

Unfolding Sennedjem's Tomb

by Hany Farid and Samir Farid

It is ironic that the Ancient Egyptian tombs, once sealed, were not intended to be seen by outsiders. Yet the highly valued and often reproduced tomb decorations have had a profound influence on art and have contributed significantly to our understanding of the Ancient Egyptian culture. This article describes how recent advances in computational and digital technology can add a new perspective to these marvels of antiquity. Of particular interest to us has been the development of a technique for digital reconstruction of tombs, allowing for the creation of undistorted panoramic views of tomb interiors that are simply unattainable with traditional imaging methods. We begin with a few words about a chosen tomb that is well suited to this treatment, then describe briefly the computational steps, followed by comments on the interplay between multiple, related scenes, which are made clearer when viewing the tomb in its entirety.

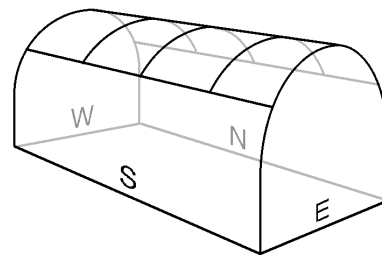


"Servant (lit. 'One who hears the call') in the Place of Truth, Sennedjem, vindicated (lit. 'True of Voice')."

Tucked in the hills opposite to the worker's village of Deir el-Medina to the west of Waset (Thebes, modern Luxor) are several tombs that belong to the artisans who lived in that village. These were the people who worked on the royal tombs in the Valley of the Kings, located about a kilometer away from their village, and who have built their own, relatively modest tombs within eyesight of their homes. Unlike the private tombs of prominent government officials, where many of the wall decorations depict their daily activities and duties, the decorations of the artisans' tombs of Deir el-Medina are devoted

largely to religious and mythological themes.

In 1886 when a tomb, now designated No. 1 in the official listing of the Antiquities Service, was discovered in the Deir el-Medina area, it proved to be one of those rare occasions because it was still intact having escaped be-



A wire-frame rendition of Sennedjem's burial chamber, base: 5.12 by 2.61 m, height: 2.40 m.

ing plundered in antiquity.¹ It must have been an exciting sight for Maspero and his workers when they opened a small wooden door leading to the burial chamber to find so many mummies and artifacts in such a tiny space. Twenty mummies, nine of which in coffins and the rest only rapped in linen, were stacked in a vaulted chamber less than 15 m².

Sennedjem, the tomb's owner, shared this "house of eternity" with his wife Ineferty, their children, and grandchildren. They have remained together in this tiny room undisturbed for over three millennia. Although it may seem to be an unfortunate fate that these mummies, together with the superb contents of this remarkable three-generation mausoleum, are now housed in several museums the world over, this may have fulfilled one of their wishes. It has kept their names alive, and that of the family patriarch well recognized, something the inhabitants of *Kmt* were keen on preserving.

The tomb inscriptions describe Sennedjem as "servant in the place of truth", which turned out to be a common title for the workers and the artisans who built and decorated the royal tombs in the nearby Valley of the Kings. Before the meaning of this title was fully understood there was, however, some confusion resulting from the fact that the Egyptian term for servant literary means "one who hears the call" and that the word for truth, Maat, also means justice. This title could be taken to mean "one who hears the call in the place of justice" and hence was thought for sometime to mean judge (one who listens to complaints).²

Although Sennedjem and the others who lived in the village were not high ranking, they were certainly highly skilled in tomb building. So, probably with the help of members of his own family and of other workers from the village, Sennedjem was able to build and decorate his eternal house. Some of the tools that Sennedjem probably used during his lifetime, a cubit rod, a right angle and a plumb level, were among the many articles found in his tomb. These tools may well have been used in the construction of his tomb and that of Rameses II, the contemporary ruler of the two lands.^{3,4}

Although the decorations of the burial chamber may not be of the same high quality as some of the artifacts found in the tomb,⁵ there is a great deal of charm in many of the often-reproduced scenes from this tomb.



Two opposing views of Sennedjem's burial chamber showing the west (top) and east (bottom) walls. Because of the small space, and a highly curved ceiling, it is not possible to embody in a single photograph the logical sequence of many of these scenes.

The burial chamber measuring 5.12 m by 2.61 m with its vaulted ceiling of 2.40 m is completely decorated; a total surface area of about 40 m². Two views given here, each showing approximately one third of the chamber convey the closeness of the space. Because of this space confinement and the strong curvature of the ceiling, however, it is difficult to combine in one photograph a large enough portion of the walls and of the ceiling to give an encompassing view of the panels and to display the sequence of the scenes.

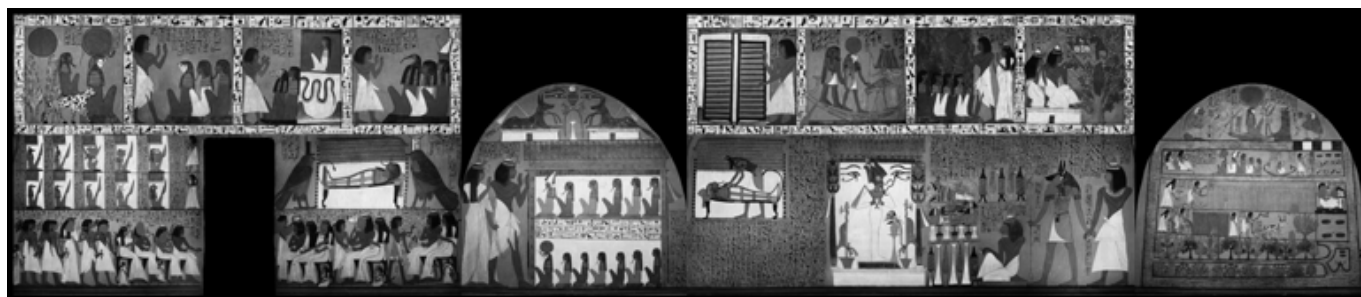
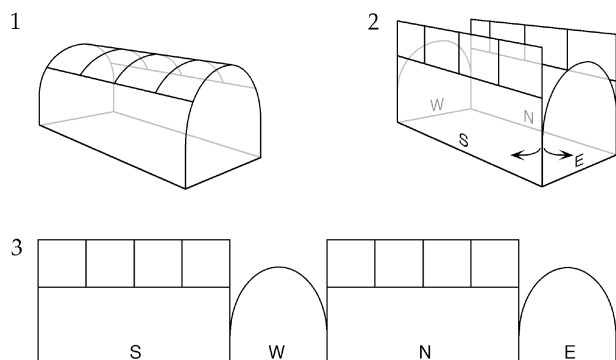
It might be possible to piece together photographs from small areas of the ceiling and walls. Virtually any region from the curved ceiling, however, remains substantially distorted and this makes it impossible to combine, in any reasonable manner, neighboring photographs. For example, the pair of neighboring ceiling panels shown here contains the same vertical strip of hieroglyphic inscription. However, due to the distortions they are bowed in opposite directions, making it impossible to combine these images. To contend with these

problems we have developed a computational technique for digitally estimating and removing distortions, thus allowing us to create a single distortion-free large-scale mosaic.

To illustrate the technique, consider again the pair of neighboring panels from the ceiling. The goal is to remove the distortions so that each panel is transformed into a rectangular shape. This is accomplished by first specifying initial and desired positions of several points in the image. For example, if we choose to specify initial points along the contour of the curves defining the panel, then the desired positions for these points will be along the contour of a rectangle. Using these points as representative of the distortion in the entire image, a mapping is automatically estimated, which describes how every point in the image should be transformed in order to remove the distortion.⁶ This mapping is then used to re-render the initial image onto the undistorted points. Where necessary, the aspect ratio is adjusted



The "unfolding" and "sewing" of two neighboring ceiling panels from the south wall. Top, the original photographs, each annotated with 30 yellow points specifying the distorted contour, and 30 red points specifying the undistorted contour. From these points, a mapping describing the transformation from distorted to undistorted positions is automatically estimated. Middle, the distortions are removed by re-rendering the original images according to this mapping. Bottom, the results of combining the undistorted panels, correcting for lighting and color imbalances, and removing some background blemishes. This entire process is repeated throughout the tomb.



Complete unfolded view of Sennedjem's burial chamber. Note that the central hieroglyphic band is duplicated on the South and North walls.

and variations in lighting are manually corrected by locally adjusting the brightness/contrast of over- or underexposed areas. We also took the liberty of digitally removing modern day blemishes in a few background areas. Finally, neighboring images are combined by overlaying their common parts and removing the overlapping areas.

We began with sixteen 35mm slides taken twenty years ago, which provided full coverage of Sennedjem's burial chamber. These slides were digitally scanned and as described above, the distortions in these images were automatically estimated and removed. The resulting, undistorted images were then seamlessly combined to form a complete and distortion-free view of the entire burial chamber.⁷ In this "unfolded" perspective of the chamber, all four walls and the ceiling can now be glimpsed in a single image.

This tomb is particularly rich in iconography, which is further enhanced by the saturated colors of the pigments⁸ and the successful use of alternating, contrasting colors. The majority of the scenes represent vignettes from the Book of the Dead (BD). Hence, it is probably no accident that these scenes are painted on a yellow-ochre background, the color of an aged papyrus, which makes the walls, especially when seen in the unfolded manner presented on these pages, appear like a BD papyrus.

From a different point of view, the burial chamber is

decorated in a way imitating that of a coffin, with the vaulted ceiling being analogous to the lid and with scenes separated by horizontal and vertical bands of hieroglyphic inscriptions imitating the pattern of the outer bandaging of a mummy.⁴ This analogy is reinforced by the fact that the three middle transverse bands have citations by Anubis and the four sons of Horus, and those of the two outer ones by Thoth. The order is also the same as that used on coffins including Sennedjem's own. The names of Hapy, Anubis, and Qebehsenuf appear from west to east on the north side of the chamber and of Imsety, Anubis and Duamutef, also from west to east, on the south side. This is the same order from head to toe on the coffin's left and right sides, respectively.

The hieroglyphic inscriptions in the bands along the length of the tomb read from left to right on the northern wall and from right to left on the southern wall, that is, from west to east in both cases. The band in the middle of the ceiling, which is arranged vertically, also reads from west to east. This arrangement, which also in this regard parallels that used on coffins, suggests that the scenes might be arranged in a west-to-east succession. The overall, unfolded view of the burial chamber can be used to illustrate Bruyère's suggestion⁴ of this west-to-east interpretation, as indicated in the following brief description of the tomb.

The West Wall

The tympanum of the west wall shows two jackals recumbent on tomb-shrines on the opposite sides of a central passage. These are the guardians of the gates to the West, the Kingdom of Osiris, and they are the openers of the road to eternity.⁹ Below, in the main scene of this wall, Sennedjem and his wife Iyneferty are shown in adoration of several gods shown in two rows inside a shrine. Osiris leads the six deities in the top row and Ra-Horakhty the seven in the lower row. The three lines of inscription between the two rows of deities are appeals to several gods, Atum, Osiris, Khenty-Imentiu, and the Enead, to grant the deceased strength, greatness, power, and dignity.

The South Wall

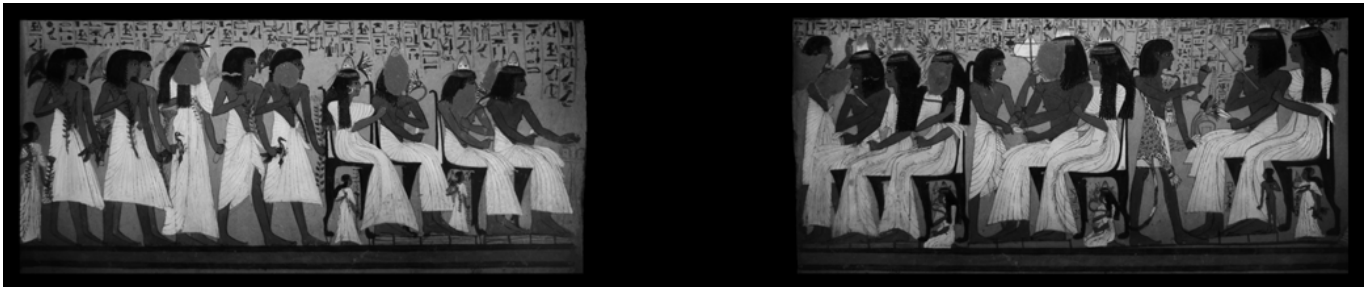
The southern wall has three registers with the lower two being interrupted by the chamber's door. In the lowest register, the two scenes on both sides of the door are complementary to each other and should be regarded as a single composition, that of a family gathering. The main figures on both sides are shown facing the door and hence each other, reinforcing the unity of the composition, which represents a banquet in honor of the deceased. Shown on the right side of the door are three groups. Seated on the far right holding a *sekhem* knife in his right hand, is the tomb owner with his wife Inyeferty closely behind, and with their son Bunakhtef facing them and officiating funerary rituals. Bunakhtef, wearing a leopard skin and performing the role of a *Sem* priest, is carrying out libation, pouring from a *Qeb* vessel towards his father. The next couple, seated in the middle, is identified as Taro and Taya (or Atya), Inyeferty's parents.¹⁰ Facing them is a son called Roma pouring from a *Qeb* vessel, and holding a billowing sail, a symbol of offering air to breathe in God's domain. The third group in this scene shows Sennedjem's parents,¹⁰ Khabekhnet and Tahenu, and Losou (a second wife of Khabekhnet) being attended to by a son also called Roma.

The scene on the left side of the door begins with four seated individuals. The first pair is identified as two brothers, Tutuya and Messu, who are probably Sennedjem's brothers and about whom very little is known. The next seated couple is Sennedjem's eldest son, Khabekhnet and his wife Sahti. Standing behind are the rest of Sennedjem's children in descending order. Bunakhtef, the second son who is also depicted in the first section in front of his parents, and Rahotep, are followed by Sennedjem's eldest daughter, Iutnefert and four more sons shown in two pairs, Khonsu and Ramose, followed by Anihotep and Ranekhu and finally by an unnamed young girl. In addition to the above mentioned, there are young children shown under the chairs of their parents on both sides (4 in the right and 2 in the left scenes).¹¹

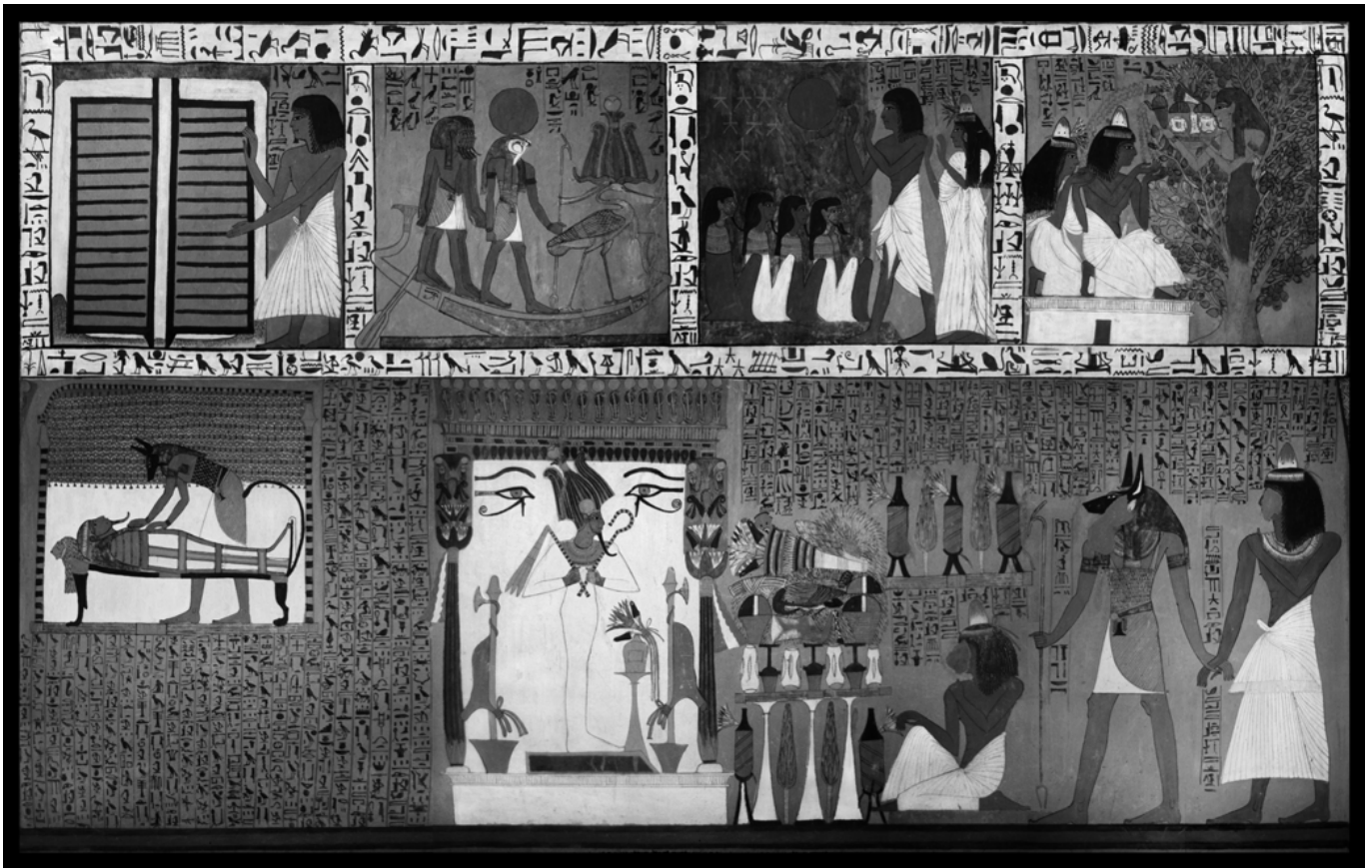
When seen as a whole, instead of breaking the flow of the composition, the door seems to enhance its unity as an entrance to a banquet room with guests on both sides of the chamber. It seems also to be deliberate that the deceased and their parents are seated in the west, the domain of the dead, whereas the young participants are in the east, the domain of the living.⁴

The middle register of the southern wall shows two scenes. On the right of the door, towards the west, Sennedjem's mummy on a lion-shaped bier in a tent is guarded by Nephthys and Isis in bird forms. Towards the east, the left part of the register, shows the deceased and his wife in adoration of ten of the traditional 21 gates of the Underworld with their respective guardians. The gatekeepers are arranged in two rows of five with 1, 3, 5, 7, and 9 from west to east in the top row and the even-numbered ones in the bottom row. The west to east sequence of these two scenes is a logical one, first the mummification then the journey through the Underworld.

The upper register of the southern wall, which is part of the vaulted ceiling, has four scenes, the first three from west to east show Sennedjem in adoration of divinities. The leading god in the first scene is Thoth, the Ibis-headed figure, referred to in the text above as lord of Wenu (Hermopolis or El-Ashmumin), and scribe of truth to the great Ennead. The divinities in the second scene are called gods of the Duat (the Underworld), and the text of the third scene refers to all the Gods of Truth. The fourth and last scene is dedicated to Ra-Horakhti-Atum, lord of the two lands of Anu (Heliopolis). When followed from west to east there is some logic in the choice of the divinities depicted in these scenes. It begins with the judgement of the deceased, usually recorded by Thoth. This is followed by the voyage through the Duat with its numerous, mysterious genies, and finally the reemergence like the sun's reappearance at the eastern horizon after an arduous nocturnal journey.



A “family portrait” from a portion of the unfolded south wall. On the right side of the entrance, from right to left, are Sennedjem and his wife Inyeferty, her parents, and Sennedjem's parents (with a second wife), each group being attended by a respective son. On the left side of the entrance are Sennedjem's children and two brothers. See text for more details.



The unfolded north wall. On the lower register, to the left, is Anubis attending to Sennedjem's mummy, and to the right, Anubis is leading the deceased to Osiris. Depicted on the upper register, from left to right (west to east), are vignettes from the Book of the Dead conveying the sequence of the journey that takes Sennedjem through the Underworld till he reaches paradise. See text for more details.

The North Wall

The northern wall is divided into two registers with two scenes in the lower one. In the scene towards the west Anubis attends Sennedjem's mummy, in an embalming tent identical to that shown on the southern wall. The scene is surrounded by 29 columns of text, the largest in this tomb, from Chapter 1 of the Book of the Dead (BD). This text is also arranged from west to east with the first three columns actually being on the western wall. Under the title: *"Chapter of going to the Tribunal of Osiris on the day of burial of Sennedjem"*, the text begins with the deceased addressing Osiris by his epithet *"Bull of the West"*. He identifies himself with several gods: the great god in the boat of the sun, a god of the tribunal that vindicated Osiris, one of those gods born to Nut, and also with Thoth, Horus, and others. Sennedjem, also identifies himself with priests from towns associated with the cult of Osiris: Busiris and Abydos. He states that in all these roles he had fought for Osiris and was among those who vindicated him against his enemies on the day of judgement.

Sennedjem then asks those who cause the perfected souls to draw near the House of Osiris, those who give bread and beer to the perfected souls in the House of Osiris, and those who open a path and open up roads for these souls, to do the same for his own Ba.¹² Thus, the overall theme of this Chapter is that, by identifying himself with those who defended Osiris and assisted in his burial, and final vindication, the deceased hopes that the same events will transpire after his burial.¹³

The next scene is the largest in this tomb, which can be better appreciated in its complete and undistorted view shown here. This scene is part of a vignette from Chapter 30B of BD. It usually follows that of the weighing of the heart against truth (not illustrated in this tomb), which is generally depicted in BD Papyri. In the first part of the scene, Sennedjem is led by Anubis (in other BD presentations, instead of Anubis, Horus can be seen leading the deceased to Osiris). Usually the deceased in this scene is shown in a humbled posture, in some Papyri he would be bowing; here, equally effective, Sennedjem is shown with his left hand resting on his

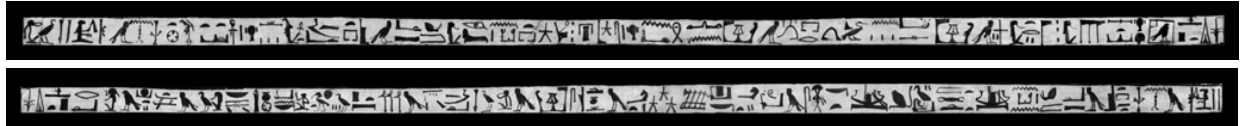
right shoulder. An accompanying 22 lines of text begins with recitation by Anubis that Sennedjem comes before Osiris, be received by the gods of the Duat. The latter part of the text quotes a recitation by Maat concerning the deceased: "...coming forth, he draws alongside in the presence of Osiris, he dwells near Wennefer like one of those gods who are the followers of Horus. He is not to be turned away when he comes to the doors of the Duat. The Osiris, servant in the place of truth to the west of Waset, Sennedjem, vindicated."

With one knee resting on the floor, Sennedjem is shown in the following section, facing an offering ta-

ble in front of Osiris. Seemingly overtaken by this momentous encounter, he is portrayed in a respectful and fearful gesture. His right hand, supported by his knee, is softly hanging, the other hand is resting on the opposite shoulder and he is wearing a slightly graying wig.¹⁴ The focal point of this scene, however, is Osiris himself who is shown wearing a colorful *atef* crown and standing on a dark Maat sign, both strongly contrasting with the white color of the shrine. The two wedjet eyes, columns on both sides of the shrine, and the cobra frieze add to the beauty of this elegant composition.

The accompanying text of 16 lines is a recitation by Sennedjem that begins with a hail to Osiris-Wennefer-Khenty-Imentiu, lord of the sacred land, etc., and follows with the passage: "...I passed upon the earth doing justice. I have not diminished food offerings in the temples and I have not damaged offerings to the gods. When I went in at the door of the Duat, I was found not to have committed sin." and finally the text concludes with the plea: "O Osiris, grant me the breath of air and the rejuvenating water." This is probably the most impor-

Consistent with the sequence of the scenes, the three bands of inscription along the length of the tomb are all written from west to east. The texts appeal to Osiris, Hathor, and Ra for what deemed to matter most to the deceased.



The text in the middle of the ceiling (vertical band) addresses Osiris, using a lengthy narrative of his attributes and epithets. He is called: "Osiris-Wennefer, Khenty-Imentiu, eldest son of Geb, great of the five (primordial) gods, father of all gods of eternity..., governor of everlasting, Ptah-Sokar." Finally the god is requested to grant Sennedjem breath of air and rejuvenating water.

The band of inscription on the south wall (written from right to left, west to east) asks Hathor, Mistress of the necropolis, to permit Sennedjem's Ka to enter and to exit God's domain without being turned away from the doors of the Duat.

The corresponding band on the north wall (written from left to right, west to east) is a call on the sun god Ra-Horakhty-Atum, lord of the two lands of Anu, to grant Sennedjem splendor in heaven, might on earth and triumph (vindication) in God's Domain. The text refers also to the sun's morning and evening barks and to stars, in allusion to the ceiling scenes above this inscription.

tant message the deceased intends to convey in order to insure a positive outcome of his judgement and to be granted eternal life.

The upper register, which is the northern half of the ceiling, depicts in chronological order, from west to east, scenes from the journey that Sennedjem must take from this world in order to reach paradise. Like the aging sun that sets daily at the western horizon and goes through the domain of Osiris in the underworld to reemerge in the east, the deceased goes also through this arduous voyage to arrive in paradise. The first scene, at the western end, shows Sennedjem opening a gate and although there are no inscriptions in this scene describing the gate, in other tombs this is called the Secret Door of the *Duat* (the underworld). Placing it between two hieroglyphic signs of cosmic significance cleverly indicates the identity of the gate. At the bottom is the hieroglyph for "mountain", *djew*, two hills on both sides of a valley, shown here in ochre red to depict the color of the desert. The Egyptians visualized a universal mountain split into a western peak (*Manu*) and an eastern peak (*Bakhu*) serving as supports for heaven. Heaven is represented here by the second hieroglyphic sign, *pet*, shown in blue on top of the gate. The sky hieroglyph represents the heaven as a physical ceiling that drops at the edges just as the sky appears to reach down to the earth's horizon. Thus, Sennedjem's voyage into the *Duat* begins by passing through the gate at the edge of the mountainous area where heaven touches the horizon.

The next scene represents the nocturnal voyage of the sun, hence the direction from west to east. Standing in a boat on the celestial Nile and facing east is the *Benu of Ra*, which symbolizes the soul of the sun god. Standing behind the bird is Ra-Horakhti holding a *Was*-scepter and is identified as “*Ra-Horakhti-Atum, lord of the two lands of Anu (Heliopolis)*”, who is followed by a group of five divinities identified as “*Gods of the great Ennead, who are in the bark of Ra*”. Although not specifically shown in this scene, it may be implied that the deceased is among those admitted to the bark and to traverse the sky with Ra.

In the next scene Sennedjem and his wife are shown in adoration before a group of five kneeling divinities under a dark blue sky studded with seven yellow stars and a dim nocturnal sun, a rather gloomy section in the voyage through the underworld.

At the northeastern corner of the chamber is the fourth and last scene of this section of the ceiling. It is a familiar scene that is encountered in many tombs and papyri. From a large sycamore with clusters of scarified figs emerges a tree goddess, identified here as the sky goddess Nut,¹⁵ dressed in red and blends gradually with the tree until her feet change color and become the tree trunk.¹⁶ The goddess holds in her left hand a tray of bread arranged in a way that may symbolize the hieroglyph for “east”.⁴ In addition, the goddess pours from a *Qeb* pitcher the enlivening water of Nut that runs in several threads into the cupped hands of Sennedjem and his wife Iyeferty, who are shown kneeling on a funerary *mastaba*. These welcoming divine offerings are meant to ensure eternal subsistence to the couple and prevent them from dying again. As this scene may be representing an arrival banquet for Sennedjem and his wife, the “guests” are shown provided with perfume cones, flowers, and head bands, as was dictated by custom.⁴

Within the space confinement that limited the presentation to just four scenes, well-chosen vignettes from the Book of the Dead were used effectively to convey the transition from death to the doors of paradise. The eternal life in the Elysium is depicted in the adjacent composition on the eastern wall of the chamber.

The East Wall

Appropriately, the tympanum of the eastern wall is a celebration of the sun god. Dominating the scene is the falcon-headed deity seated in his bark with a large sun disk encircled by a protective cobra on his head. He is identified as “*Ra-Horakhti-Atum, lord of the two lands, Kheper (the rising sun) who is in his bark*”, i.e., the sun god in several manifestations. Two baboons, whose agitation at dawn and at dusk appeared to the Egyptians as sign of adoration to the sun, are shown in such a pose on both sides of the boat. This scene is in stark contrast to the above mentioned somber scene on the opposite tympanum of the western wall, which

shows two jackals, dark-colored creatures of the night, reclining on tomb-shrines.

Together with the above mentioned ceiling panels bordering this eastern tympanum (the sun god in different manifestations on the southern wall and the tree goddess on the northern wall) these three adjacent scenes signal the triumphant end of a voyage. They anticipate the beginning of an eternal, peaceful life.

The scenes on the eastern wall, below this tympanum, are from the popular vignette of Chapter 110 of BD, which appears in various arrangements in many BD papyri and in other private tombs. In the top register, Sennedjem and Iyeferty on the far left are kneeling in adoration of five gods: Ra-Horakhti, Osiris, Ptah, and two unnamed deities representing the Ennead. This is followed by Sennedjem’s son, Rahotep, in a papyrus bark with his head turned towards his parents, and finally by the ritual of opening of the mouth of Sennedjem’s mummy performed by his son Khonsu.

The other registers on this wall make it clear that the deceased and his wife have finally reached the world of the beyond. Having successfully completed the arduous voyage through the Duat, they are now seen in the Field of Arau (Field of Reeds), the Egyptian perception of the Elysian landscape. Because of the notion that life in the beyond was not much different from that on earth, this “Field” seem to have great similarity to the Nilotic landscape. The terrain is surrounded and traversed by irrigation canals; Palm and dome trees dominate the lower section of the scene; and Sennedjem and his wife are seen plowing, seeding, and harvesting. The scene gives the impression that, although life in the beyond seems to be a continuation of the earthly life, it is more prosperous, the fields are large, the plants are tall, the harvest is plenty and Sennedjem and his wife are festively dressed in fashionable white, pleated cloth. One senses that the eternal life in this Field is peaceful and pleasant, a reward for honest conduct throughout earthly life.

In conclusion, two decades ago when we took pictures of this tomb, the only way to view them was in slide presentations. Today’s digital and processing technologies have changed that. Current computational advancements provide the flexibility and power to manipulate images in ways that were previously unimaginable. The application of these technologies to the “unfolding” of Sennedjem’s tomb has allowed us to create a single distortion-free panoramic view of the entire burial chamber.⁷ We believe this approach can be applied elsewhere, for example to the ceiling of Ramesses VI’s tomb, where a satisfactory view of the back-to-back scenes of Nut from the Book of Day and the Book of Night are yet to be published.

Finally, using standard techniques from computer graphics, the undistorted image mosaics may be combined with a three-dimensional computer model of the structure, thus providing users an immersive, albeit virtual, experience.¹⁷

Acknowledgements

We are most grateful to Satenik Farid for translating several passages from French articles, and to Paul Gilman, John Dyer, and Peter Thomas of Eastman Kodak Company for printing the final images.

Notes

1. Although the tomb had escaped the hands of robbers, it did not escape some mutilation. Probably as an act of vengeance, some twenty spots were hacked most notably of faces of different individuals including Sennedjem's as well as of divinities. The result of these deliberate acts can be seen in all but the western wall, which was probably blocked by sarcophagi or funerary furniture. Such destruction was not limited to this tomb, as the nearby tomb of Pashedu also suffered similar indignation.
2. A great deal has been written about this subject, which has been comprehensively documented by Černý, whose own research has contributed much to our knowledge about the life of the workers of Deir el-Medina village. "A Community of Workmen at Thebes in the Ramesside Period" J. Černý, Institut Français D'Archeologie Orientale du Caire Bibliotheque D'Etude, T.L. 1973. For a popular account see: M. Bierbrier, "The Tomb-Builders of the Pharaohs", The American University in Cairo Press, 1989.
3. Toda^a, who wrote the first detailed report on this tomb, thought Sennedjem to be a contemporary of Ramesses IV. Later investigators,⁴ however, provided compelling evidence to place Sennedjem in an earlier dynasty, and specifically to the reigns of both Sety I and Ramesses II, ca. 1280 BC. a) E. Toda "Son Notem en Tebas. Inventario y textos de un sepulcro egipcio de la XX dinastia" Boletin de la Real Academia de Historia. Vol. X, 1887.
4. For a leading reference to this tomb, its history, decoration, and text see B. Bruyère "La Tombe No. 1 de Sen-nedjem à Deir el Medineh" Imprimerie de L'Institut Français d'Archeologie Orientale, Cairo, 1959.
5. Fifteen items from Sennedjem's tomb, part of a collection in the Egyptian Museum in Cairo, were on display at an exhibit that toured in the late 1980's in Memphis, Denver, Boston and Montreal. Very good reproductions of these items can be found in the Catalogs of these exhibits, e.g., "Ramesses the Great, an Exhibition at the Boston Museum of Science" 1988. The door to the burial chamber is among these items, which also included his coffin and the tools mentioned in this article.
6. The initial distorted points are determined in a two-stage process. For each side of the distorted panel, a small number of points are selected, from which a fourth-order polynomial is estimated. Equally spaced points are then automatically chosen along this curve. The undistorted points are automatically chosen in a similar fashion from an appropriately sized rectangle. The mapping from distorted to undistorted points is constrained to be a third-order polynomial surface, the parameters of which are determined using standard least-squares minimization. For details see H. Farid "Reconstructing Ancient Egyptian Tombs", TR2000-383, Department of Computer Science, Dartmouth College, 2000.
7. The original 35mm Ektachrome slides (ASA 100) were digitally scanned with a 2700 dpi slide scanner (Nikon LS2000). The computer program for estimating and removing the distortions was written in Matlab (by MathWorks), and run on a dual-processor 933 MHz Pentium III processor running under Linux. The images were combined and corrected for lighting and color imbalances in Adobe Photoshop. The figures for this article were printed using a Kodak XLS 8600 thermal printer. Because of the high resolution of these images, 24,600 × 5,200 pixels for the complete panoramic view, high quality prints five to ten feet in length were obtained using a Kodak Professional large format inkjet 4760 printer.
8. According to Bruyère⁴ six different pigments were used: blanc de chaux (white wash), noir de fume (lampblack), ochre red, ochre yellow, lapis-lazuli blue, and turquoise blue.

9. The collar around the jackal's neck is a stylized form of the hieroglyph for protection.

10. This identification is according to: M.L. Bierbrier "The Late New Kingdom in Egypt" Warminster, 1975, and to: W.A. Ward, in "Pharaoh's Workers. The Villagers of Deir el Medina", L. H. Lesko, ed. Cornell University Press, Ithaca, 1994. Earlier, Bruyère⁴ made the opposite assignment of parentage.

11. It appears that of Sennedjem's sons, his eldest, Khabekhnet and his fourth, Khonsu, fared well in the Worker's Village and in following in their father's footsteps. Khabekhnet, who later had a second wife called Isis, has managed to build a tomb for himself next to his father's whereas Khonsu, together with his future wife, Kameket, were buried in Sennedjem's tomb. In fact, Khonsu's Sarcophagus is among the finest and best-decorated objects found in this tomb.

12. Unfortunately, the scribe runs out of space in the middle of the last sentence! This text is similar to that found in many Book of the Dead Papyri, e.g., that of Ani. (E.A.W. Budge "The Book of the Dead. The Papyrus of Ani" London, 1895; see also the following footnote.)

13. O. Goelet, Jr. in "The Egyptian Book of the Dead. The Book of Going Forth by Day", Chronicle Books, San Francisco, 1994.

14. Bruyère⁴ suggests that the graying of the hair may be the result of the terror from finally being in the presence of the god of justice or that it may indicate the passage of a very long time till the deceased reaches the final destination after his voyage in the Duat. Goelet¹³ suggests that Sennedjem is wearing a wig of the kind that was popular in the Ramesside period. In some BD papyri, the hair is shown completely white.

15. Accompanying text in similar scenes in private tombs and in BD papyri refers to the tree goddess as Nehet of Nut (Sycamore of the sky). Judging from the somewhat larger size and poorer execution of the hieroglyphs for "*Nut, great goddess*" on top of the scene, these may have been added later by another scribe.

16. The analogy between the shape and the decoration of the burial chamber and those of the coffin is further reflected in a similar scene of a sycamore tree that appears on the corresponding position (the left foot) of Sennedjem's coffin.

17. A virtual tour of Sennedjem's tomb is available at:
www.cs.dartmouth.edu/farid/egypt

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