Archaeological and Anthropological Sciences (2023) 15:115
https://doi.org/10.1007/s12520-023-01819-z

RESEARCH

The study of the animal remains from the Neferhotep Complex (17th–20th Dynasty, Valley of the Nobles, Luxor, Egypt)

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Received: 20 January 2023 / Accepted: 30 June 2023 / Published online: 12 July 2023

Abstract

The Tombs of the Nobles are located in ancient Thebes (modern Luxor, Egypt) and are primarily the site of elite burials. One such is the monumental funerary complex of Neferhotep, which is characterised by several tombs arranged around a central court: TT49, TT187, TT362, TT363, and TT347, which have been already excavated, while TT348 is still closed. They are dated from the end of the XVIII Dynasty (fourteenth–thirteenth century BC) to the Ramessid Period (twelfth–eleventh century BC), with phases of reuse mainly in the Third Intermediate Period and in the Ptolemaic age. From the late eighteenth century, they functioned as storerooms and stables for the houses built above them in the eighteenth, nineteenth, and early twentieth centuries. A large number of artefacts, such as pottery, shabtis, fragments of cartonnage, amulets, offerings have been found, as well as human remains belonging to at least 136 individuals. Among these finds 112 specimens of animal bones have also been attested. The remains seem to belong to three different groups: ancient votive mummies, linked to the cult of the god Amun-Ra; modern domestic animals dated to the modern phases of reuse of the tombs; and scavengers, which entered the tombs in search for food. The zooarchaeological studies complete the multidisciplinary analysis of the Neferhotep complex and provide new information about the use and reuse of the Theban tomb from ancient to modern times.

Keywords Archaeozoology · Birds · Domestic animals · Thebes · Taphonomy

Introduction

The anthropologists and archaeologists of the G. d'Annunzio University (Chieti, Italy) are involved in a multidisciplinary research project in the Neferhotep monumental complex (Fig. 1). This funerary complex is situated on the south-eastern slope of the el-Khokha hill, within the Valley of the Nobles (currently the Tombs of the Nobles), in Luxor (the ancient Thebes) (Pereyra et al. 2013). The Neferhotep complex captured the attention of archaeologists and Egyptologists not only for its monumentality in relation to the Theban necropolis but also for its history of use and reuse through ancient (Menozzi 2021) to modern times (Lemos et al. 2017). The complex consists of a main tomb on the western side of a central courtyard (Theban Tomb [TT No.] 49). According to the inscriptions on the internal walls, it belonged to Neferhotep, "Chief scribe of Amun," and it is one of the few tombs dated to Pharaoh Ay's reign (1333–1328 BC) (Pereyra 2006; Pereyra et al. 2013). On the northern side there are TT187 and TT348 (still closed), and on the southern side, there are TT362, TT363, and TT347 (all excavated recently). TT187, TT362, and TT363 belong respectively to Pakhyhat, Paanemwaset, "*Wab*-priests of Amun," and Paraemhab, "Overseer of the singers of Amun". These tombs date from the end of the XVIII Dynasty (fourteenth–thirteenth century BC) to the XX Dynasty (twelfth–eleventh century BC). All the tombs underwent different phases of reuse in ancient times. The

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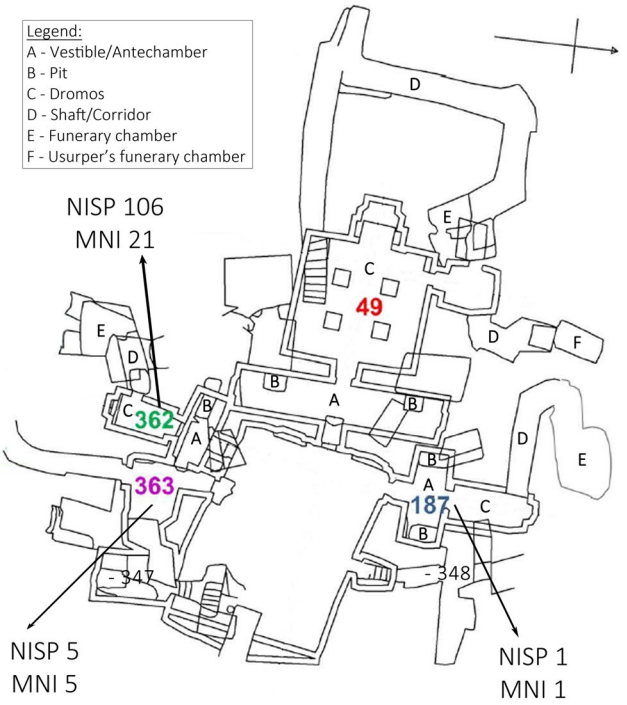

Fig. 1 Map of the Neferhotep complex. NISP: number of identified specimens. MNI: Minimum Number of Individuals

reuse seems to be related to social ties of the living with previous people who held the same noble title (and profession) within the community (Lemos et al. 2017; Menozzi 2021), such as "*wab*-priest of Amun," which allowed them to share the same scheme of decoration (Ikram 2015), but also votive object and biological remains. In recent times, the hill of el-Khokha was occupied by a modern settlement known as Old Qurna, and the ancient tombs were used as houses, warehouses, stores and cellars, where modern inhabitants used to live and keep domestic livestock. From the end of the nineteenth century until 1913 (when the Antiquities Service closed all the Neferhotep complex tombs with iron gates to protect them), the Karim Yusuf family lived in the Neferhotep complex (Pereyra et al. 2015). From then until 1920, the family limited their occupation to the courtyard, until the Supreme Council of Antiquities carried out the final eviction of the family and ordered a survey of the ancient tombs. The modern use of tombs damaged the structures and altered archaeological and osteological data. Indeed, most of the remains were not found in the original positions and were often fragmented. An excellent example is TT187, which was almost completely emptied by burning all mummified individuals in the western pit of the antechamber; the debris was then piled up in the funerary chamber, which was finally closed.

The Operative Unit of Anthropology recovered and analysed the biological remains from the Neferhotep complex, since the tombs contained a very large number of human remains, together with a discrete quantity of animal remains. These human remains analysis and taphonomic processes have already been published (see D'Anastasio et al. 2021). The data relating to animal remains and the role that animals played within the Neferhotep funerary complex over time have yet to be disclosed. Life and the afterlife of ancient Egypt were strongly connected to the surrounding environment, and especially to the animal world. Animals were not only used as food, but they also represented specific gods and goddesses. In addition to human mummification, animals were also mummified throughout Egyptian history to the point that a real "industry" was born, in which temple priests killed and embalmed animals to be sold as an offering to the gods (Bleiberg et al. 2013; Ikram 2005). In her work, Ikram (2019) organises animal remains in five main categories: pets, victual mummies, sacred animals, votive mummies (including false or amalgam mummies) and other (which consist of a variety of animal mummy deposits). Pets were mummified as humans only after their natural death, and buried with the owner or in their vicinity. Victual mummies are mummified food remains and they are unusual kinds of mummies, very rare in Egyptian history and they can mainly be found in New Kingdom Thebes. Sacred animals were most popular in the late and Graeco-Roman periods, although they are common throughout Egyptian history. These animals were worshiped during their life since they were believed to be the earthly manifestation of specific gods. Votive mummies represent the largest group of animal mummies. These animals were not sacred, but they were consecrated in some way because they might have lived within the sacred precincts, and they were probably used as votive offerings (Ikram 2015). Indeed, by the end of Egyptian history a very large number of species were mummied and offered to the gods (Ikram and Dodson 1998). The difference between sacred and votive animals is that the latter were often killed sometimes during their life to be offered, while sacred animals died naturally (Ikram 2019). The animal remains from the Neferhotep tombs showed different states of conservation and taphonomic alterations, probably related to human activities. The remains were largely represented by single, bony, mummified, or naturally dried elements and several anatomical regions were still connected (i.e., limbs, skulls and cervical vertebrae, pelvis). Furthermore, the dating of the remains and the interpretation of the meaning of their presence in the funerary complex (i.e., food source, beloved pets, victual mummies, sacred animals, and votive mummies) were made difficult by the fact that most of the original archaeological contexts had been altered over time. For example, TT362 is the tomb which shows the most complicated history of use and reuse of spaces. Indeed, TT362 was initially built during the Ramessid period, while the western funerary pit in the antechamber dates to the

second phase of reuse between the Third Intermediate Period and the Late Period. The third phase of ancient reuse, during the Ptolemaic period, was an extension of the burial chamber which included the burial chamber of a neighbouring tomb. Modern inhabitants used to live in the structure and caused an obstruction of the shaft leading to the burial chamber and the western pit with disarticulated biological remains, in order to make space inside the tomb. The partial destruction of the original archaeological stratification renders an analysis of the animal bones difficult, especially the identification of ancient and modern bones. However, the burial chamber does not present modern finds and are rich in large fragments of cartonnage, wooden boxes and *shabtis*, dated mostly to the Third Intermediate Period (Menozzi 2021). The conservation of the original archaeological stratification involves an offering table including a deposit of vegetal and animal remains (Menozzi 2021). It seems that modern use of the tomb was limited to the shaft and western pit at the entrance of TT362, which allowed to date animal remains from the burial chambers to at least the Third Intermediate Period.

Here we present the results of an archaeozoological analysis of tomb TT187, TT363, and especially TT362, where the largest number of animals remains were found. The objective of this work is trying not only to identify the animal remains but also to hypothesize what could have been the use of these animals both in the ancient and modern phases, providing new information on the Neferhotep complex difficult history.

Materials and methods

In accordance with the rules of the Supreme Council of Antiquities, all the remains were documented on site during the archaeological excavation, while analysis was carried out later in the University Museum of "G. d'Annunzio" University of Chieti (Italy). Most animal remains were recovered from TT362, and only few bones were found in TT187 and TT363. The identification of animal bones was often limited to the family and genus level although, where possible, species were identified too. The taxonomic classification was carried out by comparing bone morphology and size of our specimens with zoological atlases (Adams and Crabtree 2008, 2012; Beisaw 2013; Broughton and Miller 2016; Cohen and Serjeantson 1996; France 2009; Gilbert et al. 1996; Hillson 1996; Pales and Lambert 1971a, b), and using osteological criteria to distinguish sheep/goats (Boessneck 1969; Halstead and Collins 2002; Zeder and Lapham 2010; Zeder and Pilaar 2010), equids (Davis 1980; Hanot and Bochaton 2018), and fishes (Nelson et al. 2016; Sakashita et al. 2019). The age of the animals was determined, where possible, through the analysis of epiphyseal fusion (Reitz and Wing 2008; Schmid 1972), and by tooth eruption ages or wear (Payne 1973, 1985; Silver 1963). Their belonging to the different phases of use of Neferhotep complex has been hypothesized according to the place of discovery, the stratigraphy and the degree of preservation of the remains and other taphonomic signs.

The Number of Identified Specimens (NISP) was used in quantification analyses. It is a quantification method that gives the raw count of identified specimens within each taxonomic group (Beisaw 2013; Payne 1975). Disarticulated bones have been counted individually, while those that were found still in anatomical connection were counted as one, since, as Gautier and Van Neer (2009) stated, "a specimen consists of all the finds which clearly come from the same skeletal element (e.g., still articulated bones, mummified remains) or a combination of such elements". NISP counts were then converted in percentages to have an estimation of the frequency of animal taxa in the sample. However, in small and highly fragmented samples, the NISP could lead to an over-/under-representation of some taxa. Because of that, the minimum number of individuals (MNI) was also calculated. The MNI aims to mitigate the drawbacks of the NISP (Grayson 1984; Lyman 2008); it is especially useful in this study, as the sample is small and some remains are in anatomical connection (Chaix and Méniel 1996). According to Klein and Cruz-Uribe (1984), the MNI should be calculated as the "number of individual animals necessary to account for a particular skeletal part, such as distal humerus or proximal tibia, with ontogenetic age differences taken into account".

Results

The animal remains samples from the three tombs of the Neferhotep complex consist of 112 identified specimens (NISP), of which 77 (69%) were classified at least at a family level (Table 1). Very fragmented bones (31 specimens, 28%) could not be identified. They are represented mainly by ribs, vertebrae, and fragments of long bones. Among the identified ones, three main groups made up 44% of the samples: cattle, ovicaprids (sheep/goat), and Anatidae.

Table 2 summarizes the MNI identified for each taxon. A minimum number of 26 animals were counted. In particular, among the 21 animals inside TT362, sheep/goat and Anatidae are the most represented with three individuals each. Only few bone elements are attested in TT363; however, there are two almost complete mummified cats. As two other cats are present in TT362, this species represents the most numerous animal taxon in the Neferhotep complex.

Although most of the skeletons were incomplete, as a consequence of the reuse of the tombs during the centuries, animal bones were found in a good state of preservation. Indeed, most of the bones retain traces of organic tissues

Table 1 Number of identified specimens (NISP) and proportion (%) of animal remains from TT187, TT362, and TT363 from the Neferhotep funerary complex

	TT362		TT363	
	NISP	%	NISP	%
Cattle (Bos taurus)	12	11	1	20
Equus sp.	5	5		
Equus caballus	3	3	1	20
Sheep/goat	6	6		
Ovis aries	4	4		
Capra hircus	4	4		
Canis sp.	2	2		
Cat (Felis catus)	4	4	2	40
Leporidae sp.	4	4		
Muridae sp.	1	1		
Chicken (Gallus gallus)	1	1		
Anatidae sp.	22	21		
Ardeidae sp.	4	4		
Squamata sp.	1	1		
Ring cowrie (Cypraea annulus)	1	1		
Perciformes sp.			1	20
Unidentified small mammals*	6	6		
Unidentified medium mammals*	15	14		
Unidentified large mammals*	9	8		
Unidetified birds	2	2		
Total	106	100	5	100

*Small mammals refer to rabbit/cat size specimens, medium mammals refer to sheep/goat size specimens, large mammals refer to cattle/horse size specimens

Table 2 Minimum number of individuals (MNI) and proportion (%) for each animal taxon in TT362 and TT363 of the Neferhotep funerary complex

	TT362		TT363	
	MNI	%	MNI	%
Cattle (*Bos taurus*)	2	10	1	20
Equus sp.	1	5		
Equus caballus	1	5	1	20
Sheep/goat				
Ovis aries	2	10		
Capra hircus	1	5		
Canis sp.	1	5		
Cat (*Felis catus*)	2	10	2	40
Leporidae sp.	2	10		
Muridae sp.	1	5		
Chicken (*Gallus gallus*)	1	5		
Anatidae sp.	3	14		
Ardeidae sp.	2	10		
Squamata sp.	1	5		
Ring cowrie (*Cypraea annulus*)	1	5		
Perciformes sp.			1	20
Total	21	100	5	100

(skin, tendons, muscles) and in some cases bandages, indicating that animals were embalmed in ancient times and that burial occurred in dry conditions. All the remains (both ancient and modern) show an overall yellow-brownish colour.

More in detail, only a fragment of a medium-sized mammal rib, with traces of soft tissue, was found in TT187. Inside TT363, five specimens were accounted for. These specimens are composed by different bones still in anatomical connection. In particular, the remains included an articulated cranium and mandible of an 8–10 years old *Equus caballus* (no infundibulum is visible on the incisors; Silver 1963) (Fig. 2), two cranial fragments of a cow, a partial skeleton of a fish, composed by eight vertebrae and nine ribs (still in connection; Fig. 3), and the remains of two cats. The particular morphology of fish vertebrae, with thick plate-like ridge running longitudinally in the middle of their lateral sides, allow the identification of the specimen as belonging to at least the order of Perciformes. As for the cats, the first is a partial articulated skeleton composed by the 6th and 7th lumbar vertebrae, the 1st sacral vertebra and the right and left ilea. The second cat seems to be a naturally dried specimen, though the state of preservation is not good.

Fig. 2 *Equus caballus* cranium from TT363

TT362 is the tomb which contains the highest concentration of preserved animal remains. Of these, 30 specimens (28% of total) could not be identified due to excessive fragmentation: they belong to small-sized animals (6 bones), medium-sized animals (15 bones), and large-sized animals (9 bones). The most represented animals are Anatidae, with 22 identified specimens (21%), and sheep/goat, with 14 specimens (13%). The identified taxa (described below) are the following: *Felis catus*, *Bos taurus*, *Canis* sp., *Equus* sp., Muridae sp., Leporidae sp., *Ovis aries/Capra hircus*, *Gallus gallus*, Anatidae sp., Ardeidae sp., Squamata sp., *Cypraea annulus*.

Fig. 3 Perciformes sp. partial skeleton from TT363

Cat (*Felis catus*)

Five cat specimens were identified. They consist of different skeletal parts still in anatomical connection: a right radio and ulna; four skeletonized metatarsals of unknown laterality; a pelvic girdle in articulation with sacral and five lumbar vertebrae, with dried skin, tendon, and muscles still attached; and, finally, an entire naturally mummified cat found in a crouched position, with an unnatural rotation of the head (Fig. 4). All bones were fused. The remains belong to at least two adult cats.

Cattle (*Bos taurus*)

Twelve remains belonging to cattle have been identified. They consist of one fragment of a scapula of unsure laterality; one fragment of radio-ulna articulation and two fragments from two radii; one right tibia still articulated with the corresponding astragalus; one left metacarpus, one right and one left metatarsus, and one scaphocuboid. Some juvenile bones were also recovered: one fragmented tibia still in connection with its unfused distal epiphysis, belonging to a calf of less than 2 years of age, and a fragment of metatarsus distal diaphysis with unfused epiphysis (which has not been recovered). These remains belong to at least one adult cattle and one calf.

Canis sp.

Two specimens were ascribed to the genus *Canis*. Namely, there is an articulated left hind limb (composed of a distal half of femur, tibia, astragalus, and calcaneus) and one unfused lumbar vertebra. These remains most likely belong to the same young animal of < 2 years of age.

Equus sp.

Various equid bones were found. The cranial anatomical region included two isolated lower molars and a fragment of a mandible with three incisors. The post-cranial remains consist of a left forelimb (composed by the distal half of humerus, radio-ulna, six carpal bones, metacarpal, and three phalanges) still in anatomical connection with remains of dried soft tissue (belonging to an *Equus caballus* in accordance to osteological criteria); a right adult humerus, a left juvenile humerus with unfused epiphysis belonging to a < 42-month-old equid; a right tibia of an *Equus caballus*

Fig. 4 Mummified cat from TT362

with soft tissue still preserved, lying next to a right third tarsal bone connected to the metatarsal—these latter elements probably belonged to the same individual, the state of preservation, colour, and size being compatible with this interpretation; a metatarsal bone of uncertain laterality. All equid bones belonged to at least two specimens: an adult *Equus caballus* and a < 42-month-old juvenile *Equus* sp.

Rodent (Muridae sp.)

Only one partial cranium of a rodent was found. The fragment is about 2 cm in length and it is impossible to determine the exact species. The minimum number of individuals is, therefore, one.

Leporidae sp.

A leporid was attested with only four isolated remains, namely, a partial cranium about 6.5 cm long, two right hemi-mandibles and a fragment of humerus of unknown laterality. These remains most likely belong to at least two leporids because of the presence of the two right hemi-mandibles.

Sheep/goat (*Ovis aries/Capra hircus*)

A very well represented taxon is the ovicaprids, with 14 identified specimens. Despite the criteria to distinguish sheep and goat, it was very difficult to determine the exact species because of the high degree of fragmentation of our sample. Some of the remains are still partially connected thanks to the conservation of soft tissues (i.e., skin, cartilage, and tendons). The skull is represented by a large fragment of occipital bone with horn cores and sheaths belonging to a young *Capra hircus*, and three fragments of *Ovis Aries* mandibles (two of the right side and one of the left side) and one fragment of right-side *Capra hircus* mandible. The sheep mandibles show the second permanent molar tooth still in eruption, suggesting that the specimens belonged to 6- to 18-month-old ovicaprids (Silver 1963), while the goat mandible, based on the wear of the first and second permanent molars (Payne 1973, 1985), belong to a specimen of 2–3 years old. The axial skeleton bones found are two isolated dorsal and one cervical vertebrae; and two naturally mummified segments of the vertebral column composed by five and four cervical vertebrae respectively. The appendicular skeleton is represented by a left radio-ulna (the unfused ulna proximal epiphysis is missing) and a metacarpus (with unfused distal epiphysis is anatomical connection) belonging to a < 2 year old *Ovis aries*. The hind limbs are represented by a right tibia diaphysis with traces of burning, a mummified segment which include a metatarsus and six phalanges of a *Capra hircus*, and another mummified hind limb of uncertain laterality which consists of tibia, metatarsus, and four phalanges kept together by the mummified skin and tendons, always belonging to a *Capra hircus*. No traces of butchery are recorded on ovicaprid bones. According to the minimum number of individual calculated on the mandible fragments, it was possible to determine that all the remains belonged to at least two sheep and one goat.

Chicken (*Gallus gallus*)

Only one right foot that consists of 14 phalanges covered by dried soft tissues was found. The minimum number of individuals is one.

Anatidae sp.

Anatidae are the most abundant faunal remains in TT362, and they seem to have been artificially embalmed in ancient times. They include mummified skin and feathering but also some fragments of bandages. In detail, three crania were recovered: one cranium in connection with its mandible with preserved skin and feathering; one partially skeletonized cranium in anatomical connection with the first four cervical vertebrae; and one partial cranium with a bandage covering the vault. Other remains consist of a right wing (composed by humerus, radio, and ulna) preserving skin, feathers, and some little fragments of bandages, while other wing bones were found isolated and completely skeletonized (a right humerus, two left ulnae, one left and one right ulna and radio in anatomical connection and three carpometacarpals of uncertain laterality). One left coracoid is the only part of a shoulder girdle found. Regarding the axial skeleton, a section of the mummified vertebral column was recovered (composed by eight vertebrae); and a mummified pelvic gridle (the right and left coxae, the sacral bone, four caudal vertebrae, and three lumbar vertebrae). The inferior limbs are represented by two mummified right forelimbs, which included the tibiotarsus, fibula, tarsometatarsal, and phalanges, and one mummified left forelimb where only the tarsometatarsal and phalanges were preserved. Moreover, one isolated right tarsometatarsal and two isolated tarsometatarsals of uncertain laterality were recovered. According to the different morphology of the skulls, these remains seem to belong to at least two different taxa, *Anser* sp. and *Alopechen aegyptiaca*, although the identification is unsure. The bone remains are attributed to at least three specimens.

Ardeidae sp.

Other mummified bird remains were preserved in TT362: a skull with its mandible; another skull in connection with the first three cervical vertebrae, which preserved some of the feathering, and one right and one left tarsometatarsal. The remains belonged to at least two Ardeidae (unidentified species).

Squamata

TT362 preserved only a fragment of what seems to be the distal end of a specimen from the order *Squamata* (Fig. 5). The fragment is about 8 cm long and includes two clearly visible vertebrae and the preserved annuli which formed the segments of the tail skin. Given the small size of the preserved remains, it is impossible to determine the exact species, though it can be hypothesised that it belonged to one specimen of lizard (e.g., Scincoidea or Amphisbaenia) or snake (Serpentes).

Ring cowrie (*Cypraea annulus*)

An exceptional remain of one marine gastropod mollusc was identified as a ring cowrie of the species *Cypraea* or *Monetaria annulus* (Fig. 6).

Non-identified mammal remains

Among the remains found in TT362, unidentified remains made up 28% of the sample. They are mainly ribs and fragments of long bones, in different states of preservation and some of them show traces of butchery. The cranial skeleton is attested by the basal part with a foramen magnum of a small-size animal, and three small fragments of isolated dental roots. The axial skeleton is represented by three unidentified vertebrae with clear butchery marks, a sacral bone, and 10 ribs of different size. These ribs belong to different animals, two of them are held together by preserved soft tissue and one shows four linear cut marks. Regarding the appendicular skeleton, there is one femoral head, 1 fragment of what appears to be a tibia shaft and one fragment of tibia distal extremity with unfused epiphysis. Furthermore, 11 remains were too fragmented to be identified anatomically, though their morphology is compatible with that of long bones. Of these, one small fragment, about 9 cm long, shows a reaction of the periosteal bone probably due to a non-specific infection.

Fig. 5 Remains of the distal end of a small reptile from TT362

Fig. 6 *Cypraea/Monetaria annulus* shell from TT362

Non-identified bird remains

A fragment of occipital bone and one unidentified tarsometatarsal are present. They are anatomically compatible with birds; however, their state of preservation does not allow any identification.

Discussion

The different phases of use and reuse of tombs, from Ramessid times to the present, makes it difficult to differentiate which animals were used in ancient and modern times. First of all, from the Ramessid to the Ptolemaic periods, the tombs within the Neferhotp complex were usurped by different people who held similar positions in the Theban social network (such as *wab*-priest of Amun; Menozzi 2021), reusing not only the tombs for their burial but also votive objects and biological remains. Secondly, in modern times, the use of the tombs by the Yusuf family for living purposes led to the destruction of some of the original stratigraphy and the displacement of archaeological findings, also from different tombs. Indeed, all the biological remains were found fragmented, unwrapped from their bandages and, in some cases, burned.

From its location right at the entrance to the tomb above the modern era waste, it can be easily confirmed that the fragment of a medium-sized mammal rib found in TT187 is just a leftover from modern times having nothing to do with the history of the tomb. In the same way, the horse and cattle remains from TT363 can be most likely dated to modern times, since this tomb was used as a stable by the Yusuf family. The two cat remains could belong to scavengers which entered the tomb hunting small preys (Dixon 1989). The natural death and drying of one of them can be deduced by the position of the mummy with extended limbs, not in a crouched position and without any signs of fractures which usually can be found in embalmed animals (Johnston et al. 2020). The only faunal evidence in TT363 which could be linked to ancient times, according to the archaeological stratigraphy, is the partial skeleton of a Perciformes sp. Fish bones that are usually found in Egyptian archaeological sites are subdivided into two ecological groups, "floodplain dwellers" and "open water taxa" (Van Neer 2004). The open water taxa, such as the Nile perch, spend their life in the main rivers (Monchot and Charloux 2017; Linseele et al. 2016) and they represent a common species in prehistoric and historic settlements of ancient Egypt, often portrayed in fishing scenes of ancient Egyptian art and usually associated with some gods, e.g., the goddess of the hunt Neith (Gautier 2005).

Tomb TT362 preserved numerous human and animal remains. The latter can be found both as mummified remains with preserved fragments of bandages, and as skeletonized remains, some of which show signs of butchery (Fig. 7A, B, C). The acceptable conservation state of the animal bones enabled a division of the remains inside TT362 in three categories: votive mummies (ancient remains), domestic animals (modern remains), and scavengers (modern remains) (Table 3). However, the small size of our sample often allows only to hypothesize what could have been the use of these animals at the Neferhotep complex, making it very difficult to draw general conclusions on their origin.

Votive mummies are represented by the remains of Anatidae (Fig. 8A, B) and Ardeidae. The ancient Egyptians included all living creatures in their divine pantheon, assigned them to certain gods, according to their physical features such as colour, voices, sex, outer forms, etc. Bird mummies have been used since the last indigenous dynasty (von den Driesch et al. 2005) and they have a strong theological meaning. According to Egyptian mythology, Pharaohs, high priests and cult servants could transfer their soul into some bird species and use their power to ascend into the sky to reach the sky god. According to von den Driesch (2005), the mummification of birds usually involved three main steps: (1) the dead birds were buried into the soil to naturally eliminate soft tissues; (2) the specimens were dug up after a certain period of time and the remaining soft tissues were cleaned; and (3) the birds were wrapped in several layers of linen bandages. TT362 preserved at least two *Anser* sp., one *Alopechen aegyptiaca* and two Ardeidae sp. (Fig. 9A, B, C, D). Many Anatidae species are depicted in ancient Egyptian art (Houlihan and Goodman 1986) and they had an important role both in the cultural sphere and as food, as illustrated by the abundance of their remains in several ancient sites (Boessneck 1988). According to Newman (1982), the Egyptian goose, *Alopochen aegyptiaca*, was once widespread throughout the Nile valley, while nowadays, it is limited to southern Upper Egypt (Lake Nasser

Fig. 7 Butchered animals from TT362. **A** Unidentified vertebrae with butchery marks; **B** rib of a large-sized mammal with cut marks; **C** cattle right metatarsus with cutmarks on its proximal end

Table 3 Hypothetical interpretation of animal remains belonging to the different historical phases of TT362 in accordance with place of discovery, stratigraphy, and taphonomic conditions

Ramessid to III Intermediate Period (fourteenth–seventh century BC)	Votive mummies	Anatidae sp.
		Ardeidae sp.
	Votive objects	*Cypraea annulus*
Modern Period (nineteenth–twentieth century AD)	Domestic animals	*Bos taurus*
		Gallus gallus
		Equus sp.
		Leporidae sp.
		Ovis aries/Capra hircus
	Scavengers	*Felis catus*
		Canis sp.
		Muridae sp.
		Squamata sp.

Fig. 8 Anatidae sp. remains with preserved soft tissue from TT362. **A** Skull, cervical vertebrae, and lower limbs; **B** upper limb with mummified skin and feathers

Fig. 9 Birds skulls from TT362. **A** *Alopechen aegyptica*; **B–C** Ardeidae sp.; **D** *Anser* sp. with remains of bandage

area), where they are still common. Ardeidae (e.g., herons) was another common bird in Egyptian sites and they used to live in marshy environments, which provided favourable living conditions, and in areas where the Nile currents are not too strong. All members of the Ardeidae family are located today in the area of the 1st Nile Cataract near Aswan, where species such as *Ardea cinerea*, *Nycticorax nycticorax*, and *Ardeola ralloidea* are still observed. The remains in TT362 still show some traces of bandages (Fig. 9D), so they were embalmed probably for cultual reasons and do not represent food waste. As stated before, the stratigraphy of the TT362 funerary chamber was preserved and did not show traces of later/modern use after its last reuse in the Third Intermediate Period. The funerary chamber is characterised by the presence of a stone offering table with numerous vegetal and animal votive offerings (i.e., the Anatidae and Ardeidae remains here discussed) on and close to it (Menozzi 2021). Therefore, these embalmed remains represent interesting evidence of offerings likely dating back at least to the Third Intermediate Period (the second phase of reuse of the tomb). The presence of Anatidae and Ardeidae is linked to the social position of the tomb owners. As described before, TT362 belonged to Paanemwaset, whose title is "*Wab*-priests of Amun," as it was for Pakhyhat of TT187, while Paraemhab of TT363 was an "Overseer of the singers of Amun". In Egyptian art and history, Amun is often represented with several geese or in the form of a goose (Montet 2005; Ranke 1950), while the heron is one of the different forms of the Ba (divine essence) of god Ra (Seawright 2012), and could have been used to represent the god Amun-Ra following the fusion of the two gods after the rebellion of the Theban princes and the reign of Ahmose I (XVIII Dynasty).

One particular remain can be identified as a votive object, namely, a ring cowrie shell of the species *Cypraea annulus*. Several cypraeid species and other marine gastropods were used in commercial transactions as a mean of exchange for primary resources in Egyptian since prehistory (Gautier 2005; Germain 1909; Lortet and Gaillard 1909). Cowrie shells come from the Red Sea, therefore suggesting direct or indirect trading with the east coast of Africa (Gautier and Van Neer 2009). In addition to their commercial value, they have two additional functions; a simple decoration for the body, clothes or objects, or a spiritual function with a strong symbolic meaning (Bar-Yosef Mayer 2018).

Most of the animal bones recovered from TT362 belong to domestic species. The state of preservation, colour of the bones, lack of bandages and position inside the tomb, suggest that these bones can be ascribed to the modern phase of reuse of the funerary complex and can be considered food waste. Some bones are still anatomically connected and with traces of dried soft tissue, due to the arid desert environment in which they were deposited. The domestic animals found here include chicken, equids, and Leporidae (rabbit/hare), although the most numerous taxa are cattle and ovicaprids (sheep/goats) (Fig. 10). This heterogeneous animal group reflects those already found in other ancient Egyptian sites with history of modern reuses, such as Opet Temple in Luxor (Monchot and Charloux 2017), Wah-Sut Temple (Rossel 2006), the residential deposit of Kom el-Hisn (Redding 1992), the Elkab necropolis (Gautier 2005) or Tell el-Retaba (Gręzak 2015), and in only-modern Egyptian sites, albeit with few differences.

The chicken remains found in TT362 can be considered modern food waste. Chickens reached Egypt about 1400 BC, but they became widely bred as farm animals only in Ptolemaic Egypt (about 300 BC) (Blench and MacDonald 2000). Since then, their meat was used regularly as a supplement of animal protein (Pöllath and Rieger 2011). TT362 is dated to before the Graeco-Roman period, suggesting a modern dating for the chicken remains. Equid and Leporidae remains

Fig. 10 Assemblage of sheep/goat and cattle remains from TT362

can be dated to modern times as well. In ancient times, Egyptians preferred donkeys because of their resistance to the arid environment, and their use dates back to predynastic Egypt (Monchot and Charloux 2017; Rossel 2006).

Cattle are present with 12 identified bones, which belong to at least one adult and one subadult (< 2y) individual. The bones represent anterior and posterior limbs, and they provide the only traces of butchery found in TT362. Historically, in ancient Egypt cattle were mainly bred for their meat rather than secondary products (i.e., milk, traction). Indeed, ancient texts, including New Kingdom price lists, report that cattle were the most valued providers of meat (Ikram 1995). Some Old and Middle Kingdom texts indicate that the Nile Delta is the main area historically dedicated to cattle production (Kees 1978), and they were distributed throughout Egypt by the central authority (Redding 1992). However, Boessneck (1988) highlights also the cultural importance of cattle in ancient Egypt, as cattle has often been represented in religious iconography since prehistoric times (Gautier 2005). Cattle remains in TT362, however, are more likely to be modern food waste. This hypothesis is supported by the modern modification of the tombs, which featured a clear differentiation of spaces between those in which modern families used to live, and where cattle remains were found, and those from which ancient human remains were collected (D'Anastasio et al. 2021).

Ovicaprids is the best represented domestic animal taxon in TT362, with 14 identified specimens. The presence of numerous phalanges means that the animals were probably slaughtered at the site (Gręzak 2015). Among sheep, some of the remains belong to young (< 2 years) and very young (< 18 months) specimens. It suggests that the aim of raising these young sheep was or became meat production, while the adult goat was also used for their secondary products before, in turn, being also culled and butchered. In ancient times, "little cattle" (as Egyptians used to call sheep and goats) were of great importance for their fleece, hides, and dairy products (Rossel 2006); however, they are also well represented in Pharaonic art, especially rams, because of their connection with several key deities (Gautier 2005). The state of conservation of this sample did not enable researchers to determine if they are ancient votive remains or recent food waste, since most of them are fully skeletonized fragmented bones while others are still found in anatomical connection with preserved soft tissue (Fig. 11A, B). However, it seems more likely that they come from the modern reuse of the tombs by the Yusuf family.

All body parts of domestic animals are represented, but with small differences. The meat-bearing parts are totally skeletonized bone remains, as they were probably processed for meat extraction in butchery and through cooking, while the meatless ones (heads and lower limbs) show in many cases preserved soft tissue and they are still anatomically connected, probably having been disposed of during dismemberment. However, among the two main taxa (sheep/goat and cattle), only cattle remains show traces of butchery. This could be the result of the larger carcasses of cattle requiring more intensive butchering for portioning, but it could be also a coincidence due the small sample size. Another hypothesis is that some animals were raised as a

Fig. 11 Ovicaprid remains from TT362. **A** Limb; **B** partial vertebral column

meat source (especially cattle) and others with a greater focus on their secondary products (milk and hair). Cattle are high maintenance animals, since they depend on constant access to drinking water and better quality food, and because of this they were probably raised for a short time before being butchered. In harsh environment, along the desert edge, the only domestic food animals that can be sustainably raised are sheep and goats because these can easily endure high temperature, and tolerate limited access to water and poor quality of food (Osypińska and Woźniak 2019). According to Gautier and Van Neer (2009), Egyptian people from the Middle Kingdom onward show little preference for sheep over goats for their secondary products. This preference is attested in most Egyptian sites, such as Kom el-Hisn, Lehner (Giza), Ibrahim Awad, Merimde—Benisalame (Redding 1992), Abar el-Kanayis, Wadi Umm el-Ashdan, and Wadi Qasaba (Pöllath and Rieger 2011). However, sheep have more diet overlap with cattle then do goats, and they would have competed with cattle for forage (Redding 1992). Indeed, according to Monchot and Charloux (2017), goats were predominant in Karnak, Thebes. In Neferhotep complex, the absence of adult sheep means that they were mainly suppliers of meat (with a limited exploitation of secondary products), while the presence of older goats suggests that they were raised mainly for milking and secondary products and only later culled and butchered for meat.

The last group of animals found in TT362 is scavengers. Gautier (1987) defines them as penecontemporaneous intrusive, small vertebrates which presumably lived and died at the site around the time of human occupation but otherwise have no link to human activities, or whose remains could have been deposited by other taphonomic processes (e.g., birds; Gręzak 2015). The synanthropic species found in TT362 are cats, *Canis* sp., Muridae and an unidentified reptile of the order Squamata. One complete naturally mummified cat has been found in a crouched position, with an unnatural rotation of the head; at first, this cat could be mistaken for an ancient votive mummy. Indeed, cat mummies are well known in ancient Egypt and they were often bred in captivity to be culled for the production of votive mummies (Armitage and Clutton-Brock 1981; Lortet and Gaillard 1903); alternatively, they represented domestic pets buried with their owners. However, the absence of bandages and bitumen suggests that the cat remains here discussed belong to modern scavengers. In ancient Egypt, dogs were used as guardians, for hunting or as companions. Indeed, they were often mummified, especially since they began to represent the god Anubis. However, in the absence of clear embalming processes, they are usually interpreted as scavengers (Dixon 1989) living in human settlements. In TT362, five dog bones were found, belonging to a young individual of < 2 years of age, probably dated to the modern reuse of the tomb. Egypt has always been infested with rodents; for example, the Theban necropolis was overrun by rodents entering every crack and crevice to gain access to the food offerings placed with the dead (Dixon 1989). According to Gautier (2005), the Greater Gerbil (*Gerbillus pyramium*) has been recorded in several sites as intrusive, attracted by the great quantity of food available, including human remains; remains of the Nile Rat (*Arvicanthus niloticus*) are similarly interpreted. However, at these sites, the largest number of rodent remains usually derived from the small House Rat (*Mus musculus*), which is widely distributed in all Egypt, along the Nile, in close association with human settlements. In TT362, only one fragment of a rodent cranium was found. It is impossible to determine the exact species, but it probably is a modern intruder, since it was found right at the tomb entrance amid modern age waste. Finally, an 8-cm long specimen, found in TT362, seems to be the distal end of a reptile of the order Squamata with preserved soft tissue. The annuli covering the tail are clearly visible; however, it is impossible to determine the exact species because of the small size of the fragment. This remain could belong to some type of lizard (e.g., Scincoidea or Amphisbaenia) or to a snake (Serpentes). Nevertheless, the fragment was found inside the modern stratum covering the last phase of use of the antechamber's tomb, so it is probably a modern intruder that inhabited the Theban hills.

Conclusion

The tombs of the Neferhotep funerary complex have undergone different phases of use and reuse since ancient times, and this caused the destruction of parts of the archaeological stratification, findings and biological remains. Nonetheless, this zooarchaeological analysis allowed us at least to hypothesize what could have been the use of animals at the Neferhotep complex by ancient and modern inhabitants. Despite the small size of our sample, which not always allowed us to draw general conclusions, it was possible to divide animal remains into three main groups: ancient votive mummies, modern domestic animals and scavengers. Votive mummies of the Neferhotep funerary complex are represented by Anatidae and Ardeidae, which are historically the animal form of the sun god Amun-Ra and they described the social status of the owners of the tombs ("*Wab*-priests of Amun," "Overseer of the singers of Amun"). A particular remain is the shell of a cowry which, beside its symbolic meaning as decoration for the body, testifies connections with the Red Sea.

Domestic animals belong to the modern phase of reuse of the tombs. They indicate that either domestic animals were sheltered at the tombs in modern times and that the modern occupants of the site engaged in animal husbandry activities or that, at the very least, they processed animal carcasses at the site before consumption. Goats were mainly preferred

for their secondary products (milk and hair), while cattle probably provided meat, since this latter is the only species which shows traces of butchery. Young sheep were only partially exploited for their secondary products, and they were mainly used as meat suppliers as well. All the species found (chicken, equids, Leporidae, cattle, and ovicaprids) are taxa well adapted to the dry environment and the faunal assemblage reflects those found both in ancient and modern sites in Egypt. All domestic animals were found both as adult and as subadult specimens. Finally, scavengers are those pene-contemporaneous or late intrusive small animals (e.g., cats, dogs, Muridae, and Squamata) which entered the tombs seeking food and died in there.

This zooarchaeological study completes the multidisciplinary analysis (historical, archaeological, and anthropological) of the Neferhotep complex and provides new information about the use and reuse of the Theban tomb from ancient to modern times.

Author contribution All authors contributed to the writing of the article. Data collection was performed by J.C., O.M., and L.C. Data analysis and original draft preparation were performed by J.C.; reconstruction of the archaeological context was performed by O.M. The work was supervised by R.D. All authors read and approved the final manuscript.

Funding Open access funding provided by Università degli Studi G. D'Annunzio Chieti Pescara within the CRUI-CARE Agreement.

Data availability All data are available from the corresponding author on reasonable request.

Declarations

Ethics approval Not applicable.

Consent to participate Not applicable.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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