

**The Process of Identification: Can Mummy KV60-A be Positively Identified as
Hatshepsut?**

ARC2EGY

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In June 2007, Dr. Zahi Hawass, the former Secretary General of the Egyptian Supreme Council of Antiquities, announced to the world that he had identified mummy KV60-A as the body of Pharaoh Maatkara Khnemetamun-Hatshepsut ('Truth is the Soul of Ra', 'She who embraces Amun – the Foremost of Women'), an early New Kingdom queen who became king of Egypt. The whereabouts of this queen-turned-pharaoh had been one of Egyptology's mysteries, as her body was not in her tomb, nor part of the royal mummy cache discovered in 1881. One item found in the cache had been owned by her – a small box containing a mummified internal organ. This organ may have belonged to Hatshepsut, or to her namesake, a princess of a later Dynasty. Two unidentified female mummies were ultimately selected as potentially being the female pharaoh, due to their connection with a coffin belonging to a royal nurse, possibly Hatshepsut's wet-nurse. They were both CT scanned but, although one of the mummies was more likely to be related to Hatshepsut's male relatives based on a morphological study, neither mummy could be identified as being the female pharaoh. However, the box containing the mummified organ contained a clue – a molar tooth which, according to the Egyptologists, matched the mouth of one of the two mummies. The identification of mummy KV60-A as Hatshepsut is hinged on this tooth, yet there are serious questions raised about the tooth itself – the lack of the third root of the supposed upper back molar. There are also problems surrounding the DNA test conducted to prove a familial relationship between KV60-A, and the mummies of Hatshepsut's male relatives. Unfortunately, until these issues are resolved, mummy KV60-A cannot be positively identified as Pharaoh Hatshepsut.

Hatshepsut was a royal woman of the early 18th Dynasty, daughter of Thutmose I, wife and half-sister to Thutmose II, to whom she bore a daughter called Neferura, and co-regent to her young stepson-nephew, Thutmose III (Bickerstaffe 2008, p. 3, 11; Hawass

2007h; Tyldesley 1998, p. 1; Figure 1). Approximately six years into the co-regency she took full power, with the backing of the powerful priests of the god Amun, along with all of the trappings of a male pharaoh (Bickerstaffe 2008, p.3; Hawass 2007h; Tyldesley 1998, p.1; Figure 2). During her reign (r. approximately 1479-1458 BC), Egypt prospered, as she initiated building projects, military action against Egypt's enemies, and opened trade routes to Phoenicia, the Sinai, and the exotic Land of Punt (p. 141-143, 144, 154). Around year 20 of her reign she disappeared from Egypt's historical records, presumably coinciding with her death (Bickerstaffe 2008, p.3; Tyldesley 1998, p. 1). Scholars have speculated on the cause of her death, but none knew for certain as her body had not yet been positively identified.



Figure 1: Statue of Hatshepsut as a female wearing a pharaoh's crown (The Metropolitan Museum of Art 2012).

The female pharaoh's body was not discovered in her tomb, known as KV20 (possibly the first tomb built in the Valley of the Kings). Intended for both herself and her father, it had been looted in antiquity (Bickerstaffe 2008, p. 5; *KV20 (Thutmes I and Hatshepsut)* 2006). Nor was her body found in the royal mummy cache, discovered in 1881 (Bickerstaffe 2008, p. 3). With such an important pharaoh missing, speculation about her death was rife. So when the Discovery Channel approached Hawass with plans for a television programme about the search for Hatshepsut, he announced that he and a team of Egyptian scientists would attempt to solve the case of the missing mummy (Hawass 2007e; Hawass 2007f). They had two promising leads: a small wooden box engraved with Hatshepsut's names containing a mummified internal organ, found as part of the mummy cache; and two unidentified female mummies which had been found by Howard Carter in 1903 in KV60, a small and undecorated tomb (*KV60 (Sit-Ra, called In (?))* 2006).

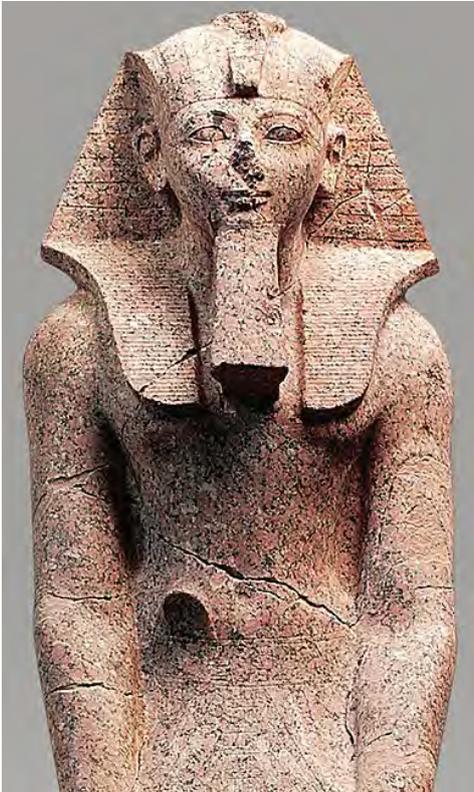


Figure 2: Statue of Hatshepsut as a male pharaoh (The Metropolitan Museum of Art 2012b).

In 1881, Emile Brugsch, a German-born assistant curator from the Bulaq Museum in Cairo, discovered a cache of New Kingdom royal mummies in a tomb (TT320) at Deir el-Bahari, about 1000 metres from tomb KV60 (Bickerstaffe 2008, p. 3; 'University Helps with Pharaoh's Identity' 2007, p. 123). The mummies had been moved by priests of the 21st Dynasty to protect them from grave robbers. They included Ahmose I, Thutmose II, Thutmose III, Seti I, and Ramesses II, and queens such as Ahmose Nefertari were also represented, but Hatshepsut was not amongst the royalty found in the cache (Bickerstaffe 2008, p. 3; Schneider 2010, p. 382). The only item relating to the female pharaoh was "a very singular relic ... a small wooden and ivory cabinet, ornamented with both cartouches of Hatasu, and containing, strange to say, a desiccated human liver – possibly hers" (Edwards 1882, p 200; Figure 3).



Figure 3: The box with the organ bundle inside (Hawass 2007d).

The box containing the aforementioned mummified liver (or spleen) was identified as belonging to the pharaoh as her birth name (Khnetmetamun-Hatshepsut) and throne name (Maatkara) were inscribed in cartouches on the wood-and-ivory box (Forbes 2012, p. 65). Although Edwards did not mention the resin dripped across the 18cm tall wooden box, it is likely that the resin was part of an anointing ritual used by the priests who rescued the viscus and placed it in the tiny, ill-fitting container (Forbes 2012, p. 71; Figure 4). The internal organ must have been placed into the box between the late 18th and the late 21st Dynasties, up to 400 years after the reign of Hatshepsut. Never intended as a canopic jar – Hatshepsut’s canopic jars had been found in KV20, with the organs missing – the small jewellery box was possibly utilised as a make-shift container for internal organs (Bickerstaffe 2008, p. 10; Graefe 2011, pp. 42-43). Scholars are still debating to whom the viscus belongs, either to Pharaoh Maatkara Hatshepsut or princess Maatkara of the 21st Dynasty (Graefe 2011, p. 41, 43; Hawass 2007f; Rose 2007). After extensive discussions, Egyptian Egyptologists have decided not to sample the mummified organ for DNA testing due to its delicate nature (Gad 2012, pers. comm., 11 Sep). Therefore, no DNA comparison is currently scheduled. Instead, the search for the mummy of Pharaoh Hatshepsut focused on two unidentified mummies.



Figure 4: Rear view of the box, note the resin stains on the outside (Hawass 2007c).

As the Egyptian team was searching for a specific type of body, the two women found in KV60 were selected as the best candidates out of a small group of female mummies. The most likely candidates would be wrapped in fine linen, aged 40-50 (Hatshepsut was 22 years old when she became pharaoh and reigned for 20 years) with broadly spaced eyes, an aquiline nose, small mouth and heart-shaped face (*Secrets of Egypt's Lost Queen* 2007). According to Carter (1903, p. 176), the two unidentified mummies were both older ladies who were “fairly well preserved and had long hair of a golden colour”. One was found lying on the floor (KV60-A; Figure 5) whilst the other (KV60-B; Figure 6) was on the bottom of a looted sarcophagus (Carter 1903, p. 176). Due to the damaged state of the lidless coffin, the only readable inscription was: “Great Royal Nurse, In. True of voice.”

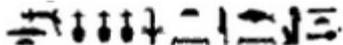
 (Bickerstaffe 2008, p. 7; Hawass 2006, p. 43). The nurse named on the coffin base was subsequently identified as Hatshepsut's wet-nurse, Sitra-In (Bickerstaffe 2008, p. 7; Schneider 2010, p. 383; Hawass et al. 2010, p. 640). Hawass (2006, p. 43) noted that the 2.3m long coffin was much larger than the 1.5m tall mummy of KV60-B, and he suggested that the coffin would better suit the obese KV60-A. KV60-B's finer linen wrappings also set her apart. He was thus persuaded that the mummy lying on the floor (KV60-A) was Sitra-In, and the smaller mummy in the Great Royal Nurse's coffin (KV60-B) was Hatshepsut (Hawass 2006, p. 43). Shortly afterwards, Hawass (2006, p. 20) decided to employ new technologies in the Discovery Channel's quest to find Hatshepsut.



Figure 5: The KV60-A mummy lying on the floor in tomb KV60 (Moreno n.d.).



Figure 6: The KV60-B mummy in the large coffin (Forbes 2012, p.68).

X-ray Computed Tomography (CT) scans were employed to try to identify any peculiarities in the bodies of the mummies. Along with both KV60-A and KV60-B, two other female mummies were given CT scans. Hatshepsut's known male family members, Thutmose II and Thutmose III were also scanned, as were artefacts relating to the female king. The mummy originally believed to have been Thutmose I was also processed, but the CT results indicated that this mummy could not be this king (Hawass 2007g, pp. 21-22). Subsequently, from a physiognomy study performed by the radiologist Dr. Selim, the Egyptologists determined that KV60-A:

...bore the most similarities to the male mummies ... Like Thutmose II and Thutmose III, she had a mild overbite and prominent zygomaticofrontal ridge; like Thutmose I, her cheekbones, chin and forehead were wide. However, her nasal bridge was wider than that of any of the three male mummies. Thus the scans pointed towards KV60-A as the most likely Hatshepsut, but did not allow us to reach any firm conclusions. (Hawass 2007g, p. 23).

The CT scans revealed that KV60-B, like Thutmose II, had a mild form of kyphoscoliosis (curvature of the spine) and a “rumpled helix of the ear” (Hawass et al. 2010, p. 642; Table 1). This morphological study, and the results of the CT scan itself, did not lead to any positive identification of the female ruler (Hawass 2007g, p. 21; Rose 2007). A serendipitous discovery during the CT scanning of Hatshepsut artefacts led the Egyptologists to the next clue in their hunt.

Marfanoid Features	Tutankhamun Lineage										Control Group				
	Tutankhamun (KV62)	Thuya (KV46)	Yuya (KV46)	Akhenaten (KV55)	Amen-hotep III (KV35)	KV35YL	Tiye (KV35EL)	Fetus 1 (KV62) ^b	Fetus 2 (KV62) ^b	KV21A	KV21B	TT320-CCG61065	Thutmose II (TT320-CCG61066)	Hatshepsut (KV60A)	Sitra-In (KV60B)
Major criteria															
Dolichostenomelia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Body height, cm	167	150	166	160	160	158	145	27.5	38	<150	<150	157	173	153	151
Scoliosis, kyphoscoliosis	+ ^c	+ ^d	-	+ ^c	-	+ ^c	+ ^c	-	+ ^c	+ ^c	+ ^c	+ ^c	+ ^c	-	+ ^c
Pectus carinatum	NA	-	-	NA	NA	-	-	NA	NA	NA	NA	-	NA	-	-
Pectus excavatum	NA	-	-	NA	NA	-	-	NA	NA	NA	NA	-	NA	-	-
Acetabular protrusion	NA	-	-	-	-	-	-	NA	NA	-	-	-	-	-	-
Pes planus	+ ^{c,e}	-	-	NA	-	NA	-	NA	NA	-	-	-	-	-	-
Minor criteria															
Dolichocephaly	-	-	+ ^{c,f}	-	-	-	-	NA	NA	NA	NA	+ ^{c,f}	+ ^{c,f}	-	-
Arachnodactyly	-	- ^g	- ^g	NA	NA	-	- ^g	-	-	-	-	NA	-	-	-
Mandibular retrognathism	+	+	-	+	+	+	-	NA	NA	NA	NA	-	+	+	-
Hypoplasia of cheek bones	-	-	-	+	-	+	-	NA	NA	NA	NA	-	-	-	-
Highly arched palate	+	-	-	+	+	-	-	NA	NA	NA	NA	-	-	-	-
Crowding of teeth	+	-	-	+	-	+	-	NA	NA	NA	NA	-	+	-	-
Striae atrophicae	-	-	-	NA	NA	-	-	NA	NA	NA	NA	-	-	-	-
Mitral annular calcification	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	-	+	-	NA
CCA feature (rumpled helix of the ear)	-	-	-	NA	NA	-	+	NA	NA	NA	NA	-	+	-	+

Abbreviations: CCA, congenital contractural arachnodactyly; EL, elder lady; minus symbol, feature absent; NA, not available (certain parts of the mummies are missing or fragmented, ie, feature cannot be observed); plus symbol, feature present; YL, younger lady.

^aNo computed tomography scan was performed on the mummy of Ahmose-Nefertari (TT320-CCG61055).

^bMany of the features cannot be evaluated in fetuses.

^cMild form.

^dCobb angle in Thuya, >20° (severe form of scoliosis or kyphoscoliosis); in all other individuals, <20° (mild form).

^ePes planus in Tutankhamun is not caused by a medial displacement of the inner malleolus (ie, no marfanoid flatfoot).

^fShape of the head is of natural occurrence, ie, not caused by craniosynostosis syndromes.

^gMadonna fingers.

Table 1: Evaluation of Marfanoid Features in the Collection of Royal 18th-Dynasty Mummies Under Investigation (Hawass et al. 2010, p. 640).

The box bearing Hatshepsut's name turned out to have a connection to KV60-A - not to her liver, but to her dental problems. Whilst scanning the wooden cabinet containing the mummified liver, the three dimensional CT images, whilst not particularly sharp, revealed a liver, intestines and, surprisingly, a molar tooth hidden in the resin inside the box (Bickerstaffe 2008, p 10; Forbes 2012, p. 65; Hawass 2007c; *Secrets of Egypt's Lost Queen* 2007). Unlike Thutmose III, KV60-A had bad teeth which comprised cavities, tooth decay, broken crowns, infection and erosion of the jaw (Hawass 2007g, pp 23-24; Rose 2007). Significantly, "the right upper seventh tooth was absent, although one root was still embedded in the jaw" which was "broken and disfigured with a large mass around it that may be soft tissue" (Hawass 2007g, p. 24). Dr. Galal El-Behri, the orthodontist working on the Hatshepsut project, concluded that the molar, with a single root still attached, was the correct size to match the gap in the jaw of KV60-A (Bickerstaffe 2008, p 10; *Egypt Says Mummy of Ancient Queen Identified* 2007; Hawass 2007b, 2007e, 2007g; Rose, M 2007). Subsequently, Hawass announced that the match was, "100 percent definitive. It is 1.80 cm (wide) and the dentist took the measurement and studied that part. He found it fit exactly 100 percent with this part," (Wright 2007). Dr. T Heilberg (2012, pers. comm., 29 Sep), dental surgeon for 39 years, notes that the CT image released by Hawass (Figure 7) is of the left side of the jaw. Without a published report on the subject, the right side of her jaw can only be seen on the *Secrets of Egypt's Lost Queen* (2007) television programme (Figure 8). A 'Frequently Asked Questions' list was released by MTV about the identification of KV60-A as Hatshepsut which stated that, "the molar ... fits within a fraction of a millimeter" and any "miniscule difference could be due to erosion of the gums after the tooth was extracted" (MTV 2007). However, not all scholars are as convinced about the match between the molar and KV60-A's jaw as Hawass and his team of specialists.



Figure 7: CT image of the left side of the KV60-A mummy (Hawass 2007b).



Figure 8: CT image of the right side of KV60-A mummy, with the mouse pointer showing the broken root (Secrets of Egypt's Lost Queen 2007).

The perfect match of the molar to KV60-A's jaw is still open for debate amongst academics. Whether the molar was pulled from the woman's mouth pre- or post-mortem is an issue, with some suggesting that the tooth was pulled whilst the woman was alive (Forbes 2012; MTV 2007), and others saying it came loose during the mummification process (Hawass 2007c). Some are also sceptical as to Hawass' conclusion that an upper molar with a single root matches a single root still in the jaw (Hawass 2007e; Hawass 2007g, p. 24; Figure 9 & 10). As Graefe (2011, p. 42) points out, to connect with the single root in the jaw, the molar in the box should have two roots rather than one. Upper molar teeth are distinguishable by their three roots (Cunningham 1818, p. 1118; Cleghorn et al. 2008, p. 177). Putting these issues aside, Hawass (2007g, p. 24) and his team have advised that the bone density of the loose molar and those still in the mummy's mouth are a close match. Further details have been published online:

More scientific proof for the match comes from the tooth density measurements. Measured in Hounsfield units – the scale for describing radio density – the densities of the tooth in the box and of those in the mummy's mouth are nearly identical (tooth in box: 1,549 HU; mummy teeth: 1,591 – considered identical since both numbers fall within 1,500-2,000 HU). These data were studied and confirmed by Dr. Paul Gostner (former head of radiology at Bolzano General Hospital in Italy and lead forensic investigator on the Ice Man mummy) and (senior computed tomography scan imaging analyst at Siemens German headquarters). (MTV 2007).

Hounsfield units are a range of numbers representing different optical densities captured by a CT machine, which uses the densities to construct CT images (Karjodkar, 2006). Despite the apparent density match, not all academics agree on the basis of a CT scan

alone, and warn against reaching conclusions from such information (Graefe 2001, p. 42; Heilberg, T 2012, pers. comm., 22 Oct; Sheldrick, P 2012, pers. comm., 16 Sep). Egyptologist Kathryn Bard notes that, “you have to be so careful in reaching conclusions from such data” (Wilford 2007). However, whilst the broken tooth could potentially belong to KV60-A, the next step in the identification of Hatshepsut is to confirm the link through DNA testing.

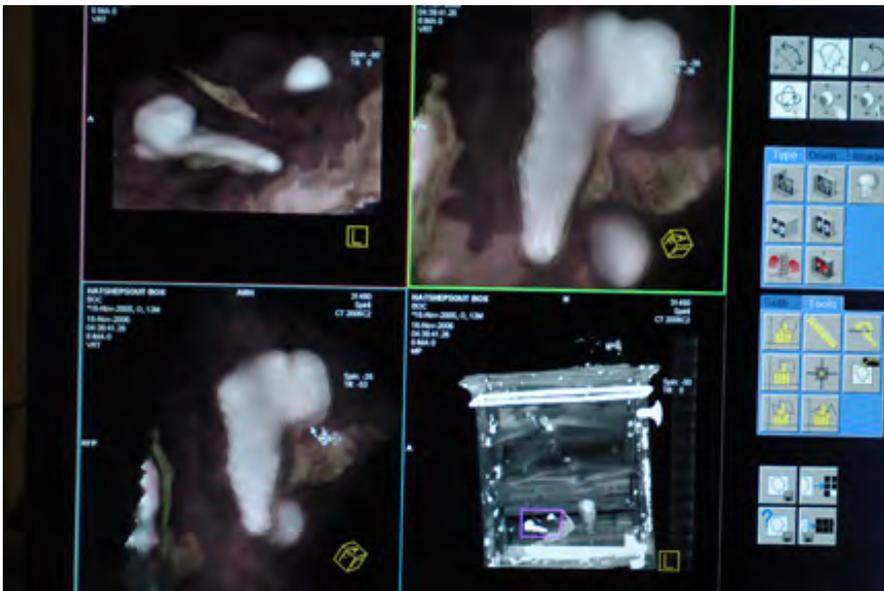


Figure 9: CT images of the box, showing the bundle and the tooth (Hawass 2007a).



Figure 10: A digital reconstruction of molar fitting into the jaw of KV60-A (*Secrets of Egypt's Lost Queen* 2007)

Both KV60 mummies were tested against Hatshepsut's relatives: Thutmose I, and Queen Ahmose Nefertari. However, there were problems, not with the new equipment supplied by the Discovery Channel and Applied Biosystems (2007, p. 2; *Secrets of Egypt's Lost Queen* 2007), but with the mummies chosen for the study itself. The CT scan of the male mummy revealed that he was too young to be Thutmose I (Elliott 2009, p. 117), nor could enough nuclear DNA be extracted for the DNA test (Elliott 2009, p. 117; *Secrets of Egypt's Lost Queen* 2007). Although Ahmose Nefertari was selected for testing as Hatshepsut's maternal grandmother (Applied Biosystems 2007, p. 2; Hawass 2007h), she is not considered to be a strong candidate as her blood relative due to a lack of historical records regarding Hatshepsut's matriarchal lineage – Ahmose Nefertari might be her great-grandmother, grandmother or no relation at all (Bickerstaffe 2008, p. 9; Forbes 2012, p. 67; Rose, M 2007). Despite this issue, her mitochondrial DNA was relatively intact (Elliott 2009, p. 117; Rose, M 2007). Hawass announced that he was sure the mummy was Hatshepsut due to DNA "similarities" with the mummy of Ahmose Nefertari, whom he described as her grandmother (*Egypt Says Mummy of Ancient Queen Identified* 2007). Dr. Corthals was more specific when she said that, "when the DNA of the mystery mummy was compared with that of Hatshepsut's ancestors, we were able to scientifically confirm that the remains were those of the 18th dynasty queen" (Haworth, 2007). However, these statements, which suggest that KV60-A and Ahmose Nefertari were related, were made on the basis of unpublished preliminary data, so no further information is available. Information on the status of the DNA testing of KV60-B is unknown (Forbes 2012, p. 69). Work is still currently being undertaken towards the completion of this project (Gad, YZ 2012, pers. comm., 16 Aug). Due to the aforementioned problems, the on-going DNA analysis and the need for a published report on the subject, preliminary DNA data cannot currently be used to identify KV60-A as Pharaoh Hatshepsut.

Hatshepsut, ruler of the 18th Dynasty, has been linked to mummy KV60-A only through circumstantial evidence. As Hawass explains, “Since the box in which the tooth was found is unmistakably marked with the cartouches of Hatshepsut, the simplest and most likely solution to our identification problem became clear: KV60-A is the mummy of Queen Hatshepsut” (Hawass, Z 2007f, p. 24). Radiology was central to this identification (Gad, YZ 2012, pers. comm., 16 Aug), but, it is not certain whether the organ, and by extension the molar, in the box came from the female pharaoh, another bearing a similar name, or someone else entirely. Even with all of the problems associated with the evidence, it is only circumstantial at best (Forbes 2012, p. 71). Preliminary DNA reports were mentioned as having promising results in linking KV60-A to Ahmose Nefertari. However, while these two women may have been related, there is no historical evidence to confirm whether Hatshepsut was a descendant of Ahmose Nefertari or not. The results of the DNA test of KV60-B are still outstanding. Until the Egyptian team finalises and duplicates the test results (Johnson 2007), nothing is certain. A peer-reviewed report is awaited which will respond to these concerns raised by Egyptologists, specialists and academics. Whilst it is possible that KV60-A could be the mummified remains of Pharaoh Hatshepsut, she cannot currently be positively identified as the 18th Dynasty female king.

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