal scars drift from MPR, obtained on sagittal and dorsal planes; this was necessary because it does have chosen a scanning plane transverse to the trunk and abdomen, as a result of skeleton shape and position within the Mummy, which does not allow an accurate study of the growth plates.

The discontinuity observed in the spinal column could be due to the manipulation during the mummification process, in particular to the forced manipulation of the scapulas. The discontinuity of bones in the skull could be interpreted as a result of the excerebration process.

The orbital cavities are almost empty, except for the residues of the ocular adnexa in the left fossa. This situation could be interpreted as a result of eyes removal, although this kind of operation is not attested in the animal mummification process yet (Ikram and Dodson, 1998; Ikram, 2005b). However, the methods of mummifying and wrapping the animals are various and by no means uniform, and the number of animals examined still relatively small (Malek, 1993).

All the fractures are not ante mortem, but it is difficult to judge from the tomographic images if some of them could be *peri mortem*. The cat does not show evident signs of a deadly trauma.

The investigation of cat mummies at the British Museum underlined that the majority of them died either at two to four months old, or between about nine and twelve months (Armitage and Cutton-Block, 1981; Morrison-Scott T.C.S. 1951-2). The mummified animals are young, considering that the expected average age of a cat, well fed and cured, could be twelve years. The most common cause of death was a dislocation of the cervical vertebrae, obtained by a forced twist of the head and the consequent break of the neck. A second system attested is the strangulation (Malek, 1993). The small size of the young animals was most suitable for the small burial containers (Malek, 1993). The explanation for the deaths is the divine cult.

The worshiping of sacred animals in Egypt has very ancient origins (A.A.V.V., 1990). However not all species of animal were sacred, but only those with special traits were considered a representation of the divine. The domestic animals, loved pets, were also worthy of an eternal destiny through mummification, as the emblematic case of Tamyt, the cat of the prince Djehutymose (1350 BC.). During the first millennium, animal cults became very important, reaching the peak during the Ptolemaic and Roman periods. The animals were intermediaries for the gods. For this reason, thousands of animals were bred in the temples where the pilgrims gathered: to send their requests to the gods, a fee was paid to have the animal mummified and then buried (Ikram, 2005a).

Vast animal necropolis have been found throughout Egypt: of ibis and baboons sacred to the god Thot, cats sacred to Bastet, of crocodiles sacred to Sobek, of dogs and jackal for Khentymentiou and Wepwawet, both canid deities, ect. The most important mummy cats necropolis is Bubastis, the modern Tell el Basta, centre of the cult of the Bastet, goddess of the hearth, femininity, joy and dance, but there are others like Saqqara, Abydos and El Menya (Zivie and Lichtenberg, 2005).

In the temple cattery, where the animals were bred, the priest may have done a cull when the cats multiplied beyond acceptable or a deliberate killing to satisfy the request of votive offering. During the religious festivals the devotee were used to pay for the burial of a mummy cat as a support for the prayer and visible expression of piety. The request of mummies may have been enormous, as attested by Herodotus for the 700.000 pilgrims at Bubastis for the festival (Herodotus, Book II. Strassler, 2007). This could be the reason of the young age of the mummy cat. The growing request of mummy gifts is also the explanation of the

dummy mummy: many mummies are not complete or the bandages cover only mud, straw, cloth, feathers, odd bones, brick, pottery or another small animals, like lizards, but however they were beautifully wrapped and so unsuspected for the pilgrims. Only the modern x-ray examinations have revealed the trickery. The 'sacred animal industry', supplied considerable employment and also provided tax income to the Pharaohs.

This attitude towards cats seems in contrast with the high status of these animals in Egyptian society, but it has to be seen as a way to enter into the eternity.

In this case the cat does not show signs of a deadly trauma, but this do not exclude at all, that the cat could be killed by other system, like for example drowning.

Looking at the mummification process, it can be observed that with all the care and attention given to a deceased human, the animal's internal organs were removed and probably natron (a naturally combination of salt and baking soda, found in the Wadi El Natrun) utilized to suck and dry all the moistures, to deodorize and disinfect it. It can be presumed, judging from the high quality of the mummy that the cat was oiled before been wrapped in linen bandages. It is not possible to determine which indigenous feline species fit the cat: *Felis chaus*, found only in Egypt and southeastern Asia or *Felis Silvestris Libica*, the african wild cat.

The sex is not definable.

From the data collected, it is evident that the quality of the mummy is high: the numerous layers of bandages, with decorative geometric pattern and painted elements on the muzzle to reproduce eyes and nose, the presence of the complete skeleton and his position. Nevertheless all these elements are not enough to understand if the cat was a votive offering or a beloved pet; furthermore, the missing information concerning the provenance of the mummy and the archeological contest can not solve the mystery.

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