

Review Article

THE TOMB OF TUTANKHAMUN: A SEMANTIC REVIEW ARTICLE

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Abstract:

This semantic review article aims to present the artifacts found in the tomb of King Tutankhamun. After presenting King Tut's birth, accession to the throne, and death, it highlights the building materials used in the tomb (walls, ceiling, and floor that were cut into the local limestone bedrock on the floor of the Valley of the Kings. Moreover, the mortar used that was gypsum-based calcium sulfate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) mixed with local soil aggregate. Furthermore, the plaster layer of the tomb surface was coarse mud or gypsum applied directly to the uneven limestone rock walls, followed by a smoother, finer plaster layer to provide a surface for paintings, as in most tombs in ancient Egypt. The colors used in the tomb were black (charcoal black), white ($\text{CaMg}_3(\text{CO}_3)_4$), red (Fe_2O_3), yellow ($\text{FeO}(\text{OH})$), Egyptian blue ($\text{CaCuSi}_4\text{O}_{10}$), and green ($\text{CaCu}_3\text{Si}_3\text{O}_9$). After assessing its conditions, especially during and after excavation. Moreover, the article shad on layout, architectural and artistic features of the tomb, in addition to its used painting style. Finally, the paper illustrates the of the treasures of the king Tut discovered in the tomb.

1. Introduction

Tutankhamun reigned as pharaoh between c. 1334 and 1325 BC, towards the end of the 18th Dynasty during the New Kingdom [1,2]. He took the throne after the death of his father (Akhenaten). Tutankhamun's tomb (KV62), fig. (1) is a nearly intact 18th Dynasty burial discovered in 1922 by Howard Carter. It is located in the Valley of the Kings on the West Bank of Luxor [3]. It is situated on the Nile River and about 640 kilometers south of Cairo city, with coordinates 25°44'25.4"N and 32°36'05.1"E [4], fig. (2).



Figure (1) location of tomb KV-62 [5].



Figure (2) location of tomb (KV62)

The tomb, which consists of four chambers, an entrance staircase, and a corridor, contained over 5000 treasures, including the iconic Tut gold mask [6]. It is smaller and less extensively decorated than other Egyptian royal tombs of its time [7]. It probably ori-

ginated as a tomb for a non-royal individual but was adapted for Tut after his premature death [8]. Due to unusually limited space, it contained a wide variety and densely packed funerary objects, personal possessions, and many treasuries, such as coffins, furniture, clothing, and jewelry, in addition to the king's mummy [1, 9-11]. The main goal of this short essay is to present the unique masterpieces studied in this special issue.

2. King Tut's Birth and Death

Born in about 1343 B.C., he was probably a son of Pharaoh Akhenaton from his wife, known as the Younger Lady (daughter of Amenhotep III and Tiye) [12]. He was chosen by Akhenaton in about 1336 BC. heir apparent, after his marriage to his half-sister, Meritaton (the daughter of Akhenaton and Nefertiti) [13]. Two years after the death of Akhenaton, some events resulted in the accession of Tutankhamun, when he was about nine years old. In about the 3rd year of his reign, he reopened the temples of the older gods and restored the capital to Thebes (Luxor) [14]. To signify the return of the former state god Amun, he changed his own name to Tutankhamun and his wife's to Ankhesenamun. He died at the age of nineteen around 1325 B.C [15].

3. Building Materials of the Tomb

3.1. Building stones

The main structural analysis of the tomb of King Tut (*walls, ceiling, and floor*) was cut into the local limestone bedrock in the floor of the Valley of the Kings, where it lies on the eastern branch of the Valley, fig. (3-a) [16]. In the same context, the historical evidence and artistic features, in addition to some visible changes, such as differently sized and spaced chisel marks, suggest more than one phase of cutting, which produced different standards of work that vary among semi-rough, regularity, and meticulously leveled [17]. This type of limestone is characterized by soft features typical of the Theban geological formation, where Eocene-age limestone is commonly found [18,19]. Theban limestone, one of the most extensive rock outcrops in Egypt, extends from the western bank of the Nile River to the Khaga oasis [20]. It is known as the Thebes Formation, which is characterized by the thickest formation (~340 m) and regionally extensive outcropping lithostratigraphic units of Egypt [21]. The tomb's outer walls were filled with potsherds and flakes of limestone [22] and flint boulders [23], with chips of lime mortar and sealed with lime mortar and plaster, fig. (3-b).

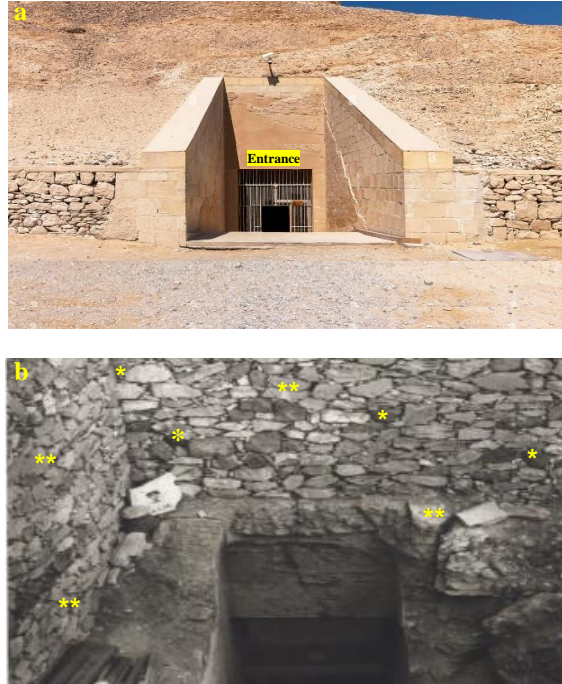


Figure (3) **a.** Tutankhamun's tomb used stone [24] **b.** the outer walls (*gypsum-based mortar / **flakes of limestone and flint boulders, modified after [25]

3.2. Mortar and plaster

Ancient mortars were based on various materials, such as gypsum lime used for rendering, but carbonated lime was predominantly used in structural mortars [26]. The mortar used in King Tut's tomb is a similar type used in most the Theban tombs, (gypsum-based calcium sulfate $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) mortar mixed with local soil aggregate, e.g., mud, sand, or crushed rock [27]. The outer corridors of the tomb were filled with limestone chips and sealed with plaster. These mortars were used for wall bedding, leveling, and as a plaster base for decoration, tailored to specific locations and moisture conditions [28]. Regarding the plaster layer applied to the tomb surface, it was coarse mud or gypsum applied directly onto the uneven limestone rock walls, followed by a smoother, finer plaster layer to provide a surface for paintings like most tombs in ancient Egypt [29]. *The coarse plaster* is composed of sepiolite ($\text{Mg}_4\text{Si}_6\text{O}_{15}(\text{OH})_2 \cdot 6\text{H}_2\text{O}$), which varies in its aggregate size mixed with calcite (CaCO_3), ankerite $\text{Ca}(\text{Fe},\text{Mg},\text{Mn})(\text{CO}_3)_2$, and added amounts of low quartz (SiO_2) [17]. *The fine plaster* is a clay binder also composed of the sepiolite ($\text{Mg}_4\text{Si}_6\text{O}_{15}(\text{OH})_2 \cdot 6\text{H}_2\text{O}$) and palygorskite ($\text{Mg},\text{Al})_2\text{Si}_4\text{O}_{10}(\text{OH}) \cdot 4(\text{H}_2\text{O})$), mixed with fine aggregate of carbonates, in addition to low amounts of quartz (SiO_2), gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), and anhydrite (CaSO_4) [17].

3.3. Decorative layer and pigments

The decorative layer applied in ancient Egyptian painting is a final thin coat of different colors applied

on white gypsum or calcite-based plaster [30]. According to the Getty Institute's investigation, this layer is characterized by several technical distinctions, in particular in the burial chamber [31,32], including

- 1) A unique preparatory gray layer in the northern part of the chamber;
- 2) Discontinuous yellow background painted around the preexisting figures, fig. (4-a).
- 3) Some specific colors, such as bright yellow and a pale green.
- 4) appearing and disappearing snapped paint lines in some parts of the chamber, fig. (4-b).

These findings are accurately argued with the data of Robins [33], who affirmed clear differences in the proportional layout of the north wall's decoration. On the contrary, Wong [13] noted that both paint layers have the same composition all over the tomb's walls. He confirmed that it has a yellow background, with an estimated thickness between (~ 0.01-0.06 mm).

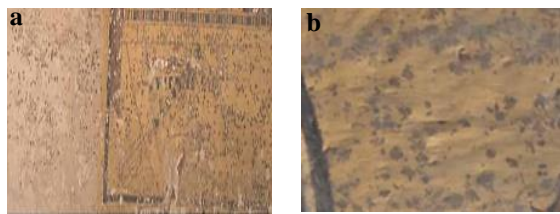


Figure (4) some painted features in the Tut tomb

Many authors [17,34-39] asserted that the different types of pigments used in the tomb are similar to the most common color types used in this era, including:

- **Black color:** charcoal black.
- **White color:** extracted from a natural mineral known as huntite ($\text{CaMg}_3(\text{CO}_3)_4$).
- **Red color (red ochres):** extracted from red iron oxide known as hematite (Fe_2O_3).
- **Yellow color (yellow ochres):** extracted from yellow iron oxide known as goethite ($\text{FeO}(\text{OH})$).
- **Blue color (Egyptian blue):** a synthetic crystallized material created through burning a mixture of lime Qz and Cu ore ($\text{CaCuSi}_4\text{O}_{10}$) known as cuprorivaite or blue frit.
- **Green color (Egyptian green):** a synthetic amorphous material created through burning a mixture of lime, Qz and Cu ($\text{CaCu}_3\text{Si}_3\text{O}_9$) known as copper wollastonite or green frit.

The essential differences between the two phases of the synthetic pigments are attributed to mineral structure and synthesis temperature. Blue is a crystalline phase and is produced at higher temperatures (~850-1000°C) [40], while green is an amorphous Cu-bearing glassy phase with para-wollastonite, containing more alkaline flux and less copper and is produced at (~900-950°C) [41]. In the same context, the review of the ancient Egyptian palette proved that these pigmented sources were used for painting in the tomb of King

Tut, mixed with Acacia gum media as a single hue. They were also combined to create a wider range of hues, as noted by Lee and Quirke [42].

4. Layout and Architectural Features

4.1. Architectural features

Tutankhamun's tomb is cut into the bedrock of the valley. Its design is similar to most non-royal tombs of its time, but with the conventional plan of similar royal tombs [16]. According to the previous excavation and subsequent studies on the tomb's plan, fig. (5), it was unusually compact compared with typical royal hypogea. Its layout is a short sequence of descending and axial spaces that fit a hastily arranged royal burial [43]. It consists, like most of the conventional Egyptological system for the royal tombs, of the following sections:

- (A) a westward-descending stairway with a short descent from the surface that leads into the entrance and first descent into the tomb architecture [44]. The entrance stair descends steeply beneath an overhang [7]. This stair originally consisted of 16 steps. The lowest six were cut away during the burial to make room for the largest pieces of funerary furniture to enter through the doorway.
- (B) an east-west descending corridor.
- (I) an antechamber at the west end of the passage.
- (Ia) an annexe adjoining the southwest corner of the antechamber.
- (J) a burial chamber north of the antechamber.
- (Ja) and a room east of the burial chamber, known as the treasury [7].

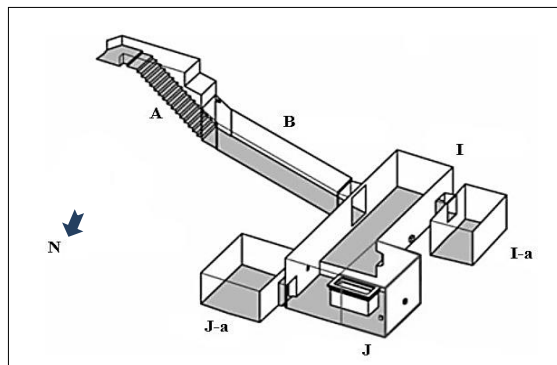


Figure (5) plan of King Tut's tomb; **a.** stairway, **b.** corridor, **i.** antechamber, **i-a.** annexe, **j.** burial chamber, **j-a.** the annexe

4.2. Tomb measurements

Regarding the measurements of king Tut tomb, it could be asserted that there are notable variations among its different sections as follow:

- The corridor (B) measures 8 m. long and 1.7 m. wide.
- The antechamber (I) measures 7.9 m. from north to south and 3.6 m from east to west.

- The annexe (**I-a**) is 4.4 m. from north to south direction and 2.6 m. east-west direction.
- The burial chamber (**I**) measures 4 m. from north to south and 6.4 m. in the east-west direction.
- The treasury measures 4.8 m. from north to south and 3.8 m. from east to west.

In the same context, the highest of all chamber's ranges from 2.3 m. to 3.6 m., and the floors of the annexe, burial chamber and treasury are about 0.9 m. below the floor of the antechamber [1,7,16]. It could be concluded that the accurate measurements are:

- 1) total area: 109.83 m².
- 2) total volume: 277.01 m³.
- 3) total length: 30.80 m.
- 4) max. height: 3.68 m.
- 5) min. width: 0.66 m.
- 6) max. width: 7.86 m.

5. Condition Assessment

5.1. During excavation

As presented by many authors, it could be affirmed that at the beginning of excavation in the tomb area, the workers uncovered a flight of 16th stone steps ending in a seal-stamped, plastered-over door blocking, backfilling. They found several geological faults that affected the rock, which the tomb is cut out of, fig. (6), including a large one that runs south-southeast to north-northwest across the antechamber and burial chamber [45]. Although they had sealed a fault in the burial chamber with plaster [44], these faults caused water seepage that affected the tomb. In addition, the tomb was subjected to long-term impacts from flash flooding in the area, leading to varying degrees of instability and damage that have progressively worsened over time [46]. In this regard, the tomb was crammed with objects, most of which were made of organic materials, such as wood, leather, and textile, thus highly susceptible to changes in the aggressive effects of temperature and humidity dominated in this area.



Figure (6) limestone flake with a drawing of a cockerel modified (After: Riggs, 2020)

5.2. After excavation

The structural instability of the tomb and rising damp overtime, led to the flaking of wall paintings that were

applied over wet plaster and was damaged by mold [44]. Within the same context, severe damages of the main structures of the tomb had been extensively defined in most of the tombs in the valley of the kings as discussed previously by many authors [9,47-50]. They warned that the infiltrating and salty water weakened the load-bearing capacity and strength of the rock, making it less able to support the mountain above. Furthermore, it could be noted that there are other deterioration forms, especially laminar peelings, that affected some parts in the ceiling as direct physical mechanisms of the internal stress, which essentially resulted from the collapsing of the shale (the main components dominated in the area) [51], fig. (7).



Figure (7) laminar peelings resulting from internal stress

Finally, it could be assured that all deterioration symptoms that affected the pigmented surfaces in the tomb are owed to four main factors:

- Saline water [52,53].
- Ion migration [54].
- Alternating cycles between AT and RH [54,55].
- Effects of different ranges of light [56].

6. Artistic Features of the Tomb's Paintings

In addition to the iconic treasures, the paintings in King Tutankhamun's tomb are characterized by their well-finished artistic features, particularly the wall paintings in the burial chamber, but with rough, conventional, and severely simple ones as noted by Carter and Mace [57]. According to Brodowicz [58], the decoration in each of the four chambers in the tomb reflects the primary components of the earliest myth of the sun's regeneration and of the King's vindication in the afterlife. This style changed considerably, however, with the passage from the annexe to the burial chamber, where the work was being done much more carefully. These paintings fuse traditional religious imagery that characterized the Amarna era artistic realism, including yellow-painted scenes and other decorated scenes featuring figures in red color, fig. (8).

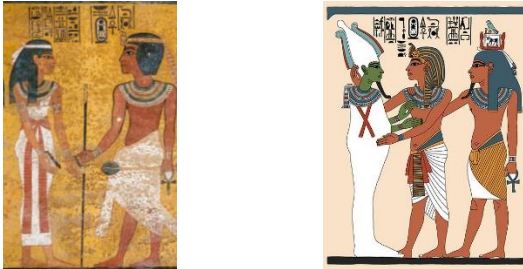


Figure (6) **a.** N wall in burial chamber [59], **b.** Tutankhamun, his Ka and Osiris [60]

In addition to the detailed scenes painted in the sky for goddess Nut on the ceiling [61], it could be noted that some of these feature's themes focused on the paintings that reflect the sun's journey and Tut's introduction to the afterlife, with scenes depicting him with deities such as Nut and Osiris. Concerning the ceiling decoration, the burial chamber, it could be noted that the ceiling is painted with images representing the night sky, featuring the goddess Nut in vibrant color symbolizing the sky, protection, as most ancient tombs in Thebes [62].

7. Tomb Treasures

According to the data extracted from many scientific and archaeological authorities and authors [63-66], the tomb of King Tut included more than 2000 individual artifacts for the afterlife. Most of these findings were placed in the annexe, fig (8). They were jumbled together with objects that had been haphazardly replaced during the restoration after the robberies.



Figure (8) The antechamber of King Tut's tomb containing some of his treasures (After: Riggs, 2020)

In this regard, the most important findings of the tomb include:

- Golden funerary mask
- Mummy
- Beds
- Meteoric iron dagger
- Jars of jewelry contained gold
- Precious stones
- Stone artifacts
- Pottery vessels

- Anubis shrine
- Head of Nefertem
- Stools
- Selket lamps
- Goddess gilded wood
- Trumpets
- Lotus chalice
- Chariots

Furthermore, the room housed most of the shabtis and many wooden funerary models, such as boats [1], weaponry, bows, throwing sticks, khopesh-swords, as well as ceremonial shields, in addition to some personal objects that he used as a child, such as toys, a box of paints, and a fire-lighting kit [11]. From a specialized point of view, this issue presents articles on some of these important objects in the form of case studies, in addition to some experimental studies related to objects found in the tomb:

- Innermost shrine (Carter No. 239, JE 60668, GEM 16)
- Bed of Tutankhamun (Carter No. 377, JE 62015, GEM 14276)
- Royal armchair (Carter No. 91, JE 62028, GEM 4573)
- Tutankhamun's 6 funeral bouquets (JE 62724-JE 62730)
- Wood covered with gesso layers (Exper. Stud.)
- Ziziphus spina-christi wood (Exper. Stud.)
- Replica of Tutankhamun's bouquet (Exper. Stud.)

Conclusion

This research paper reviewed the tomb of Tutankhamun. First, it reviewed King Tut's birth, reign, and death. Then, it reviewed the tomb, starting with the building materials, particularly building stones, mortar, plaster, and pigments. After that, the paper reviewed the tomb's layout and architecture, showing that its design resembled that of most non-royal contemporary tombs, particularly in the stairway, corridor, and burial chamber. It also considered the conditions of the tomb. It assessed the conditions during excavation and its post-excavation deterioration. The paper concluded by presenting the tomb's treasures, showing that it contained more than 2000 artifacts.

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