

Identifications of Ancient Egyptian Royal Mummies from the 18th Dynasty Reconsidered

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ABSTRACT

For centuries, ancient Egyptian Royal mummies have drawn the attention both of the general public and scientists. Many royal mummies from the New Kingdom have survived. The discoveries of the bodies of these ancient rulers have always sparked much attention, yet not all identifications are clear even nowadays. This study presents a meta-analysis to demonstrate the difficulties in identifying ancient Egyptian royal mummies. Various methods and pitfalls in the identification of the Pharaohs are reassessed since new scientific methods can be used, such as ancient DNA-profiling and CT-scanning. While the ancestors of Tutankhamun have been identified, some identities are still highly controversial (e.g., the mystery of the KV-55 skeleton, recently most likely identified as the genetic father of Tutankhamun). The meta-analysis confirms the suggested identity of some mummies (e.g., Amenhotep III, Thutmose IV, and Queen Tije). *Am J Phys Anthropol* 159:S216–S231, 2016. © 2016 American Association of Physical Anthropologists

INTRODUCTION

For centuries, ancient Egyptian mummies have been an important subject for scientific studies (Camerarius and Maier, 1625; Pettigrew, 1834; Virchow, 1888; Maspero, 1889) and many other research fields (e.g., Egyptology, Anthropology, Paleopathology). Royal mummies are of particular interest to historians and the reconstruction of the lives of the famous kings and queens of Ancient Egypt. The identity of some mummies has remained controversial since their discovery. The first royal mummies (which are covered here in this article) were found in an undecorated tomb in the Valley of the Kings in Luxor (KV 21), in 1817 by Giovanni Battista Belzoni (1778–1823). The two mummies found there appear to have been robbed and damaged by vandals after the initial opening in 1817 (Weeks, 2014). Another major find was made by the Abd el-Rassul family, who secretly discovered the Deir el-Bahari Cache (DB 320) in the mid-1870s. The authorities officially discovered this cache in late summer 1881. Emil Brugsch (1842–1930) cleared DB 320 recovering 45 mummies, most of them kings of the 17th–20th Dynasty and family members of the high priest of Amun (Brugsch and Maspero, 1881; Virchow, 1888; Forbes, 1998; Reeves and Wilkinson, 2002). Some mummies seemed to be missing (for instance, a coffin with the name of Ramses I was found, but apparently not his body). It is debated whether the mummy from the Carlos Museum USA, now in the Luxor Museum, is Ramses I; because of this uncertainty this mummy was not included as part of this study (Bickerstaffe, 2006).

The structure of DB 320 was documented imprecisely (by modern standards) and thus the original locations of some mummies remain unclear (Graefe, 1999; Graefe and Belova, 2010). Victor Loret (1859–1946) discovered a second royal cache in 1898 (KV35; Fletcher, 2004). This time, the priest had used the royal tomb KV 35 as a hiding/storage place. One mummy was lying in the former

tomb owner's stone sarcophagus, nine mummies were found in a side-room, another three were in second side-room, and a damaged mummy in a small boat was found in the antechamber of the tomb.

Additional important burials were found some years later: KV 46, containing the parents-in-law of Amenhotep III found in situ in 1905, the Amarna Cachette KV 55 in 1907, and as crown-jewel of all discoveries, the tomb of Tutankhamun KV 62 in 1922, and more recently some potential royal entourage (or high officials) in KV 31 and KV 64 (Bickel and Paulin-Grothe, 2012; Bickel, 2013; Rühli et al. 2015). The most recent and still on-going discovery of more than 80 royal entourage individuals in KV 40 may bring further information on the royal families, but also may raise many new questions (Bickel and Paulin-Grothe, 2013; Bickel, 2014; El-Aref, 2014; Felske, 2014; Poisson, 2014).

Some of these mummies—some vitally important ancestors of the Thutmoside royal house ruling in the 18th Dynasty—have been recently investigated by means of molecular genetics (Hawass et al., 2010). That investigation triggered many theories and a major controversy in the field of Egyptology (Baker, 2010;

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TABLE 1. *Mummies used in this meta-analysis*

Mummy Invent. No	Find location	Present location	Reference
Mummy CG 61066	DB 320	Egypt. Mus., Cairo	Smith, 1912
Mummy CG 61068	DB 320	Egypt. Mus., Cairo	Smith, 1912
Mummy CG 61069	KV 35 in the sarcophagus	Egypt. Mus., Cairo	Smith, 1912
Mummy CG 61073	KV 35 room Jb	Egypt. Mus., Cairo	Smith, 1912
Mummy CG 61074	KV 35 room Jb	Egypt. Mus., Cairo	Smith, 1912
Mummy CG 51190	KV 46	Egypt. Mus., Cairo	Davis, 1910
Mummy CG 51191	KV 46	Egypt. Mus., Cairo	Davis, 1910
Mummy CG 61075	KV 55	Egypt. Mus., Cairo	Smith, 1912; Reeves, 2002
Mummy CG 61070	KV 35 room Jc	Egypt. Mus., Cairo	Smith, 1912; Fletcher, 2004
Mummy CG 61072	KV 35 room Jc	Egypt. Mus., Cairo	Smith, 1912; Fletcher, 2004
Mummy KV 62	KV 62	In situ, KV 62	Derry, 1925; Harrison, 1968; Hawass et al., 2007, 2010

TABLE 2. *Remains from unconfirmed burial situations used in this meta-analysis*

Mummy Invent. No	Finding location	Actual location	Reference
Mummy KV 21 A	KV 21	In situ	Hawass et al., 2010
Mummy KV 21 B	KV 21	In situ	Hawass et al., 2010
Mummy remains WV 23 (West Valley, Luxor)	WV 23	unknown	Schaden, 1984

Braverman and Mackowiak, 2010; Phizackerley, 2010; Timmann and Meyer, 2010; Gad, 2010; Lorenzen and Willerslev, 2010; Habicht, 2011, 2012; Schlögl, 2012, 2014; Schott, 2012; Schüle, 2012; Stanglmeier, 2012; Gabolde, 2013a,b; Hussein et al., 2013; Marchant, 2013, 2014; Dodson, 2014). The aim of this study is to review all available evidence for the identification of some of the most famous ancient Egyptian royal mummies. This overview of all methods used may help to identify more conclusive evidence for identification.

MATERIAL

The selected list of mummies has an important role on the on-going debate of identifications. Some other mummies from the Hawass et al. (2010) article are too distant to be of real importance for the connection with Tutankhamun (e.g., KV 60 A as purported Queen Hatshepsut). Few of the mummies covered here were found in situ as an original burial. For the royal families they are these three: King Tutankhamun found in KV 62 (still in situ), and the parents-in-law of King Amenhotep III, Yuya and his wife Thuya in KV 46 (Davis, 1907; Carter, 2010), whose mummies are now in the Egyptian National Museum in Cairo: Yuya (Egypt. Mus., Cairo CG 51190) and Thuya (Egypt. Mus., Cairo CG 51191). Their identity is not disputed (Gabolde, 2013a). The presented study focus on mummies connected with recent genetic studies and exclude unsolved cases, such as the identification of mummy KV 60 A as Queen Hatshepsut (Hawass, 2006, 2007; Quilici, 2007; Thimes, 2008; Graefe, 2011). Purported diseases of Akhenaton and the many causes of death of Tutankhamun do not help in identification and were also excluded (Rühli and Ikram, 2014).

The following mummies were used in the meta-analysis: Table 1.

Also, some unidentified remains from unconfirmed burial situations (original or secondary) are used: Table 2.

METHODS USED FOR INVESTIGATION

Scientists have used various approaches by Egyptology, medicine, anthropology, and molecular genetics. This study presents a meta-analysis of the complex and often contradictory information collected in various research programs over the last century. The focus lies on the Thutmoside dynasty of the 18th Dynasty from Thutmosis II to Tutankhamun, where molecular genetic data are available. The dates of reign are an approximation, following generally used chronological models (von Beckerath, 1997)

Inscriptions and historic information

These results are entirely independent from the other investigation methods, using archaeological methods only: Some mummies carried restoring inscriptions on the secondary non-royal coffins, on wrapping and shrouds.

The identification tags can be classified the following:

Type 1: Only the name

Type 2: Name, titles, and information on the date when the restoration was made in the Third Intermediate Period.

This archaeological identification is considered to be generally correct, especially the labels directly on the mummy bandages. There has not been a single documented mummy to have been proven wrongly identified by such identification tags so far (Reeves and Wilkinson, 2002, p 202).

Contemporary historic monuments with inscription are also used to identify individuals, especially mummies without a label. Tutankhamun is attested to be the son of Akhenaton by a relief now in Ashmunein (Dodson, 2014, p 131, fig. 104). The inscription in room γ of the Royal tomb in El-Amarna undeniably names Nefertiti as the mother of a baby who can be identified as Tutankhamun (Habicht, 2011; Schlögl, 2012; Gabolde 2013a). Other theories speculate that the relief depicts an abstract concept of rebirth (Harris, 2004; Dijk, 2009; Dodson, 2014). Such theological interpretations remain uncertain and speculative. Maketaton died far too young (c. 10 years) to be considered as mother of Tutankhamun (Schlögl, 2012, p 88; Habicht, 2014a); thus Dodson describes Nefertiti to be the perfectly plausible candidate for Tutankhamun's mother (Dodson, 2014).

Some historical background knowledge is mandatory to understand the feasibility of presented identifications (Clayton, 1995; Schneider, 1996; von Beckerath, 1997; Shaw, 2003; Hornung, 2008; Tyldesley, 2008; Habicht, 2014a).

Thutmose II came from a secondary line and was married to his half-sister, Queen Hatshepsut. Thutmose II was a weak ruler and passed away after less than 5 years of rule [or 13 years according to Manetho (von Beckerath, 1997)]. Historical evidence for his reign is scarce; only one year is confirmed. Since Thutmose II left few monuments, a short reign can be assumed. He must have died young; his successor Thutmose III was still a child. Once again, the son of a secondary queen, Isis, became ruler of Egypt, while his stepmother Hatshepsut was acting regent. Later she made herself King Maat-Ka-Ra, ruling jointly with Thutmose III. She died after two decades at the age of ~40–45 years, while Thutmose III continued his reign for another three decades. He died on the last day of month 7 in his 53rd year of reign (Schneider, 1996). Thus he must have reached an age of over 55 years. His son Amenhotep II was known for his physical strength and his extraordinary brutality in battle (Galling et al., 1968; Decker, 1971, 1987; Habicht, 2014a). This bodily characteristic may be visible in his mummy. For 2.5 years, he was coruler at the side of his father. His reign lasted for 26 years, and he died at around 45 years old. Once again, the kingship passed to a secondary line; his successor, Thutmose IV, was the son of a secondary queen Tiaa. Thutmose IV's reign lasted only around 10 years, but it was a peaceful and prosperous time. He died a young man, somewhere around 30–35 years of age. As history repeats itself, a child of a lesser queen Mutemwia was named King Amenhotep III, while his mother acted as regent for the first years. Amenhotep III was between 4 and 12 years old at the time of accession and ruled for 38 years. Since the designated crown prince Thutmose died during the reign of his father, the kingship passed to the second son of Amenhotep III and Queen Tjye, Amenhotep IV (who later renamed himself Akhenaton). There is no information on his age of accession. In the third year of his reign (or co-reign), he launched his religious experiment, finally leading to chaos (Reeves, 2002; Hornung, 2005; von Falk, 2012). New archaeological evidence supports theories of a longer co-regency with his father (Habicht, 2014b,c; Ibrahim, 2014). A re-evaluation of the Amarna-age is needed, but does not cause problems with identification. Akhenaton died after 17 years on the throne in his new capital Akhet-Aton. His successor is controversial. In the later years of Akhenaton's reign, a figure called Smenkhkare appeared on the scene. Was he a young man of unclear descent or was he in reality Queen Nefertiti in her new role as a "male" successor? The reliefs show an intimacy between Akhenaton and Smenkhkare, highly unusual if Smenkhkare was male. As Marc Gabolde indicated convincingly, Smenkhkare carried two throne names but no birth name, and one can assume that behind this figure must be someone else (Gabolde, 2001). Nefertiti was certainly alive and Queen at least until year 16 of Akhenaton's reign (Van der Perre, 2012). King Smenkhkare ruled for ~3 years, possibly as either a sole ruler or a co-ruler. Since his or her family background is uncertain regarding sex and age, we have no clues for identification. Smenkhkare remains a phantom. Tutankhamun, the last male of the royal family, is likely to have been about eight or nine years old when he became king. He ruled under the guidance of Ay and General Horemheb for at least nine years. He died young, at about 18 years old. His identification is certain due to his burial in KV 62.

Anthropological macroscopic examination

The first serial investigation was made by G. E. Smith (1871–1937) in 1912 (Smith, 1912). He measured the mummies to establish cranio-facial resemblances. The ancient designations of the mummies were generally accepted. Age estimation was based on macroscopic examination. Douglas E. Derry (1874–1961) investigated the newly discovered mummies of Tutankhamun, the mummy from KV 55, King Psusennes I and other mummies some decades later with similar methods (Derry, 1927, 1931, 1940). Again, cranio-facial measurements and resemblances were used as an argument to strengthen the close familiar relationship between Tutankhamun and the mysterious male in KV-55 (Derry, 1931).

Radiology

New technologies yielded some additional information, but increased the level of controversy: the serial x-rays from the 1960's by Harris and Weeks revealed the first insights (Wente and Harris, 1992). In some cases, the x-rays suggested a considerably lower age at death than reported by regal years, for example, Thutmose III. Computed Tomography (CT) has been applied many times in assessing morphological traits in ancient mummified individuals. Furthermore, CT can be specifically used to assess "virtually" individual age and sex (Grabherr et al., 2009); as would be the case in still wrapped mummies. CT-scans confirmed certain morphological similarities that indicated close relationships of kings and putative causes of death but do not prove or disprove identity (Hawass et al., 2007).

Blood group testing

During this decade of x-ray investigation, a detailed anatomical examination of mummy from KV 55 and serological testing of mummies from the Amarna period also provided scientific data (Harrison, 1966; Harrison et al., 1969; Connolly et al., 1976; Schnabel, 1980). The blood groups amongst the Amarna rulers were similar, but this could not resolve their exact relationships. Tutankhamun and the KV 55 male have the same blood group A2 and MN. Thus they could be brothers or—if their mother shares the same groups—father and son. The solution father-son is supported by genetics (Hawass et al., 2010).

Hair identification

In the tomb of Tutankhamun Howard Carter (1874–1939) found set of miniature coffins with the inscription of Queen Tiye (Egypt. Mus., Cairo JE 60697-60700, Carter No 320a-d). They contained a ringlet of hair (Egypt. Mus., Cairo JE 60701, Carter No 320). This was incorporated into Tutankhamun's burial as a souvenir from his ancestor, Queen Tjye (James, 2000, pp 134–135). The hair was compared with the wavy hair of the Elder Lady in KV 35, leading to a proposed identification as Tjye (Anon, 1976; Harris et al., 1978; Harris and Wente, 1979) which was later confirmed by genetic testing in 2010 (Hawass et al., 2010).

Facial resemblance

The cranio-facial study presented in 1992 raised further questions about the age and identity of several

kings of the 18th Dynasty and the possibility of the misinterpretation of some of the ancient designations was discussed (Harrison, 1971; Harris et al., 1978; Wente and Harris, 1992; Wente, 1995).

Molecular genetics

Woodward made the first attempt at genetic analyses of some of these mummies, but the results remained unpublished; however, some information was only shown in a documentary movie (Woodward et al., 2001; Habicht, 2014b, pp 52–53, 88; Marchant, 2014). He discovered inbreeding at the beginning and at the end of the 18th Dynasty and proposed that the mummy CG 61074 really is Amenhotep III. After the millennium, molecular genetics opened a new door into the past, but the feasibility of acquiring authentic ancient DNA from Egyptian mummies is still debated. Another project to obtain genetic profile of the Pharaohs by Sakuji Yoshimura was turned down in 2000 (Marchant, 2014).

Zink and Nerlich postulated that DNA analysis was feasible based on the lower temperature in the tombs, the beneficial fact that mummies are dry and that natron increases the pH-value (Zink and Nerlich, 2003). The success rate of amplifying DNA by PCR from ancient samples is generally 50–60% (Zink et al., 2001). Other studies, based on the decay rate of DNA in papyrus rejected the idea that authentic DNA from ancient Egypt could survive at all (Marota et al., 2002). Factors such as humidity, chemical agents, temperature, and modern contamination are a challenge for molecular genetic studies (Gilbert et al., 2005). A study on the extent of modern contamination was presented by Malmström, investigating animal remains for human DNA: all 29 samples contained human DNA, but in 25 cases authentic animal DNA was found also (Malmström et al., 2005). To eliminate contamination, procedures were developed to assure the collection of authentic ancient DNA (Yang and Watt, 2005; Bouwman et al., 2006; Anderung et al., 2008). To ensure authentic and credible data they suggest:

- Extraction of clean samples in new excavations, the traditional cleaning of bones must be avoided no washing, no chemicals, and separate storage from modern samples; and investigators should handle them only with gloves and wear forensic suits.
- For old material, which is possibly contaminated, a decontamination strategy should be used first.
- Search for criteria of authenticity (short DNA strands of less than 300 base pairs and authentic aDNA should contain modified bases).
- UV irradiation and removal of the surface material, extraction from the bone cortex or dentine.

For the Tutankhamun Family project, such safety protocols were applied (Richards et al., 1995; Gad, 2010; Gabolde, 2013a). Several facts speak clearly in favor of authentic aDNA:

- All female genetic profiles were negative for Y-Chromosome markers.
- All male mummies showed homozygous (i.e., hemizygous) Y-chromosomal profiles.
- The profiles and haplotypes of all mummies showed individual differences and therefore could not have originated from the same source of putative contaminant DNA.

- The combination of nuclear data (Y- and autosomal chromosome-related markers) complemented each other.
- Different biopsies and extractions on each mummy resulted in reproducible genotypes.
- The profiles established a multigeneration family tree. This family line concurs with information from Egyptology on the relationship of the individuals: Modern contamination by excavators and anthropologists would be extremely unlikely result in such a family line (Gabolde, 2013a).

Claims that it is not possible to extract authentic DNA from Egyptian mummies (Marota et al., 2002; Gilbert et al., 2005; Lorenzen and Willerslev, 2010) can be challenged by the fact that recent studies were able to identify ancient animal DNA in Egyptian crocodile and cat mummies (Hekkala et al., 2011; Kurushima et al., 2012; Marchant, 2014). New technology, such as Next Generation Sequencing will make it easier to identify contamination and separate it from authentic DNA. From all methods applied to identify royal mummies, molecular genetics are the most reliable together with accurate information from the historic inscriptions provided by archaeological research.

The cases are presented in chronological order:

INDIVIDUAL CASES

The mummy Cairo CG 61066: King Thutmose II Aa-Kheper-en-Ra (reign c. 1493–1479 BC) Figure 3 & 4

- Sex: Male
- Age: Not older than 30 years (Smith, 1912); about 30 years (Harris and Weeks, 1973); 25–30 years (Wente and Harris, 1992); about 40 years (Hawass, 2007).
- Historic Age: Uncertain. Probably he had a short reign of 3–4 years.
- Inscription: Type 2.
- Coffin: Secondary, CG 61013.

Ancient grave robbers had badly damaged this royal mummy, the left arm was broken off at the shoulder, the right arm was ripped off at the elbow joint and the right leg was severed from the body. G. E. Smith estimated the age-at-death about 30 years of age (Smith, 1912). CT-scans by Supreme Council of Antiquities (SCA) suggested an age-at-death about age forty because his teeth are in good condition but he seemed to have suffered from an enlarged heart (Hawass, 2007). The mummy was identified by means of a type 2 label, giving the name and the date of rewrapping in the sixth year of the reign of an early 21st Dynasty king, probably Smendes I. Only the throne name was used, but incorrectly spelled as *Aa-en-Ra* (instead of *Aa-Kheper-en-Ra*). No other Thutmose ruler carries “en” in the name. The next closest would be *Aa-kheper-ka-Ra* (“Thutmose I”) Figure 1 & 2. Georges Daressy (1864–1938) observed that the “en” was unusually spelled with the red crown of Lower Egypt (Gardiner Sign S3) and it had overwritten an earlier sign that might have been “ka (Gardiner Sign D28; Daressy, 1909). From of this information, Wente and Harris concluded in 1992, that the inscription had been changed from Thutmose I to Thutmose II and suggested that he could be in fact Thutmose I (Wente and Harris, 1992). The historic length of reign from Thutmose I (about a decade) would concur with age of the mummy. Thus, the identification of CG 61066 as Thutmose II must be considered as uncertain.

The mummy Cairo CG 61068 Thutmose III Men-Kheper-Ra (reign c. 1479–1425 BC) Figure 5 & 6

- Sex: Male
- Age: 35–40 years (Wente and Harris, 1992); about 50 years (Hawass, 2007).
- Historic age: 55–65 years (53 years of reign on historic inscription).
- Inscriptions: Coffin and shroud.
- Coffin: Probably original, but stripped of its gilding, CG 61014, inside: inscriptions.

The mummy was among the first to have an autopsy and was opened in July 1881 and repeated in 1886 (Smith, 1912). It had been badly damaged by ancient plunderers and had fallen into pieces. The well-preserved head is broken off, all four limbs are detached, and the feet are severed. The king has a small, narrow, and elliptical face with a prominent nose. At the time of his death, the king was almost completely bald. Smith quotes Rudolf Virchow (1821–1902), who stated that although the King Thutmose III had a long reign, his mummy had a juvenile appearance (Virchow, 1888; Smith, 1912). A precise age is not given. As Smith notes, a new placement of the side incision can be observed: instead of the vertical incision extending upward from near the anterior superior spine of the ilium towards the ribs, as was usual in the earlier mummies of the 18th Dynasty, the side cut here is now lower towards the pubes, following a course parallel to inguinal ligament (Smith, 1912). Later mummies including Amenhotep II, Thutmose IV, Yuya and Thuya and Amenhotep III show the same tradition. This mummification style places the mummy in the middle of the 18th Dynasty.

The age assessment of 35–45 years does not fit well with a minimum historic age of 55 years or more. According to later studies, mummy CG 61068 was not only considerably taller, but also older (Robins and Shute, 1983). Hawass and Selim described the mummy as a 175 cm tall individual aged around 50 years. He shares a striking resemblance with Thutmose II (mummy CG 61066), his purported father; both have a prominent zygomatico-frontal ridge, narrow cheekbones, thin mandibular rami, obtruse mandibular angles, shallow nasal bridges, and narrow foreheads (Hawass, 2007). According to Gaston Maspero's (1846–1916) excavation reports, based on a description from Emil Brugsch (1842–1930), the coffin containing the mummy was found in the niche in the middle of the cachette DB 320 (Brugsch and Maspero, 1881). Newer research by Graefe revealed several flaws in the old map of DB 320; the structure is much more bent and more irregular (Graefe and Belova, 2010). The room where more than 5 coffins were allegedly deposited is in fact a small niche of 3-m length only at the roof. It is therefore impossible that the coffin containing the mummy CG 61068 was found there. The identification of CG 61068 is based on the fact that the mummy was lying in a coffin (Cairo CG 61014) from which all gilding was removed, but where traces of inscriptions made for Thutmose III remain visible on the inside. On the mummy, there was a linen shroud with a funerary book, containing spells from the Book of the Dead, the litany of Ra and from the Pyramid Texts (Dunham, 1931; Piankoff, 1964). This Book of the Dead is in Cairo (CG 40001) and a fragment is in the Museum of Fine Arts, Boston (Inv. No. 82.31). Several examples of the names “Thutmose” and “Men-Kheper-

Ra” are clearly visible and legible. The Book certainly belonged to Thutmose III, but its connection with the mummy has been questioned, since it was folded and simply placed on the rewrapped mummy (Nagel, 1949; Wente and Harris, 1992). The identification by means of this shroud possibly placed there by the embalmers is as secure as any other, perhaps more so since it comes from the same time period as the king. More problematic is the estimated age of the mummy of 35–40 years, contrasting with the historical 53 years of his reign. However, this can be explained; Bickerstaffe (2009) claims that the identification is generally secure. While no study provides an objective (blind, independent, multiobserver) account, matching individual known-age in ancient Egyptian mummies with an anthropological age assessment, there are similar studies for skeletal remains. One example is the English Spitalfields project of the mid 1980s, where over 900 coffins with remains were compared with the length of the occupants' lives indicated by coffin plates (in 383 cases); this revealed a systematic error of age assessment: only 39% of the individuals were correctly aged within a 5 year range to their real age, while 58% are under-aged. Bickerstaffe recommended raising the age assessment for all mature royal mummies by at least ten years (Loth, 1995; Bickerstaffe, 2009). Thus, with some reservations, CG 61068 can be accepted as King Thutmose III.

The mummy Cairo CG 61069 Amenhotep II Aa-Kheperu-Ra (reign c. 1428–1397 BC)

- Sex: Male.
- Age: 40–50 years (Smith, 1912); 35–40–45 years (Wente and Harris, 1992).
- Historic age: 40–45 years.
- Inscriptions: Type 1.
- Coffin: Secondary, cartonnage (21st Dynasty).

French excavator Victor Loret found the mummy CG 61069 lying in wooden coffin placed into the sarcophagus of KV 35 (Fletcher, 2004). A simple type 1 label presented the identity of Amenhotep II. The first inspection on the mummy CG 61069 was on January 17th 1902 (Carter and Maspero, 1903). Gaston Maspero and Howard Carter inspected the mummy and removed some bandages after a robbery took place in the same year in KV 35. They removed the bandages covering the face and upper body. After this first inspection, the mummy was placed back in the sarcophagus, and remained in situ with the three naked mummies inside chamber Jc: The Elder and Younger Lady and a boy. Mummy CG 61069 lying in the sarcophagus was identified as Amenhotep II. G. E. Smith inspected the mummy in 1907 (Smith, 1912). He had long brown hair, including some white ones and a patch of baldness over the upper occipital and parietal regions. The well-worn teeth indicated for Smith, that CG 61069 was much older than Thutmose IV, somewhere between 40 and 50 years of age. Smith also observed a “striking resemblance” in face and cranial form between CG 61069 and Thutmose IV, but this man has a much stronger physique (Smith, 1912, pp 36–37). This opinion was substantiated in 1973 (Harris and Weeks, 1973; Wente and Harris, 1992). Wente and Harris used biological arguments to question the identification of CG 61069 as Amenhotep II, namely that his appearance does place him in the early Thutmoseid sequence (Thutmose I – III) nor can he be considered to be the biological son of Thutmose III (Wente and

Harris, 1992). The inscriptions are on the stone sarcophagus, originally belonging to Amenhotep II. The secondary coffin did not give a name, and the excavator, Loret, could have misread the inscription on the mummy's shroud. He also mentioned that the coffin was too large for the mummy. It is possible that the throne name '*Aa-Kheperu-Ra*' was misread and CG 61069 could be a different ruler (e.g., Sety II *User-Kheperu-Ra*). The signs for Aa and User look similar, especially in a faded hieratic ink inscription. Historical sources described Amenhotep II as a strong, powerful and sportive man, with a sinister tendency to brutality in warfare, which would generally concur with the physical appearance of CG 61069 (Galling et al., 1968, p 31; Decker, 1971, 1987). With reservations the mummy CG 61069 should be considered as Amenhotep II until proven otherwise (Bickerstaffe, 2009).

The mummy CG 61073 Thutmosis IV Men-Kheperu-Ra (reign c. 1397–1387 BC) Figure 7 & 8

- Sex: Male.
- Age: 25–28 years (Smith, 1912); 25–35 years (Harris and Weeks, 1973); 30–35–40 years (Wente and Harris, 1992).
- Historic age: About 30 years.
- Inscriptions: Type 1 (on coffin and mummy).
- Coffin: Secondary, CG 61035, and Inscriptions.

The mummy was found in 1898 in KV 35 and was first autopsied in 1903 (Smith, 1912). It is the body of an extremely emaciated man and shows no signs of any *ante-mortem* injuries. Both feet are broken off. The right leg was ripped off at the knee joint. The body and the face are in good condition. Smith estimated the man to be about 25 years old and placed the highest possible age at 28 years, based on x-ray examination of the degree of closure of the epiphysis of the left ileum and the upper end of the right tibia. Smith also observed a "striking resemblance" of Thutmosis IV with the mummy identified as "Amenhotep II" (Smith, 1912, p 45), this was also noted by Harris and Weeks (1973) stating that his resemblance helps to confirm the known order of royal succession (Harris and Weeks, 1973). Harris and Weeks estimated the king to be 30 years of age. The cranio-facial study of Wente and Harris (1992) confirmed the identification, but added some doubt, although the inscription on mummy and coffin are correctly spelled and clearly visible (Wente and Harris, 1992). The facial resemblance between Thutmosis IV, KV 55, and Tutankhamun was emphasized again. The coffin bore the two names of King Thutmosis IV: "*Men-Kheperu-Ra*" and "Thutmosis" (label type 1). On the chest of the mummy there was once again an inscription in blue hieratic signs: "*Men-Kheperu-Ra*." The identification therefore has to be considered reliable. Until proven otherwise, CG 61073 must be regarded most likely as King Thutmosis IV.

The mummy CG 61074 Amenhotep III Neb-Maat-Ra (reign c. 1387–1349 BC) Figure 9 & 10

- Common ID: Amenhotep III (Smith, 1912; Harris and Weeks, 1973; Ikram and Dodson, 1998; Hawass et al., 2010; Habicht, 2011; Gabolde, 2013a).
- Alternative ID: Ay (Schlög, 2012).
- Sex: Male.

- Age: 30–35 years (Wente and Harris, 1992); about 50 years (Hawass et al., 2010).
- Historic age: Amenhotep III: 42–50 years. Ay: 50–65 years.
- Inscription: Type 1 and 2.
- Coffin: Secondary, Lid was intended for Sety II, relabelled for Neb-Maat-Ra, CG 61036, container (original?) made for Ramses III, CG 61040.

The mummy was found in KV 35. The wrappings were opened by Grafton E. Smith in September 23, 1905 and revealed a body in a bad condition, somewhere between fully preserved mummy and skeleton (Smith, 1912). Smith assumed that the body was exposed and severely damaged by ancient grave robbers. The head was broken off, and most of the soft tissue from the face is gone. The right leg was also broken away from the trunk, and part of the foot is missing. The embalmers tied the fragments of the body together with bandages. Inside the body cavity, there were bones from birds, a human big toe, and parts of an arm (ulna and radius). The embalmers basically had 'taped' the mummy together and tried to restore a lifelike appearance by placing a resinous mass of subcutaneous stuffing in the legs, arms, and neck (Smith, 1912). Smith estimated the mummy to be of an individual between 40 and 50 years of age and noted the bad condition of the teeth. Carter also had some doubt about the identity of CG 61074, which was mentioned in the second volume of his book on Tutankhamun; this was based on the fact that there was unusual packing material under the skin, which points to a 21st Dynasty style (Carter, 2010). Genetic studies have indicated that mummy CG 61074 comes from the 18th Dynasty, and this raises several issues: why did the embalmers develop this new technique of stuffing to achieve a life-like appearance and why was this new style then abandoned until it reappeared three centuries later as state-of-the-art mummification of the 21st Dynasty? It is highly unlikely that the subcutaneous stuffing with resinous material was carried out on dry mummified tissue some 300 years later during restoration, which would severely damage the friable dry tissue. The stuffing of CG 61074 is most likely to have been carried out during the original mummification process in an attempt to create a life-like appearance.

This new technique requires an explanation. Smith observed the technical aspect and explained it as a short lived style in the time of Amenhotep III which was abandoned after the Amarna period until the embalmers of the 21st Dynasty revived it (Smith, 1912).

Fletcher (2004) has discussed the new mummification techniques of the Amarna time, describing the special features of Amenhotep III as part of his religious motivation to declare himself as a living God and claiming that his gold-covered body once looked like a shiny golden statue of the sun-god, symbolizing the king's solar powers in afterlife. The style of mummification fits in with the emerging Amarna era (Ikram and Dodson, 1998; Fletcher, 2004). The religious motivation would explain why the new technique was abandoned together with the Atonism. This statue-like appearance fits and the putative use of liquid natron only fits to the time of Amenhotep III, while unrealistic for the post-Amarna King Ay (Buckley, 2014). Recent investigations using CT-scan have revealed a more frequent use of subcutaneous stuffing of royal mummies throughout all Dynasties (mid-18th to 20th); stuffing of the face is frequently observed (Saleem and Hawass, 2015). Therefore the

TABLE 3. Single tandem repeat (STR) data as published by Hawass et al. (2010)

STR	D13S317	D7S820	D2S1338	D21S11	D16S539	D18S51	CSF1PO	FGA
CG 61074	10 16	6 15	16 27	25 34	8 13	15 22	6 9	23 31
Amenhotep III								
EL KV 35	11 12	10 15	22 26	26 29	6 11	19 22	9 12	20 26
Skeleton from KV 55	10 12	15 15	16 26	29 34	11 13	16 19	9 12	20 23

The male mummy CG 61074 is the husband of the Elder Lady (EL; identified as Queen Tjye). Chemistry identifies him too as King Amenhotep III. They are the parents of the controversial “KV-55-male.”

stuffing must be considered as not decisive against dating of this mummy to the mid-18th Dynasty. Yuya (see below) shows similarities in stuffing and is firmly dated in the reign of Amenhotep III. Later the subcutaneous stuffing became more localized (Saleem and Hawass, 2015). The stuffing material used for mummy CG 61074 was a mixture of resin, natron and inorganic matter (Smith, 1912). As Saleem and Hawass emphasised, such material would be unusual for the 21st to 22nd Dynasties (when clay, sand, sawdust, and fatty matter were the preferred materials).

Harris and Weeks accepted this identification in 1973 describing Amenhotep III as a fat, diseased, and sedentary man who was almost bald and suffered considerably from dental problems in his last years (Harris and Weeks, 1973). The identification of this mummy as Amenhotep III is supported by inscriptions on the coffin and shroud: the coffin inscription is confusing, since the mummy was placed in a wooden coffin, which was originally intended for the reburial of Sety II whose names have a somewhat unusual writing “*User-Maat-Ra mery en Ra*” and “*Seth-mery-en-Ptah*” (Daressy, 1909; Smith, 1912; Gabolde, 2013a). The container of the coffin bore the name of Ramses III. The lid provides his name (type 1 label) as “*Neb-Maat-Ra Amenhotep, life! prosperity! health!*” The shroud, covering the wrapping is a label type 2, giving the name and additional information about the restoration: “*Year 12, month 4 of the peret-season, day 6. At this day, restoration of the King Neb-Maat-Ra, life! prosperity! health! by the high priest of Amun-Ra, Pinudjem...*” according to Wente and Harris (1992, p 22). The name of the high priest is debated, Reeves translated it as high priest Piankh (Reeves and Wilkinson, 2000, p 203). Piankh and Pinudjem I both were High Priests of Amun in the 21st Dynasty. The cranio-facial study from 1992 by Wente and Harris claimed that CG 61074 had little resemblance to the KV 55 mummy and Tutankhamun. They speculated that CG 61074 might be in fact King Ay, who was not a member of the Thutmoside Dynasty. The pitiful condition of the mummy was explained with a supposed mutilation during a *damnatio memoriae* under King Horemheb (Wente and Harris, 1992). They did include the fact that some human remains discovered by Schaden in the tomb of Ay (WV 23) or the “yellow skeleton” found by Belzoni in WV 25 (West Valley, Luxor) or WV 25 were possibly the remains of Ay (Schaden, 1984). Bickerstaffe offered another suggestion in 2009: The unusual mummification could be a sign, that CG 61074 was a completely different ruler: Ramses VI of the later 20th Dynasty also carried the throne name *Neb-Maat-Ra* (Bickerstaffe, 2009).

The genetic profiling established that CG 61074 as the consort of Queen Tjye and as the genetic father of the mummy from KV 55, thus identifying the mummy Amenhotep III. In fact, there is no evidence to support the identification of CG 61074 as King Ay: neither the

name on the shroud nor on the coffin would support such conclusions. The mummy’s age also does not concur with the identification as King Ay. The genetic identification of CG 61074 as Amenhotep III was recently questioned again by Schlögl who believes him to be King Ay: [transl.] “*A weakness of the JAMA publication, which used Genoproof 1.3 software, was obvious the complete uncritical identification of mummy CG 61074 as Amenophis III; in this constellation would this King and his wife Tjye not only be the parents of Akhenaton, but also of Nefertiti*” (Schlögl, 2012, p 101). This opinion was rejected by several researchers since the whole theory is based on the unfounded assumption that the embalmers of the 21st Dynasty committed an error (Schüle, 2012; Schlögl, 2014). The controversial nature of Schlögl’s theory resulted in several reactions (Schott, 2012). Members of the “Tutankhamun Family Project” dismissed this interpretation as speculation (Schüle, 2012). The identity of CG 61074 has become the pivotal factor deciding which interpretation is correct. One way to determine the identity of this mummy lays in genotyping his putative father CG 61073 Thutmosis IV (Habicht, 2012). Ay was probably around 60–70 years old when he became king of Egypt, while the mummy CG 61074 is more likely 40–50 years of age. The unusual stuffing technique clearly favors the identification of the mummy as Amenhotep III and not Ay. According to Buckley, material used in mummy CG 61074 was not employed in the later 18th Dynasty, and he proposed a mummification with liquid natron bath, causing salt crystals in the soft tissue of the muscles (Buckley, 2012; Dodson, 2014). There seems no substantive doubt that CG 61074 is Amenhotep III (Dodson, 2014). Buckley confirmed the identification as Amenhotep III with chemistry arguments, while King Ay is highly unlikely (Buckley, pers. commun, 2014). Until proven otherwise, CG 61074 should be regarded as King Amenhotep III (Table 3).

The mummies Cairo CG 51190 Yuya and CG 51191 Thuya

- Age: Yuya: 50–60 years (Hawass et al., 2010), Thuya: 50–60 years (Hawass et al., 2010).
- Inscription: on coffins, found in situ.
- Coffin: Original: CG 51006 and CG 51007 (Thuya).

The parents of Queen Tjye and parents-in-law of King Amenhotep III were found in Tjye’s shaft tomb KV 46 in 1905 by James E. Quibell (1867–1935) in their original coffins (Davis, 1907). They are exceptionally well-preserved mummies, whose identities are secure, since the coffins and funerary objects bear their names and status (Gabolde, 2013a; Dodson, 2014). The Commemorative Marriage Scarab testifies that Tjye was their daughter. Their funerary assemblage shows the pre-Amarna traditions; a considerable amount of gold is still

TABLE 4. Single tandem repeat (STR) data from the Hawass et al. (2010) study

STR	D13S317	D7S820	D2S1338	D21S11	D16S539	D18S51	CSF1PO	FGA
Thuya	9 12	10 13	19 26	26 35	11 13	8 9	7 12	24 26
Yuya	11 13	6 15	22 27	29 34	6 10	12 22	9 12	20 25
EL KV 35	11 12	10 15	22 26	26 29	6 11	19 22	9 12	20 26

It is most likely that the Elder Lady (EL) is a daughter of Yuya and Thuya, making her almost certainly Queen Tjye.

on the bodies (Harris and Weeks, 1973). X-ray revealed that Yuya suffered from degenerative arthritis in vertebrae and knees. Both mummies had dentition: teeth are missing or heavily worn, and evidence of abscesses was found. Thuya also suffered from arthritis and scoliosis. Yuya and Thuya were embalmed in different ways. Yuya's brain was removed by breaking bones in the nose (Saleem and Hawass, 2013), while Thuya's was apparently not removed (Harris and Weeks, 1973).

The mummy Cairo CG 61070 "Elder Lady from KV 35" Figure 13 & 14

- Common ID: Queen Tjye (Hawass et al., 2010; Habicht, 2011; Gabolde, 2013a).
- Alternative ID: Tjy II, the wife of King Ay (Schlögl, 2012).
- Sex: Female.
- Age: "Middle-aged woman" (Smith, 1912); 35–45 years (Harris and Weeks, 1973); about 50 years (Hawass et al., 2010).
- Inscriptions: None.
- Coffin: None.

This unknown, nameless, and naked mummy was found in 1898 in the cachette KV 35 together with the so-called Younger Lady and a teenage boy. Because of her bent arm and the regal quality of mummification she always was considered to be a queen, either Tjye, Nefertiti, or Hatshepsut. An identification as Tjye is the most realistic one (Harris and Went, 1979; Went and Harris, 1992). The labelled hair of Queen Tjye, found in Tutankhamun's tomb (see above) suggested an identification with Queen Tjye (see above). In the 'Tutankhamun Family Project' she was proved with molecular genetics to be the daughter of Yuya and Thuya, and thus must be identified as Queen Tjye based on the "marriage scarabs" of year 2 and the "princess scarab" of year 10 under Amenhotep III (Habicht, 2011). Schlögl recently proposed a different interpretation, claiming that CG 61070 is not Queen Tjye, but Tjy II, the wife of King Ay. To match the genetic results, Schlögl associated her with the family of Yuya and Thuya, suggesting that she was the younger sister of Queen Tjye, first named Taemwadjesi, who later renamed herself as Tjy (Schlögl, 2012). However, there is no proof that the harem lady Taemwadjesi was a daughter of Yuya and Thuya, and the court lady Tjy II is well known from inscriptions as being the nurse of Nefertiti, not her mother, according to Helck (Urkunden No. 756; Helck, 1961). It is thus quite impossible, to declare that the "mna.t" (wet-nurse or royal nanny) is the mother of Queen Nefertiti. Therefore it seems impossible that Tjy (or Taemwadjesi) was the mother of Nefertiti (Dodson, 2014, pp 87–88). Another (first) wife of Ay named Iuy has been suggested, but this remains speculation (Dodson, 2014, p 88). The family background of Ay and his wife Tjy II is still unknown. As genetic daughter of Yuya and Thuya the "Elder Lady

from KV 35" should be regarded as Queen Teye, wife of King Amenhotep III (Table 4).

The mummy Cairo CG 61075 "The Skeleton from KV 55" (reign c. 1349–1333 BC) Figure 11 & 12

- ID: Akhenaton Nefer-Kheperu-Ra (Smith, 1912; Reeves, 2002; Hawass et al., 2010; Habicht, 2011, 2015; Maciejewski, 2012; Gabolde, 2013a; Dodson, 2014).
- Alternative ID: Smenkhkare Ankh-Kheperu-Ra (Derry, 1931; Harrison, 1966; Ikram and Dodson, 1998; Schlögl, 2012, 2014).
- Sex: Female (Davis, 1910).
- Male (Smith, 1912; Derry, 1931; Harrison, 1966; Germer, 2001; Hawass et al., 2010; Gabolde, 2013a).
- Age: Controversial: 18–45 years: Min. 25, probably older than 28 years (Smith, 1912); about 25 years (Derry, 1931); 18–25 years (Harrison, 1966); over 30 years, Harris and Hussein 1990, unpublished (Hussein and James E. Harris, 1988; Germer, 2001); 30–35 years (Wente and Harris, 1992); Less than 25 years (Ikram and Dodson, 1998; Dodson, 2014); in his early twenties (Rose, 2002); 35–45 years (Hawass et al., 2010); 27–30 years (Gabolde, 2013a; Habicht, 2014b).
- Historic age: If Akhenaton: 30–40 years, certainly older than 22 years.
- If (male) Smenkhkare: unclear, since his family background is unknown.
- A female identity of Smenkhkare would rule out the male mummy KV 55 to be Smenkhkare (Habicht, 2014b).
- Coffin: Rishi-Design, unclear, if secondary from a female owner or original.

Grafton E. Smith noticed that the body found in KV 55 bore golden bands with the name Akhenaton and concluded that it would be hardly credible that the embalmers could have put someone else in the coffin. The inscriptions support the identification as Akhenaton (Smith, 1912). The scapula is described as completely ossified, which led Smith to conclude an age of 25–28 years according to anthropological knowledge in 1912. The first three vertebrae are completely ossified (for Smith: 25–30 years). He also observed the contrast with his father Amenhotep III, and a facial resemblance with Yuya, his grandfather from the maternal line (Smith, 1912). The shape of the skull has a close resemblance to Tutankhamun, which was observed by Douglas Derry during the autopsy of Tutankhamun in 1925. Carter identified the KV 55 body with reservation as Akhenaton, as Smith did in 1912. Later examinations and researchers argued the body might be Smenkhkare's: Ronald G. Harrison (1921–1983) presented a long and detailed anatomical examination in 1966 (Harrison, 1966): the KV 55 body is a completely disarticulated skeleton, with few missing parts. The skull is damaged, and many places show Derry's reconstruction. The pubis, the left innominate, and both fibulae were broken. Most

of the bones are coated in shellac. The vertebral column is completely ossified, but the experts disagree on the estimated age as to when this occurred and was completed (between 24 and 30 years). Harrison noted that the pelvic girdle shows that the skeleton was male. Based on the ossification of the first four sacral elements (the fifth is missing possibly due to incomplete ossification), Harrison aged the skeleton as less than 23 years. In contrast, Smith suggested an age of less than 30 years. Harrison described the long bones as fairly heavy and with well-marked muscular impressions, thus characteristically male. The right humerus was unfused, while the left humerus was completely united, which led Harrison to deduce that the remains could not be much older than 21 years, because the union of humeral epiphysis and the shaft are normally complete at this age. Harrison concluded therefore that mummy CG 61075 is undoubtedly a man and less than 25 years old. Scientific evidence is inconclusive as to whether the mummy from KV 55 is the father or the brother or half-brother of Tutankhamun. Vital to this debate is the proposed age of the mummy. Akhenaton ruled for 17 years and was therefore most likely older than 25 years at the time of his death. An age of 30, maybe up to 40 years would be a realistic age-at-death for Akhenaton. The lower age determination would probably exclude Akhenaton and bring the elusive Smenkhkare into debate. Newer studies have revised the mummy's estimated age towards 30–35 years, concurring with the archaeological evidence (Wente and Harris, 1992; Hawass et al., 2010; Gabolde, 2013a) and permitting the identification as Akhenaton, but consensus on the age of the individual has yet to be reached (Germer, 2001). From the archaeologist's point of view all objects found in KV 55 support the theory that Akhenaton was buried here, and the name of Smenkhkare is absent on the tomb objects. In Harrison's study, the mummy's face was reconstructed at the University by Kidd from the University of Liverpool, who used the anthropologic data but was not told the suspected identity of KV 55. The resulting facial reconstruction bore a striking resemblance to Tutankhamun but not to Akhenaton as Harrison claimed. The face resembles the statue of Smenkhkare in the Musée du Louvre, Paris (N 831) (Harrison, 1966). Today, several experts consider many objects from the burial of Tutankhamun to be duplicates for a female successor (Reeves, 2002; Gabolde, 2009; Habicht, 2014b). The statuette in the Louvre (N 831) is nowadays considered to be an example of the moderate late Amarna style and attributed to Akhenaton. The facial reconstruction clearly shows a realistic face of Akhenaton with accented chin, big lips, and all the features one can observe in the caricature-type exaggeration of the early Amarna style.

Once again, the "Tutankhamun Family Project" has produced a higher age revision for KV 55 (Quilici, 2010). Zink stated that the fusion of the skull is not complete. It is closed, but the fissures are still visible, indicating a younger individual between the ages of 20–40 years. Selim suspected that the osteophytes on the vertebrae indicated an older man. The mild arthritis found in the knee also points towards 40 years (Quilici, 2010). Based on published pictures our study supports this assessment that the man from KV 55 was between 20 and 40 years old, with arthritis indicating a likely age of 25–35 years. The "Tutankhamun Family Project" resolved where he must be placed in the family line. The genetics identified him to be a direct descendant of the "Elder

Lady" (Queen Tiye) and mummy CG 61074 (commonly regarded as "Amenhotep III"), and this would indicate that he was the heretic king Akhenaton. The KV 55 mummy is the genetic father of Tutankhamun. This concurs with inscriptions from Tell el-Amarna, describing Tutankhaton (later Tutankhamun) as bodily son of the King (Akhenaton) and as son born by the Great Royal wife Nefertiti (Habicht, 2011, 2014a; Schlögl, 2012; Gabolde, 2013a). Therefore, based on the genetic results, one must identify mummy CG 61075 as King Akhenaton, until proven otherwise. This view is also supported by Dodson (2014): The age of KV 55 seems to be more towards 18–25 range, but Smenkhkare is unlikely to be the father of Tutankhamun. Smenkhkare would have been c. 16 years old, while his Queen Merytaton would only be about 10 years, too young to be the mother of Tutankhamun. Thus Dodson concluded: the view that Akhenaton was Tutankhamun's father remains by far the most attractive on both historical and genetic grounds (Dodson, 2014).

Smenkhkare

The origin of King Smenkhkare still remains unknown. There is no proof that he was either a younger son of Amenhotep III and Tiye (Dodson, 2014) nor the son of Ay and his wife Tiye II, as proposed (Schlögl, 2012): this theory would make Smenkhkare not only the brother of Queen Nefertiti, but also the genetic father of Tutankhamun. With this conclusion, Schlögl contradicts himself, since he also claims, based on inscriptions, that King Akhenaton was the father of Tutankhamun. Identifying the KV 55 body as Smenkhkare and as father of Tutankhamun would cause several chronological problems as Bickerstaffe has pointed out that the KV 55 mummy probably was a son of Amenhotep III and Queen Tiye but not Akhenaton. As a man in his early twenties, he might be the enigmatic Smenkhkare, as many believe, but this would require unattested co-regencies (Bickerstaffe, 2011).

Little is certainly known about Smenkhkare: he makes a short appearance in the later years of King Akhenaton's reign by the side of the king. Often one is unsure if many reliefs portray Smenkhkare or Nefertiti. Certain are only some seal impressions, carrying the name. The most important evidence is the graffito of Pawah in the tomb of Pairi (TT 139) in Thebes-West, certifying, that a king called "*Ankh-Khepru-Ra meryt[...]* Nefer-Neferu-Aton meryt[...]" ruled for at least 3 years (Dodson, 2009). This inscription has often been interpreted as indicating a joint rule of Smenkhkare at the side of the heretic king. It only testifies that Queen Nefertiti using one of her regal names (*Ankh-Khepru-Ra Nefer-Neferu-Aton-[Nefertiti]*) had her own reign for 3 years, putatively after her husband's death. The only certain picture of Smenkhkare is the ink painting in the tomb TA 2 of Meryre II in Akhet-Aton. The walls of the chapel show two important scenes (Dodson, 2009): The so-called "Dunbar scene" where Akhenaton and Nefertiti had a formal reception of foreign diplomats in the year 12 of the king's reign, are represented as identical-looking "double kings." On the next wall towards the north-east, another scene shows Smenkhkare accompanied by Queen Merytaton, rewarding the official Merire II (Dodson, 2009; von Falk, 2012; Habicht, 2014b.). The inscriptions which are now destroyed, but scientifically recorded, provided us the names:

"Ankh-Khepru-Ra" "Smenkhkare," and "Merytaton." The queen presents herself in her usual style, completely naked, wearing only a uraeus-diadem. Smenkhkare wears a cap-crown or the blue-crown, resembling those of Queen Nefertiti in her later years. The face is not well preserved and provides no information. One can only observe that Smenkhkare has wider and even more feminine hips than Queen Merytaton. Other objects, previously connected with Smenkhkare are now attributed to Queen Nefertiti, such as the second "feather-style" coffin of Tutankhamun and the miniature coffins holding his viscera (JE 60688-91). They once carried not only the name *"Ankh-Khepru-Ra"* but also *"Nefer-Neferu-Aton Akhet-en-hz,"* which identifies Nefertiti as the former owner of the small coffins (Gabolde, 2009; von Falk, 2012). There is currently no definitive proof that Smenkhkare was male (Reeves, 2002; Fletcher, 2004; Habicht, 2014b). New evidence increases the chances that Smenkhkare and Nefertiti could be the same person. Identifying CG 61075 as Smenkhkare could be problematic. Kate Phizackerley and Bickerstaffe questioned the identification of the KV 55 body as Akhenaton, since the KV 55 mummy carries the mismatch of alleles (Phizackerley, 2010; Bickerstaffe, 2011), indicating that the mummy from KV 55 could not be Akhenaton, if Ankhesenamun or one of her sisters is the mother of the two fetuses found in tomb KV62. Phizackerley also speculated that later king Ay may have been the son of Yuya and Thuya. The reason for this genetic speculation lies in the genetic locus D7S820: Tutankhamun carries the alleles 10 and 15. Foetus 1 has 10 and 13, while foetus 2 has 6 and 15. The alleles of the fetuses' mother can be reconstructed as 13 and 6, but mummy KV 55 has alleles 15 and 15. The deduction is simple: Ankhesenamun, the third daughter of King Akhenaton would have inherited alleles 15 and 15. This would exclude the identification of the mummy KV 55 as Akhenaton or, more probably, the women from KV 21 as Queen Ankhesenamun. The stillborn fetuses are based on the incomplete aDNA profile, and are probably the offspring of Tutankhamun and a secondary wife or harem ladies. These genetic theories which attempt to dismiss KV 55 as Akhenaton are not realistic, because they do not take into account the archaeological evidence, which strongly suggests that Akhenaton himself was the father of Tutankhamun. Not only the royal name "Living image of Aton" (Tutankhaton), but also the blocks from the sun-shadow chapel and a relief from El-Ashmunein indicate that Akhenaton was the father indicate that Akhenaton was the father of Tutankhamun. The identification of the KV 55 mummy as Akhenaton is supported by several objects found in the tomb (Helck, 2001): magic bricks with the name Akhenaton Nefer-Kheperu-Ra, remains of a gilded shrine made for Queen Tjye and transported from Akhet-Aton and four canopic jars. According to Alfred Lucas (1867–1945), the jars still contain their original filling of viscera and resinous matter (Lucas, 1931; Habicht et al., 2013). The reconstructed inscription revealed that the jars once belonged to the second wife of Akhenaton (Krauss, 1986; Gabolde, 2009). Krauss also reconstructed a two-phase alteration: first the name and titles of Kiya were removed, the sky hieroglyph shortened and only the names of Aton and Akhenaton remained on the body of the jar. The human-headed lids were changed too; the curled hair on the front was removed and changed to a diadem holding the royal uraeus-snake. The second owner certainly was King Akhenaton, re-buried in KV 55. In the second alteration, the whole inscription was chiselled

away, but with less care to make the jars anonymous. The cartouches removed from the "rishi"-coffin, made in the Amarna style and the Nubian wig instead of a royal *nemes* head-cloth gives the coffin a female appearance. Based on the genetic results, the coffin can be interpreted in two ways (Helck, 2001; Habicht, 2012):

1. The coffin was made for Kiya and later reworked to be used for a secondary burial either for Akhenaton (Reeves, 2002; Habicht, 2011) or Smenkhkare (Helck, 2001).
2. The coffin was originally made for Akhenaton without any alterations (Grimm and Schoske, 2001).

Archaeological evidence indicates a secondary burial of King Akhenaton. The suggested age of 25–35 years makes Akhenaton a likely candidate, but another unknown member of the royal Amarna family cannot be excluded entirely. In 2014, the Minister of Antiquities, Mohammed Ibrahim officially announced definitive proof for an 8-year co-regency of Amenhotep IV Akhenaton with his father Amenhotep III starting in the year 30 at the first Heb-Sed-Festival of his father (Ibrahim, 2014). This new information makes it realistic to assume that Amenhotep IV/Akhenaton may have acceded to the throne as a teenager, not much older than 13–14 years old (Dodson, 2014; Habicht, 2014c; Valentín, 2014). When he died after a confirmed 17 years of reign, he might have been around 30 years old. This fits in with the age assessment of 25–35 years for mummy CG 61075.

A new, controversial study was published in 2015, speculating that Queen Nefertiti alias King Smenkhkare was buried in hidden chambers in the tomb KV 62 of Tutankhamun (Gohar, 2015; Reeves, 2015a,b). On November 28th 2015 the Egyptian Ministry of Antiquity confirmed the possible existence of hitherto unknown chambers with 90% certainty after investigating KV 62 with thermo-photography and geo-radar (Hessler, 2015). It seems that behind the western wall might be an unopened side-chamber from the time of Tutankhamun's burial, while behind the northern wall a corridor is suspected. It may lead to an undisturbed burial of a Royal who ruled shortly before Tutankhamun. Several candidates were suggested: Nefertiti (by C. N. Reeves), Kiya (by His Excellency M. El-Damaty) (El-Aref, 2015) or Meritaton, the eldest daughter of Akhenaton and Nefertiti (by M. Gabolde & M. Habicht) (Arrizabalaga, 2015; Habicht et al., 2015; Lorenzi, 2015). But also it is possible that no mummy (and artefacts) at all will be found (Habicht et al., 2015).

The mummy Cairo CG 61072 "Younger Lady from KV 35" Figure 15 & 16

- ID: Queen Nefertiti.
- Sex: Female.
- Age: Less than 25 years (Smith, 1912); 25–35 years (Hawass et al., 2010).
- Historic Age: If Nefertiti: about 35 years If Merytaton: about 20–25 years.
- Coffin: None.

When CG 61072 was found by Victor Loret (1858–1946) in 1898, the mummy was considered to be a young male until her female identity was confirmed by macroscopic inspection (Piacentini and Orsenigo, 2005). For a long time the mummy was considered to be an unknown royal family member of Amenhotep II, because she was

TABLE 5. Single tandem repeat (STR) data (Hawass et al., 2010)

STR	D13S317	D7S820	D2S1338	D21S11	D16S539	D18S51	CSF1PO	FGA
CG 61074	10 16	6 15	16 27	25 34	8 13	15 22	6 9	23 31
Amenhotep III								
EL KV 35	11 12	10 15	22 26	26 29	6 11	19 22	9 12	20 26
Skeleton from KV 55	10 12	15 15	16 26	29 34	11 13	16 19	9 12	20 23
Tutanchamun	10 12	10 15	16 26	29 34	8 13	19 19	6 12	23 23

The royal family: CG 61074 (Amenhotep III) and Elder Lady KV 35 (EL; Queen Tjye), their son (skeleton from KV 55). The skeleton from KV 55 is the genetic father of Tutankhamun.

TABLE 6. Single tandem repeat (STR) data (Hawass et al. 2010)

STR	D13S317	D7S820	D2S1338	D21S11	D16S539	D18S51	CSF1PO	FGA
CG 61074	10 16	6 15	16 27	25 34	8 13	15 22	6 9	23 31
EL KV 35 Tjye	11 12	10 15	22 26	26 29	6 11	19 22	9 12	20 26
Skeleton from KV 55	10 12	15 15	16 26	29 34	11 13	16 19	9 12	20 23
YL KV 35	10 12	6 10	16 26	25 29	8 11	16 19	6 12	20 23

The Younger Lady (YL) KV 35 is a daughter of Amenhotep III and Tjye and sister of the mysterious skeleton from KV 55-man.

TABLE 7. Single tandem repeat (STR) data (Hawass et al., 2010; Hawass et al. 2012) in comparison to demonstrate the nonfeasibility of partial and few STR matches if one adds Ramses III and a modern profile as nonrelated individuals

STR	D13S317	D7S820	D2S1338	D21S11	D16S539	D18S51	CSF1PO	FGA
Ramses III	9 12	6 15	15 28	28 35	8 11	8 12	7 10	24 34.2
Mummy from KV 21 A	10 16		26	35	8	10	12	23
Amenhotep III	10 16	6 15	16 27	25 34	8 13	16 22	6 9	23 31
Yuya	11 13	6 15	22 27	29 34	6 10	12 22	9 12	20 25
Thuya	9 12	10 13	19 26	26 35	11 13	8 19	7 12	24 26
Sample from one of the authors of this study	10 11	11 13	17 20	29 30	11 11	16 17	11 14	19 23

found in his tomb. In 1999, Luban suggested the mummy might be Queen Nefertiti, based on the profile resemblance of the mummy with the famous Berlin bust (Luban, 1999). Joann Fletcher continued the search for Nefertiti and in 2004, she presented her theory based on portable x-ray, forensic face reconstruction and resemblance between art and mummy (Fletcher, 2004). A disarticulated right arm, found on the floor of KV 35 room Jc, was associated with the mummy. Because the arm, which had once held a sceptre, was bent, it was concluded that she probably was a queen. However Fletcher had some doubts that the arm may not have belonged to her after all (Fletcher, 2004). Many experts rejected the identification of CG 61072 as Nefertiti. The Supreme Court of Antiquities (SCA) conducted a genetic investigation of the arm. It was male and the SCA announced in a press conference, that CG 61072 was male, based on the genetic testing of the arm. Testing the mummy showed that the Younger Lady is in fact female (Tyldesley, 2013). The male arm obviously does not belong to the female mummy CG 61072. The position of the arms (both arms crossed: King, one bent arm: Queen) is highly speculative and an unreliable identification “fact.” To achieve conclusive results, the mummy has now been DNA tested at several points (hip, long bone, spine etc.). The body parts should be morphologically or archaeologically confirmed to belong to one mummy. In 2007, CT scans revealed the morphological resemblance of the “Younger Lady” with Tutankhamun, making her a candidate for the mother of the boy king. Therefore, from the beginning of the ‘Tutankhamun Family Project’, the ‘Younger Lady’ was the most likely candidate to be the genetic mother of Tutankha-

mun. The aDNA analysis confirmed these expectations: While CG 61072 is now accepted as the mother of Tutankhamun, her historical identity is still the debated point. Possible (and realistic) candidates of royal family members of Akhet-Aton are:

- The ca. 35 yrs. old Queen Nefertiti, supported by inscriptional evidence and facial resemblance.
- The ca. 30 yrs. old Kija, second wife of Akhenaton.
- The ca. 20–25 yrs. old Merytaton, oldest daughter of Akhenaton and Nefertiti.

While the team of the “Tutankhamun Family Project” did not offer an identity for the Younger Lady, subsequent studies have presented her as Queen Nefertiti: either as one of the daughters of Amenhotep III and Queen Tjye who changed her name to Nefertiti during the reign of her brother and husband Akhenaton (Habicht, 2011); or as daughter of (later king) Ay and his wife Tyj II (Schlögl, 2012), or as cousin-wife of Akhenaton (Gabolde, 2013a; Dodson, 2014). Another theory proposes that she is Satamun, the eldest daughter of Amenhotep III and Tjye, who did not change her name to Nefertiti, but to Kiya, the second wife of Akhenaton (Maciejewski, 2012). A recently published paper suggested that CG 61072 may be another putative sister of Akhenaton, either Baketaton or Nebetiah (Hussein et al., 2013). This confirms the incestuous union of Tutankhamun’s parents, but suggests other sisters without further explanation. Nebetiah was the youngest sister, she is not well attested in inscriptions and disappears at the end of Amenhotep’ III reign (like the other sisters). The parents of Baketaton are completely unknown. She appears to be a small girl, accompanying Queen Tjye and carried the

title of “King’s Daughter” but her father is never mentioned. She seems to be in the same age range as the daughters of Nefertiti and Akhenaton. There is no indication that that Baketaton was either was the mother of Tutankhamun (Table 6).

The mummy of Tutankhamun (reign c. 1332–1322 BC)

- Sex: Male.
- Age: 18–20 years (Derry, 1927); 18 years (Harrison and Abdalla, 1972); 23–27 years (Wente and Harris, 1992); 18–20 years (Hawass et al., 2007); 19 years (Hawass et al., 2010).
- Historic age: 17–19 years.
- Coffin: Outer coffin, wood, gilded, JE: None, in situ in KV 62 Middle coffin, ‘feather style’ design, from Ankh-Khepru-Ra, Cairo JE 60670 Inner coffin, solid gold, Cairo, JE 60671.

Tutankhamun is among the most certain cases, since he was found in situ in his tomb, enclosed in a series of shrines of which the second and third, at the time of discovery, retained their original seals. This is the only royal burial where the owner’s identity is absolutely certain (Wente and Harris, 1992). Douglas E. Derry (1874–1961) made the autopsy on November 11, 1925. He noted that the head closely resembled that of Akhenaton, suggesting a close family relationship. Akhenaton is highly unlikely to be just the father-in-law unrelated by bloodline (Derry, 1931). Macroscopic measurement of the body indicated a height of about 1.63 m (5 feet 4 $\frac{1}{4}$ inches). Derry estimated the living height according to the formulae by Karl Pearson to 1.676 meters (5 feet 6 inches; Pearson, 1899). The head of the femur was fixed to the neck of the bone and a line of unions was visible for Derry. He concluded an age of over 18 but below 20 years for Tutankhamun (Derry, 1927). His age is nowadays normally determined somewhere around 18 years; re-examination of the mummy in 1978 by the University of Michigan suggested a higher age of 23–27 years (Wente and Harris, 1992), but Harris’ findings remain unpublished (Hawass et al., 2007). Most experts reject the suggested age of 23–27 years. A modern examination using state-of-the-art technology of the 21st century was undertaken in 2005 (Hawass et al., 2007). Dental observations were also taken in account. Yet one has to consider that these age-assessment criteria are based on maturation charts derived from modern samples (Hawass et al., 2007). CT-scan revealed a mild malalignment of three wisdom teeth. Overall the dentition was in excellent condition, without notable caries, periodontal abscesses, or abrasion. Dentition and the nonfusion of the epiphyseal plates at the distal right femur both indicate an 18–22 year old individual. Unlike his ancestors, Tutankhamun did not suffer from major vertebrae deformation. The “Tutankhamun Family Project” also established a genetic 5-generation family tree (Hawass et al., 2010). Eight STR markers (short tandem repeats: genetic loci which vary by the number of repeats of a 1–6 base pair motif) were tested for Tutankhamun.

DISCUSSION

On-going controversy: likelihood of kinship

Not only were the molecular genetic data questioned (Baker, 2010; Braverman and Mackowiak, 2010; Gad,

2010; Gamble, 2010; Timmann and Meyer, 2010) but also speculative Egyptological interpretation: It was claimed that mummy CG 61074 is in fact King Ay, wrongly relabeled as Amenhotep III by the priests of the 21st Dynasty (Schlögl, 2012). The Amarna tradition of mummification style, age assessment, and identification a consort of Queen Tjye were neglected. Based on a 5-allele match between the mummy of Amenhotep III and Yuya it was also claimed that Yuya was an uncle of Amenhotep III and therefore a putative brother of King Thutmose IV, while the mummy KV 21A should be, not a putative mother of Tutankhamun’s dead born children, but rather a candidate for an identification as Queen Mutemwia, the mother of King Amenhotep III and great-grand mother of Tutankhamun (Gabolde, 2013a). Without hard evidence, such theories remain speculative. But they highlight the problem of allele sharing in related and unrelated individuals: In legal cases, the courts of the United Kingdom today demands 10 matches for parentage claims (Second Generation Multiplex Plus, SGM+ with 11 loci) while North America requires 13 matches (Combined DNA Index System, CODIS with 13 core loci). SGM+ tests 10 genetic markers along with the sex (XX or XY), CODIS identifies 13 STR loci and Amelogenin to determine sex (FBI, 2014). For a sibling relationship, a range of 10–13 shared alleles are needed, and at least one allele in more than 10 loci is mandatory for a hypothesis of a full-sibling relationship vs. unrelated (Farfan et al., 2004). Therefore one has to consider a nonrelation of Yuya and Amenhotep III to be more likely. Only a comparison of the genetic profiles of Thutmose IV and Yuya would confirm or disapprove the suspected brother relationship. A match of only five alleles does not prove any conclusive close family relationship. The data published by Hawass et al. gives only eight autosomal STR markers (Hawass et al., 2010). The mummy KV 21A shares only one full match and six partial matches with the other individuals in Hawass et al. (2010), and KV 21B is even worse: two full matches and one partial match.

One can take the published autosomal STR Profile of Ramses III, a ruler from the later 20th Dynasty, ~200 years later than Tutankhamun and compare it with some of the tested individuals from the 18th Dynasty (Hawass et al., 2010, 2012). Ramses III also shares two partial matches with KV 21A and one full and one partial match with Amenhotep III. The Lady Thuya shares one full match and three partial matches with Ramses III.

Even with a modern sample (belonging to a different Y-DNA haplogroup than Tutankhamun) the autosomal STR markers provide three partial matches with Amenhotep III, one partial with Ramses III and two partial matches with Yuya. The modern sample was independently tested by iGENEA/myfamilytreedna.com (Table 7).

CONCLUSIONS

All presented methods (archaeology, blood group testing, facial resemblance, inscriptions) lead to the same conclusion, supporting the presented genetic results of Hawass et al. (2010). Some attempts to claim further relationships remain problematic: if one accepts only five matches (full and partial) as proof of family relationship, many readers of this article would also be related to Tutankhamun and his family. Thus the claims that Yuya might be a brother of Thutmose IV or that one of the KV 21 mummies may be Queen Mutemwia (the mother

TABLE 8. Suggested identifications

Mummy Invent. No	Previous Identifications	Hawass et al. (2010)	Schliögl (2012)	Gabalde (2013a,b)	Present Study
Mummy CG 61065	Thutmosis I	Unidentified royal	—	—	Unidentified royal Figure 1 & 2
Mummy CG 61066	Thutmosis II	Thutmosis II	—	—	Thutmosis II Figure 3 & 4
Mummy CG 61068	Thutmosis III	—	—	—	Thutmosis III Figure 5 & 6
Mummy CG 61069	Amenhotep II	—	—	—	Amenhotep II
Mummy CG 61073	Thutmosis IV	—	—	—	Thutmosis IV Figure 7 & 8
Mummy CG 61074	Amenhotep III	Amenhotep III	—	Amenhotep III	Amenhotep III Figure 9 & 10
Mummy CG 51190	Yuya	Yuya	Ay Yuya	Yuya, brother of Thutmosis IV	Yuya
Mummy CG 51191	Thuya	Thuya	Thuya	Thuya	Thuya
Mummy CG 61075	Akhenaton or Smenkhkare	Akhenaton	Smenkhkare	Akhenaton	Akhenaton Figure 11 & 12
Mummy CG 61070	Queen Tjye	Queen Tjye	Queen Tjye II, wife of Ay	Queen Tjye	Queen Tjye Figure 13 & 14
Mummy CG 61072	Unidentified	Unidentified	Nefertiti	Nefertiti	Nefertiti Figure 15 & 15
Mummy KV 62	Tutankhamun	Tutankhamun	Tutankhamun	Tutankhamun	Tutankhamun
Mummy KV 21 A	Unidentified	Unidentified	—	Queen Mutemwia?	Unidentified female royal
Mummy KV 21 B	Unidentified	Unidentified	—	—	Unidentified female royal

of Amenhotep III) cannot be proven based only on partial matches of the autosomal STR data alone. It would require sufficient complete matches, preferably with Y-DNA or mtDNA markers to establish a more reliable family lineage.

Based on anthropology, age-at-death, genetics, historic inscription, and name tags by the ancient restorers we propose the following identifications: Table 8.

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LITERATURE CITED

- Anderung C, Persson P, Bouwman A, Elburg R, Götherström A. 2008. Fishing for ancient DNA. *Forensic Sci Int Genet* 2:104–107.
- Anon. 1976. Queen Tjye Found! *Orient Inst News Notes* 30.
- Arrizabalaga M. 2015. «Si hay una cámara secreta en la tumba de Tutankamón es más probable que esté Meritaton que Nefertiti». El egiptólogo francés Marc Gabalde cree que la momia de la mítica esposa de Akenatón es la conocida como la Dama Joven. *ABC Cult* [Internet]. Available at: <http://www.abc.es/cultura/20150929/abci-camara-secreta-tumba-tutankamon-201509281011.html>. Accessed on December 12, 2015.
- Arnaud B. 2015. Sur la piste de Néfertiti ? *Sci Avenir* [Internet]. Available at: <http://www.sciencesetavenir.fr/archeo-paleo/archeologie/20150809.OBS3899/sur-la-piste-de-nefertiti.html>
- Baker BJ. 2010. King Tutankhamun's family and demise. *JAMA* [Internet] 303:2471–2472. author reply 2473–5.
- Bickel S. 2013. Ein neues Grab im Tal der Könige. *Antike Welt* 1:75–82.
- Bickel S. 2014. Basler Ägyptologen identifizieren Grab der Königskinder. *Univ Basel Medien* [Internet]. Available at: <https://www.unibas.ch/de/Aktuell/News/Uni-Research/Basler-gyptologen-identifizieren-Grab-der-K-nigskinder.html>. Accessed on December 11, 2015.
- Bickel S, Paulin-Grothe E. 2012. A New Tomb in the VOK: KV 64. *KMT* 23:8–31.
- Bickel S, Paulin-Grothe E. 2013. Preliminary Report on the Work carried out during the season 2013. Available at: <https://aegyptologie.unibas.ch/forschung/projekte/university-of-basel-kings-valley-project/report-2013/>. Accessed on December 11, 2015.
- Bickerstaffe D. 2006. Examining the Mystery of the Niagra Falls Mummy. Was He from the Royal Mummies Cache? And Is He Ramses I? *KMT* 17:26–33.
- Bickerstaffe D. 2009. Identifying the Royal Mummies. Refugees For Eternity: The Royal Mummies of Thebes. London: SOS Free Stock; Canopus Press.
- Bickerstaffe D. 2011. Have the DNA test proved Akhenaten was Tutankhamun's father? Or did they told us something else? Available at: <http://www.dylanb.me.uk/wp/?p=463>. Accessed on August 6, 2011.
- Bouwman AS, Chilvers ER, Brown KA, Brown TA. 2006. Brief communication: identification of the authentic ancient DNA sequence in a human bone contaminated with modern DNA. *Am J Phys Anthropol* 131:428–431.
- Braverman IM, Mackowiak PA. 2010. King Tutankhamun's family and demise. *JAMA* [Internet] 303:2472–2473. author reply 2473–2475.
- Brugsch E, Maspero G. 1881. *La trouvaille de Deir-el-Bahari*. Le Caire: Cairo, Imprimerie Française F. Mourés & Co.
- Buckley S. 2012. Lecture at Ancient World Tours Conference. University College London 18. August 2012.

- Buckley S. 2014. Personal Information on the mummification techniques applied in the Amarna period (Turin. Museo Egizio).
- Burzacott J. 2015. Meet the Real Owner of Tutankhamen's Tomb. Nile Mag [Internet]. Available at: <http://www.nilemagazine.com.au/featured-post/2015/7/28/meet-the-real-owner-of-tutankhamunstomb>
- Camerarius P, Maier G. 1625. Philippi Camerarii Operae horarum succisivarum, sive, Meditationes historicae, das ist, Historischer Lustgarten: in welchemallerley denckwirdige, nützliche vnd lustige Historien und Exempel zu finden: secunda Centuria Historica: das ist, Ander Theil de. Leipzig: Leipzig: In Verlegung Michael Wachssmanns Buchh.
- Carter H. 2010. The Tomb of Tut-Ankh-Amen. Cambridge: Cambridge Library Collection - Archaeology.
- Carter H, Maspero G. 1903. Procès-Verbal D'Examen Du Corps Du Pharaon Aménôthes II. ASAE 3:120–121.
- Clayton PA. 1995. Die Pharaonen. Herrscher und Dynastien im Alten Ägypten. München: Bechtermünz.
- Connolly RC, Harrison RG, Ahmed S. 1976. Serological evidence for the parentage of Tut'ankhamun and Smenkhare. JEA 62:184–185.
- Daressy G. 1909. Cercueils des cachettes. Catalogue général des antiquités égyptiennes du Musée du Caire/Service des Antiquités de l'Égypte; 61001/61044. Le Caire: Impr. de l'Inst. Français d'Archéologie Orientale.
- Davis TM. 1907. The Tomb of Ioiya and Touiyou. London: Constable & Co.
- Davis TM. 1910. The Tomb of Queen Tiye. London: Constable & Co.
- Decker W. 1971. Die physische Leistung Pharaos: Untersuchungen zu Heldenentum, Jagd und Leibesübungen der ägyptischen Könige. Köln: Historisches Institut der Deutschen Sporthochschule.
- Decker W. 1987. Sport und Spiel im Alten Ägypten. München: Beck.
- Derry DE. 1927. Report Upon The Examination Of Tut-Ankh-Amen's Mummy. In: The Tomb of Tut.ankh.Amen, Vol. 2, 2010th ed. Cambridge: Cambridge University Press. p 143–161.
- Derry DE. 1931. Note On The Skeleton Hitherto Believed To Be That Of King Akhenaten. ASAE 31:115–119.
- Derry DE. 1940. An Examination Of The Bones Of King Psusennes I. ASAE 40:967–940.
- Dijk J van. 2009. The Death of Meketaten. In: Brand PJ, Cooper L, editors. Causing His Name to Live: Studies in Egyptian Epigraphy and History in Memory of William J. Murnane. Culture and History of the Ancient Near East, Vol.37. Leiden: Brill. p 83–88.
- Dodson A. 2009. Amarna Sunset. Cairo: The American University Press.
- Dodson A. 2014. Amarna Sunrise. Egypt: from Golden Age to Age of Heresy. Cairo: The American University Press.
- Dunham D. 1931. A Fragment From The Mummy Wrappings Of Tuthmosis III. JEA 17:209–210.
- El-Aref N. 2014. Almost 60 royal mummies discovered in Egypt's Valley of the Kings. Ahram Online [Internet]. Available at: <http://english.ahram.org.eg/News/100031.aspx>. Accessed on April 28, 2014.
- El-Aref N. 2015. Egyptian minister believes hidden chamber may not contain Queen Nefertiti. Ahram Online [Internet]. Available at: <http://english.ahram.org.eg/News/149605.aspx>. Accessed on December 12, 2015.
- von Falk M. 2012. Zwischen Echnaton und Tutanchamun. Sokar 25:86–97.
- Farfan MJ, Prieto V, Sanz P. 2004. Allele sharing in related and unrelated individuals: implications in kinship analysis. Int Congr Ser 1261:449–451.
- FBI. 2014. Frequently Asked Questions (FAQs) on the CODIS Program and the National DNA Index System. Available at: <http://www.fbi.gov/about-us/lab/biometric-analysis/codis/codis-and-ndis-fact-sheet>. Accessed on December 11, 2015.
- Felske C. 2014. Fast 60 königliche Mumien im Tal der Könige gefunden. Selkets Blog [Internet]. Available at: <http://blog.selket.de/aus-der-archaeologie/fast-60-koenigliche-mumien-im-tal-der-koenige-gefunden>. Accessed on December 11, 2015.
- Felske C. 2015. Liegt Nofretete noch unentdeckt in Tutanchamuns Grab? Selkets Blog [Internet]. Available at: <http://blog.selket.de/aus-der-forschung/liegt-nofretete-noch-unentdeckt-intutanchamuns-grab#more-8977>
- Fletcher J. 2004. The Search for Nefertiti. New York: William Morrow.
- Forbes D. 1998. Tombs, Treasures, Mummies: Seven Great Discoveries Of Egyptian Archaeology. Weaverville NC: KMT Communications.
- Gabolde M. 2001. Das Ende der Amarnazeit. In: Grimm A, Schoske S, editors. Das Geheimnis des goldenen Sarges. Echnaton und das Ende der Amarnazeit. München: Lipp. p 9–41.
- Gabolde M. 2009. Under a Deep Blue Starry Sky. In: Brand P, Cooper L, editors. Causing His Name to Live: Studies in Egyptian Epigraphy and History in Memory of William J. Murnane. Culture and History of the Ancient Near East Volume 37. Leiden: E. J. Brill Academic Publishers. p 109–120. Available at: https://web.archive.org/web/20131012051415/http://cassian.memphis.edu/history/murnane/M_Gabolde.pdf
- Gabolde M. 2013a. L'ADN de la famille royale amarnienne et les source égyptiennes. ENiM [Internet] 6:177–203. Available at: http://www.enim-egyptologie.fr/revue/2013/10/Gabolde_ENIM6_p177-203.pdf
- Gabolde M. 2013b. A different take on Tut. University of Harvard Lecture, February 11, 2013. Available at: <http://news.harvard.edu/gazette/story/2013/02/a-different-take-on-tut/>
- Gad YZ. 2010. King Tutankhamun's Family and Demise (Reply). JAMA 303:2473–2475.
- Galling K, Borger R, Edel E. 1968. Textbuch zur Geschichte Israels. Tübingen: J.C.B. Mohr (P. Siebeck).
- Gamble JG. 2010. King Tutankhamun's family and demise. JAMA 303:2472- author reply 2473–5.
- Germer R. 2001. Die Mumie aus dem Sarg in »KV55«. In: Grimm A, Schoske S, editors. Das Geheimnis des goldenen Sarges. Echnaton und das Ende der Amarnazeit. München: Lipp. p 58–61.
- Gilbert MTP, Barnes I, Collins MJ, Smith C, Eklund J, Goudsmit J, Poinar H, Cooper A. 2005. Long-term survival of ancient DNA in Egypt: response to Zink and Nerlich (2003). Am J Phys Anthropol 128:110–114. discussion 115–8.
- Gohar R. 2015. Interview with Nicholas Reeves: The archaeologist on brink of solving mystery of Queen Nefertiti's burial. Ahram Online [Internet]. Available at: <http://english.ahram.org.eg/News/137945.aspx>.
- Grabherr S, Cooper C, Ulrich-Bochsler S, Uldin T, Ross S, Oesterhelweg L, Bolliger S, Christe A, Schnyder P, Mangin P, Thali MJ. 2009. Estimation of sex and age of "virtual skeletons"—a feasibility study. Eur Radiol. 19:419–429.
- Graefe E. 1999. Die königliche Cachette TT 320 von Deir el-Bahri. Nachgrabungen im berühmtesten Königsmumienversteck Ägyptens. Antike Welt 4:369–374.
- Graefe E. 2011. Der angebliche Zahn der angeblich krebsskranken Diabetikerin Königin Hatschepsut, oder: Die Mumie der Hatschepsut bleibt unbekannt. Göttinger Miszellen 231:41–43.
- Graefe E, Belova G. 2010. The Royal Cache TT 320: a re-examination. Cairo: Supreme Council of Antiquities.
- Grimm A, Schoske S. 2001. Das Geheimnis des goldenen Sarges. Echnaton und das Ende der Amarnazeit. München: Lipp.
- Habicht ME. 2011. Nofretete und Echnaton: Das Geheimnis der Amarna-Mumien. Leipzig: Koehler + Amelang Gmbh.
- Habicht ME. 2012. Das Geheimnis der Amarna-Mumien. DNA-Untersuchung klären Verwandtschaftsverhältnisse auf. Antike Welt 6:21–26.
- Habicht ME. 2014a. Das Imperiale Ägypten. Die Geschichte des Neuen Reiches und der dritten Zwischenzeit. Die 18. bis 22. Dynastie (1543 – 757 v. Chr.). Berlin: epubli.
- Habicht ME. 2014b. Semenchkare - Phantom-König(in) von Achet-Aton. Berlin: epubli.
- Habicht ME. 2014c. Some reflections on the proposed 8-year coregency of Amenhotep III and Amenhotep IV Akhenaton. Göttinger Miszellen 241:25–36.
- Habicht ME. 2015. Semenchkare - Phantom-König(in) von Achet-Aton [2. Ed], 2nd ed. Berlin: epubli.

- Habicht ME, Bouwman AS, Rühli FJ. 2013. Die Bedeutung von Kanopen als Quelle medizinischer und ägyptologischer Informationen. *Göttinger Miszellen* 237:25–39.
- Habicht ME, Galassi FM, Wettengel W, Rühli FJ. 2015. Who else might be in Pharaoh Tutankhamun's tomb (KV 62, c. 1325 BC)? [online]. Academia [Internet]. Available at: https://www.academia.edu/16769699/Who_else_might_be_in_Pharaoh_Tutankhamun_s_tomb_KV_62_c._1325_BC. Accessed on December 12, 2015.
- Harris JE, Weeks KR. 1973. *X-Raying the Pharaohs*. New York: Charles Scribner's Sons.
- Harris JE, Wente EF. 1979. The Identification of the 'Elder Lady' in the Tomb of Amenhotep II as Queen Tiye. *Del Med J* 51:39–93.
- Harris JE, Wente EF, Cox CF, Nawaway IE, Kowalski CJ, Storey AT, Russell WR, Ponitz PV, Walker GF. 1978. Mummy of the 'Elder Lady' in the tomb of Amenhotep II: Egyptian museum catalog number 61070. *Science* 200:1149–1151.
- Harris JR. 2004. En sag om forveksling. *Papyrus* 24:4–13.
- Harrison RG. 1966. An Anatomical Examination Of The Pharaonic Remains Purported To Be Akhenaton. *JEA* 52:95–119.
- Harrison RG. 1971. Post Mortem on Two Pharaohs. Was Tutankhamen's Skull Fractured? *Buried Hist* 4:114–129.
- Harrison RG, Abdalla AB. 1972. The Remains of Tutankhamun. *Antiquity* 46:8–14.
- Harrison RG, Connolly RC, Abdalla A. 1969. Kinship of Smenkhkare and Tutankhamen demonstrated serologically. *Nature* 224:325–326.
- Hawass Z. 2006. Quest for the Mummy of Hatshepsut. Could She Be the Lady in the Attic of the Egyptian Museum, Cairo? *Kmt* 17:40–43.
- Hawass Z. 2007. The Scientific Search for Hatshepsut's Mummy. *Kmt* 18:20–25.
- Hawass Z, Gad YZ, Ismail S, Khairat R, Fathalla D, Hasan N, Ahmed A, Elleithy H, Ball M, Gaballah F, Wasef S, Fateen M, Amer H, Gostner P, Selim A, Zink A, Pusch CM. 2010. Ancestry and pathology in King Tutankhamun's family. *JAMA* 303:638–647.
- Hawass Z, Ismail S, Selim A, Saleem SN, Fathalla D, Wasef S, Gad AZ, Saad R, Fares S, Amer H, Gostner P, Gad YZ, Pusch CM, Zink AR. 2012. Revisiting the harem conspiracy and death of Ramesses III: anthropological, forensic, radiological, and genetic study. *BMJ* 345:e8268.
- Hawass Z, Shafik M, Rühli F, Selim A. 2007. Computed Tomographic Evaluation of Pharaoh Tutankhamun, ca. 1300 BC. *ASAE* 81:159–173.
- Hekkala E, Shirley MH, Amato G, Austin JD, Charter S, Thorbjarnarson J, Vliet KA, Houck ML, Desalle R, Blum MJ. 2011. An ancient icon reveals new mysteries: mummy DNA resurrects a cryptic species within the Nile crocodile. *Mol Ecol* 20:4199–4215.
- Helck W. 1961. *Urkunden der 18. Dynastie*. Übersetzung zu den Heften 17–22. Berlin: Akademie-Verlag.
- Helck W. 2001. Das Grab Nr. 55 im Königsgräbertal. In: Grimm A, Schoske S, editors. *Mainz am Rhein: Philipp von Zabern*.
- Hessler P. 2015. Radar Scans in King Tut's Tomb Suggest Hidden Chambers. *Natl Geographic* [Internet]. Available at: <http://news.nationalgeographic.com/2015/11/151128-tut-tomb-scans-hidden-chambers/>. Accessed on December 12, 2015.
- Hornung E. 2005. *Echnaton: die Religion des Lichtes*. Düsseldorf: Patmos Verlag.
- Hornung E. 2008. *Grundzüge der Ägyptischen Geschichte*, 6th ed. Darmstadt: WBG Wissenschaftliche Buchgesellschaft.
- Hussein F, James E. Harris. 1988. The Skeletal Remains From Tomb No 55. 5th International Congress of Egyptology, Cairo 1988. Abstracts. Cairo. p 140.
- Hussein K, Matin E, Nerlich AG. 2013. Paleopathology of the juvenile Pharaoh Tutankhamun-90th anniversary of discovery. *Virchows Arch* 463:475–9.
- Ibrahim M. 2014. Egyptologists' Electronic Forum: EEF Bulletin Board. Minist State Antiq Aff [Internet]. Available at: http://www.egyptologyforum.org/bbs/MSA_Asasif_Feb2014.pdf.
- Ikram S, Dodson A. 1998. *The Mummy in Ancient Egypt: Equipping the Dead for Eternity*. London: Thames & Hudson.
- James TGH. 2000. *Tutanchamun*. Köln: Karl Müller Verlag.
- Krauss R. 1986. Kija, die ursprüngliche Besitzerin der Kanopen aus KV 55. *MDAIK* 42:67–80.
- Kurushima JD, Ikram S, Knudsen J, Bleiberg E, Grahn RA, Lyons LA. 2012. Cats of the Pharaohs: genetic comparison of Egyptian Cat Mummies to their Feline Contemporaries. *J Archaeol Sci* 39:3217–3223.
- Lorenzi R. 2015. Who Else May Be in King Tut's Tomb? *Discovery News* [Internet]. Available at: <http://news.discovery.com/history/archaeology/who-else-may-be-in-king-tut-tomb-151015.htm>. Accessed on December 12, 2015.
- Lorenzen ED, Willerslev E. 2010. King Tutankhamun's family and demise. *JAMA* 303:2471– author reply 2473–5.
- Loth SR. 1995. Age assessment of the Spitalfields cemetery population by rib phase analysis. *Am J Hum Biol* [Internet] 7:465–471.
- Luban M. 1999. Do we have the mummy of Nefertiti? Available at: http://www.reocities.com/scribelist/do_we_have_.htm
- Lucas A. 1931. The Canopic Vases from the 'Tomb of Queen Titi'. *ASAE* 31:120–122.
- Maciejewski F. 2012. *Nofretete. Die historische Gestalt hinter der Büste*. Hamburg: Osburg Verlag.
- Malmström H, Storå J, Dalén L, Holmlund G, Götherström A. 2005. Extensive human DNA contamination in extracts from ancient dog bones and teeth. *Mol Biol Evol* 22:2040–2047.
- Marchant J. 2013. *The Shadow King: The Bizarre Afterlife of King Tut's Mummy*. Boston MA: Da Capo Press.
- Marchant J. 2014. Tutankhamun's Blood. Why everyone from the Mormons to the Muslim Brotherhood is desperate for a piece of the Pharaoh. *Matter* [Internet]. Available at: <https://medium.com/matter/9fb62a68597b>
- Marota I, Basile C, Ubaldi M, Rollo F. 2002. DNA decay rate in papyri and human remains from Egyptian archaeological sites. *Am J Phys Anthropol* 117:310–318.
- Maspero G. 1889. *Les momies royales de Déir el-Baharî*. Paris: Leroux.
- Nagel G. 1949. Le linéol de Thoutmès III. *ASAE* 4:317–329.
- Pearson K. 1899. Mathematical Contributions to the Theory of Evolution. V. On the Reconstruction of the Stature of Prehistoric Races. *Philos Trans R Soc London Ser A* [Internet] 192: 169–244. Available at: <https://archive.org/details/philtrans06400427>
- Pettigrew TJ. 1834. *History of egyptian mummies: and an account of the worship and embalming of the sacred animals by the egyptians*. London: Orme, Brown, Green and Longman.
- Phizackerley K. 2010. DNA Shows that KV55 Mummy Probably Not Akhenaten. Available at: <http://www.kv64.info/2010/03/dna-shows-that-kv55-mummy-probably-not.html>. Accessed on December 11, 2015.
- Piacentini P, Orsenigo C. 2005. La valle dei Re riscoperta. I giornali di scavo di Victor Loret (1898-1899 e altri inediti). Skira.
- Piankoff A. 1964. *The Litany of Re*. New York Pantheon Books, Bollingen Foundation.
- Poisson O. 2014. Basel Egyptologists identify tomb of royal children. Available at: http://www.eurekalert.org/pub_releases/2014-04/uob-bei042814.php. Accessed on December 11, 2015.
- Quilici B. 2007. *Discovery Channel Secrets of Egypt's Lost Queen*. USA. Available at: <https://www.youtube.com/watch?v=5yRSSPhLzeM>.
- Quilici B. 2010. *Discovery Channel: King Tut unwrapped: Royal Blood*. USA. Available at: <http://dsc.discovery.com/tv-shows/other-shows/videos/king-tut-unwrapped-king-tuts-paternal-line.htm>.
- Reeves NC. 2002. *Echnaton. Ägyptens falscher Prophet*. Mainz am Rhein: Philipp von Zabern.
- Reeves NC. 2015a. The Burial of Nefertiti? Amarna Royal Tombs Proj Occas Pap [Internet] 1:1–16. Available at: https://www.academia.edu/14406398/The_Burial_of_Nefertiti_2015. Accessed on December 11, 2015.
- Reeves NC. 2015b. The Burial of Nefertiti? Addenda and Corrigenda (2015). *Academia* [Internet]. Available at: https://www.academia.edu/15247276/The_Burial_of_Nefertiti_Addenda_and_Corrigenda_2015_. Accessed on December 11, 2015.

- Reeves NC, Wilkinson RH. 2000. Das Tal der Könige. Sonderausgabe. Geheimnisvolles Totenreich der Pharaonen: Amazon.de: Nicholas Reeves, Richard H. Wilkinson: Bücher. Bechtermünz.
- Reeves NC, Wilkinson RH. 2002. The Complete Valley of the Kings: Tombs and Treasures of Egypt's Greatest Pharaohs. London: Thames and Hudson Ltd.
- Richards MB, Sykes BC, Hedges RE. 1995. Authenticating DNA extracted from ancient skeletal remains. *J Archaeol Sci* 22:291–299.
- Robins G, Shute CCD. 1983. The physical proportions and living stature of New Kingdom pharaohs. *J Hum Evol* 12: 455–465.
- Rose M. 2002. Who's in Tomb 55? *Archaeology* 5:22–27.
- Rühli FJ, Ikram S. 2014. Purported medical diagnoses of Pharaoh Tutankhamun. Ca. 1325 BC. *HOMO J Comp Hum Biol* 65:51–63.
- Rühli F, Ikram S, Bickel S. 2015. New Ancient Egyptian human mummies from the Valley of the Kings, Luxor: Anthropological, radiological and Egyptological investigations. *Biomed Res Intern*. 530362. doi: 10.1155/2015/530362.
- Saleem SN, Hawass Z. 2013. Variability in Brain Treatment During Mummification of Royal Egyptians Dated to the 18th–20th Dynasties: MDCT Findings Correlated With the Archaeologic Literature. *Am J Roentgenol* 200:336–344.
- Saleem SN, Hawass Z. 2015. Subcutaneous Packing in Royal Egyptian Mummies Dated From 18th to 20th Dynasties [online]. *J Comput Assist Tomogr* [Internet], 39:301–306. Available at: <http://journals.lww.com/jcat/pages/articleviewer.aspx?year=9000&issue=00000&article=99769&type=abstract>
- Schaden OJ. 1984. Clearance of the Tomb of King Ay. *JARCE* 21:39–64.
- Schlögl HA. 2012. Nofretete. Die Wahrheit über die schöne Königin. München: Beck C. H.
- Schlögl HA. 2014. Königin Nofretete. Sokar [Internet] 29:46–55.
- Schnabel D. 1980. Wer waren Tut-ench-Amuns Eltern? *Altertum* 26:89–95.
- Schneider T. 1996. Lexikon der Pharaonen. München: Deutscher Taschenbuch Verlag GmbH & Co.
- Schott K. 2012. Streit um Tutanchamun. *epoc* 4:76–81.
- Schüle C. 2012. Nofretete. Die Schöne ist gekommen. *Natl Geogr* (German Ed) Dec.
- Shaw I. 2003. The Oxford history of ancient Egypt. In: Ian S, editor. Oxford: Oxford University Press. p 46–75.
- Smith GE. 1912. The Royal Mummies. Cairo: Impr. de l'Inst. Français d'Archéologie Orientale (reprint 2000: Duckworth).
- Stanglmeier GFL. 2012. Der Fall Nofretete. München: Herbig Verlag.
- Thimes JL. 2008. A Dental Observation. *Kmt* 19:6–7.
- Timmann C, Meyer CG. 2010. King Tutankhamun's family and demise. *JAMA* 303:2473- author reply 2473–5.
- Tyldesley J. 2008. Die Königinnen des Alten Ägypten. Von den frühen Dynastien bis zum Tod Kleopatras. Leipzig: Koehler + Amelang GmbH.
- Tyldesley J. 2013. Tutankhamen's Curse. The developing history of an Egyptian king. London: Profile Books.
- van der Perre A. 2012. Nofretetes [vorerst]letzte dokumentierte Erwähnung. Im Licht von Amarna. 100 Jahre Fund der Nofretete. Petersberg: Imhof Verlag. p 195–197.
- Valentín FJM. 2014. Proof of an Amenhotep III/IV Coregency Found in Assasif Tomb 28. *Kmt* 25:17–27.
- Virchow R. 1888. Die ägyptischen Königsmumien im Museum zu Bulaq. Sitzungsberichte der königlich preussischen Akademie der Wissenschaften zu Berlin (1888) XXXIV. Berlin: Verlag der Königlichen Akademie der Wissenschaften. p 767–788. Available at: http://archive.org/stream/sitzungsberichte1888deutsch/sitzungsberichte1888deutsch_djvu.txt
- von Beckerath J. 1997. Chronologie des Pharaonischen Ägypten. Mainz: Philipp von Zabern.
- Von Rauchhaupt U. 2015. Wer liegt hinter der vermauerten Wand? Frankfurter Allg [Internet]. Available at: http://www.faz.net/aktuell/wissen/mensch-gene/hinweise-auf-unbekanntekammern-im-grab-des-tutanchamun-13740138.html?printPagedArticle=true#pageIndex_2
- Weeks KR. 2014. The Theban Mapping Project. Available at: <http://www.thebanmappingproject.com/>
- Weeks KR, Weeks S, Ikram S, Hetherington N, Hassan AM, Bakhoun DI, Kaéienik M, Chan W, El-Hadidi L, Jones LT, Ali MA. 2014. The Theban Mapping Project. Available at: <http://www.thebanmappingproject.com/>. Accessed on December 11, 2015.
- Wente EF. 1995. Who Was Who Among The Royal Mummies. *Orient Inst News Notes* 144.
- Wente EF, Harris JE. 1992. Royal Mummies of the Eighteenth Dynasty: A Biologic and Egyptological Approach. In: Nicholas Reeves C, editor. After Tut'ankhamun. Research and Excavation in the Royal Necropolis at Thebes. London: Kegan Paul International. p 2–20.
- Woodward SR, Gaballah F, Filer J, Fletcher J, Reeves NC, Harris JE, Iskander N. 2001. The Private Lives Of The Pharaohs - The Fall Of The House Of Tutankhamun. USA. Available at: <https://www.youtube.com/watch?v=JVVbVcLLhA>.
- Yang D, Watt K. 2005. Contamination controls when preparing archaeological remains for ancient DNA analysis. *J Archaeol Sci* 23:331–336.
- Zink A, Haas CJ, Reischl U, Szeimies U, Nerlich AG. 2001. Molecular analysis of skeletal tuberculosis in an ancient Egyptian population. *J Med Microbiol* 50:355–66.
- Zink A, Nerlich AG. 2003. Molecular analyses of the 'Pharaohs': Feasibility of molecular studies in ancient Egyptian material. *Am J Phys Anthropol* 121:109–11.