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Trabajos de Egiptología

The Fate of Expatraite Temples: Ellesiya, Taffa, Dendur and Debod
Alfonso MARTÍN FLORES

Napatan Tomb Decorations. Loans from Private Theban Burials in the Royal Kushite Necropolises
Simone PETACCHI

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Preliminary Report on the Third and Fourth Seasons of the New Kingdom Scribes Project (2021-2022)

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During the third and fourth seasons of fieldwork, the New Kingdom Scribes Project undertook epigraphic, conservation, cleaning and documentation tasks in the burial chambers of TT 61 and TT 87. The aims included: the continuation of the epigraphic study and the restoration of the walls of the burial chambers; the systematic cleaning of the underground structures in TT 87; the detailed digital documentation of both monuments once the archaeological and restoration works had advanced or concluded; and the application of non-destructive techniques to study the materials used by ancient craftsmen and scribes to decorate the walls.

Informe preliminar de la tercera y cuarta campañas del Proyecto Escribas del Reino Nuevo (2021-2022)

Durante la tercera y cuarta campañas de trabajo de campo, el Proyecto Escribas del Reino Nuevo emprendió tareas epigráficas, de conservación, de retirada de escombros y de documentación en las cámaras funerarias de TT 61 y TT 87. Los objetivos eran: la continuación del estudio epigráfico y la restauración de las paredes de las cámaras funerarias; la limpieza sistemática de las estructuras subterráneas en la TT 87; la documentación digital detallada de ambos monumentos una vez avanzados o concluidos los trabajos arqueológicos y de restauración; y la aplicación de técnicas no destructivas para estudiar los materiales utilizados por los antiguos artesanos y escribas para decorar las paredes.

Keywords: Sheikh Abd el-Qurna, TT 61, TT 87, Nakhtmin, Useramun.
Palabras clave: Sheikh Abd el-Qurna, TT 61, TT 87, Nakhtmin, Useramón.

The *Spanish Epigraphic and Conservation Project at Sheikh Abd el-Qurna* –also known as the New Kingdom Scribes Project (hereafter NKS)– obtained official permission from the Ministry of Tourism and Antiquities in 2018 to undertake fieldwork in the underground structures of TT 61 (Useramun), TT 82 (Amenemhat), and TT 87 (Nakhtmin). It has since 2019 completed four seasons of fieldwork, which have mainly centred on the first and third of those monuments.

The aim of the project is to combine traditional and new methodologies with novel digital technologies in order to document three burial chambers belonging to members of the Egyptian elite and sub-elite that were built and decorated during the first half of the Eighteenth Dynasty and to contribute to their preservation. These

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overarching objectives include tasks such as archival research on previous fieldwork documentation and reports,[1] as well as epigraphic study of the afterlife and cosmographic texts and images that decorate the walls of the burial chambers from a material point of view. Onsite, the NKS Project has assessed the state of preservation of these decorated surfaces and is implementing the necessary restoration and conservation actions to ensure their endurance. It has reconditioned the curbs of the shafts by building low retaining walls and installing new metal platforms (the latter in TT 87)[2] and has cleared the underground structures in TT 87, removing the debris and limestone blocks that had been left by previous archaeological teams. The digital documentation of all the structures in TT 61 and 87 was carried out by applying different techniques (photogrammetry, multispectral and infrared photography) to generate accurate plans, sections, and non-distorted images of the decorated surfaces. The study of the inks used by ancient Egyptian scribes is also an important interest of the project.

The research questions that guide this fieldwork revolve around the agents behind the decoration of the burial chambers, i.e. both the commissioners/patrons of the tombs and the scribes who copied texts onto the walls of the final resting place of the former. The aim is to delve into aspects of Egyptian culture that were not recorded in ancient sources, but which are at the foreground of current debates and questions on textual transmission.[3] Amongst these questions are: How can we distinguish individual scribal hands? What were the education and working conditions like for the scribes in charge of copying texts in tombs? These two questions are directly addressed in this paper and other publications signed by several team members,[4] while the following two issues are more open and will be analyzed in the long run: what intellectual and material aspects underlie the manufacture of inscribed objects and the transmission of funerary compositions? What role did those who commissioned private monuments play in the selection of the decorative programmes deployed in their tombs?

The monuments selected for study are located within a specific zone in the Theban necropolis–the area of Sheikh Abd el-Qurna. The earliest burials located here date to the Middle Kingdom,[5] although the peak of tomb-construction was reached during the Seventeenth and early Eighteenth Dynasties. In the latter period, not only were Middle Kingdom structures reused[6]

1 This research entailed a survey of existing publications (Mond 1905: 75–76, fig. 11, pls. iv–ix; Dziobek 1994; Guksch 1995), of the archival material stored at the Griffith Institute (for which we counted with the invaluable assistance and efficiency of Francisco Bosch-Puche), and personal interviews with the former directors of the teams of the German Archaeological Institutes that undertook fieldwork in the 1970's and 80's in TT 61 and TT 87, respectively Eberhard Dziobek and Heike Heye (formerly called H. Guksch), who gladly shared their knowledge, unpublished and photographic materials, and memories with us.

2 Díaz-Iglesias Llanos 2020, 45.

3 Díaz-Iglesias Llanos 2020, 2022. These research questions were devised in the course of the epigraphic work undertaken by the mentioned author in the burial chamber of the tomb of Djehuty (TT 11), as part of the *Spanish Mission at Dra Abu el-Naga* directed by J.M. Galán.

4 Díaz-Iglesias Llanos and Méndez-Rodríguez 2023. See also n. 24.

5 Dziobek 1987: 72, 74–76; Roehrig 1995; Soliman 2009.

6 For the reuse of Middle Kingdom tombs in Thebes during the early Eighteenth Dynasty, see Dziobek 1987 (cf. Polz 2007: 279–297); Galán 2023.

but new tombs were also built, with their façades oriented towards the main royal mortuary monuments of the West Bank and the divine cult complexes of the East Bank.[7] The tomb-chapels of Nakhtmin (TT 87) and Useramun (TT 61) are located in the so-called upper enclosure of Sheikh Abd el-Qurna, the latter being a Middle Kingdom monument in origin.

The first two seasons of fieldwork took place in February 2019 and March 2020, and were dedicated to the preliminary digital documentation, the start of the epigraphic study, and the first evaluation of the preservation state of the monuments.[8] The third season was undertaken between 26 August and 12 September 2021 and the fourth in two stages between 21 and 28 of February and 20 September to 6 of October 2022.[9] The goals of the two latter included the continuation of the epigraphic[10] and restoration[11] tasks on the walls of the burial chambers of TT 61 and 87. We also undertook the systematic cleaning of the underground structures in TT 87, completing the work of previous archaeological teams, and the detailed documentation of both monuments once the archaeological and restoration tasks had advanced or concluded.[12] Finally, we also applied non-destructive techniques (Fourier Transform Infrared FTIR and Raman spectroscopy) to study the materials used by ancient craftsmen and scribes to decorate the walls.[13] The following two sections outline the objectives, working methodology, and preliminary results attained for each burial chamber in the third and fourth seasons of fieldwork.

7 The structure, location, and size of early Eighteenth Dynasty tombs in the areas of Sheikh Abd el-Qurna and Khokha has been analysed by Engelmann-von Carnap 1998 and Engelmann-von Carnap 1999: 64–90. For theoretical and methodological aspects related to the study, distribution, and organisation of the sacred landscape in the Theban necropolis, see most recently Jiménez-Higueras 2020.

8 Díaz-Iglesias Llanos 2022.

9 Thanks are due to the following authorities of the MoTA for granting our work: the Ministers of Tourism and Antiquities, Khaled El-Enany and Ahmed Issa; the General Director of the Supreme Council of Antiquities, Mostafa Waziry; the Director of Foreign Missions, Nashwa Gaber; the General Administrator of the Upper Egypt Committee, Mohamed Abd el-Badia; the General Director of Antiquities in Upper Egypt, Fathy Yasin; the General Director of Antiquities in Luxor, Gadafi Abdelrahim; the General Director of Antiquities in the West Bank, Bahaa Abdel Gaber; the Manager of all archaeological missions on the West Bank, Ramadan Ahmed Ali; the General Manager of the West Bank, Ezz el-Din Kamal; the General Manager of the Middle Area, Abdel Ghani Abdelrahman; the Chief Inspector of the Middle Area: Ahmed Boghdady. The team was composed of the following members (for the two seasons, unless date indicated): Lucía Díaz-Iglesias Llanos (director), José M. Galán (assistant director, 2021), Ángeles Jiménez-Higueras (assistant director and archaeologist, 2022), Daniel Méndez Rodríguez (epigraphist), Ignacio Bermeja Gigorro (restorer), Antonio Gómez Laguna (photographer, 2022), Sagrario Martínez (chemist, 2022), Santiago Sánchez-Cortés (chemist, 2022), Ignacio Forcadell (architect, 2021). Other collaborators included David García González (archaeologist, 2022). Inspectors of the MoTA on site were: Eman Hagag (2021, 2022) and Mohamed Abd el-Wares (2022). Hassan Moltam was conservator from the MoTA. An average of 10–15 Egyptian workmen were under the supervision of Rais Ali-Farouk el-Qiftauy.

10 Lucía Díaz-Iglesias Llanos and Daniel Méndez-Rodríguez are in charge of the epigraphic study.

11 Ignacio Bermeja Gigorro is responsible for the execution of conservation and restoration tasks.

12 While Ángeles Jiménez-Higueras undertook the clearing tasks, Antonio Gómez Laguna prepared the digital documentation.

13 Santiago Sánchez-Cortés and Sagrario Martínez Ramírez executed the non-destructive study of the writing surfaces and inks.

1 | The Burial Chamber of Nakhtmin

Nakhtmin reached the zenith of his career as the overseer of the Double Granary of Upper and Lower Egypt (*jmy-r šnwty n šmʿw mḥw*) during the sole reign of Thutmose III, after having devoted his professional life to the temple (and most likely also court) administration.[14] His funerary monument (TT 87) was probably built during the early and mid- reign of the mentioned pharaoh.[15] Although his tomb had been known since the end of the 19th century,[16] it was not until the work of Robert Mond at the beginning of the following century that his burial chamber was discovered in the courtyard of the tomb belonging to his son (Menkheperraseneb, TT 79)[17] and subsequently cleaned, drawn and photographed.[18] The original locations of the objects retrieved during Mond's excavations –fragments of a canopic jar and a papyrus and model-ostraca for copying the texts of the burial chamber– are unknown, due to the imprecise references given in his report.

A milestone in the study of the burial chamber of Nakhtmin was the work undertaken on behalf of the German Archaeological Institute by Heike Heye (formerly Heike Guksch).[19] The team executed archaeological tasks, which led to the preparation of detailed plans, the discovery of construction marks (red lines and graffiti, see section 1.2) and the identification of different phases of use and plunder of the structures. The latter was possible by means of the thorough recording and analysis of the findings. According to Heye, the scarce quantity of artefacts dated later than the Eighteenth Dynasty indicates that there was no reuse of the structures, but only episodes of looting in both the burial chamber of TT 87 and probably also in the courtyard of TT 79.[20] No restoration assessments or measurements were undertaken by the German team (see section 1.3).

14 References to the publications dealing with the titles and career of Nakhtmin are collected in Díaz-Iglesias Llanos and Méndez Rodríguez 2023: 1, n. 1. Overseer of the Double Granary was a high rank position in the central administration, bestowed upon individuals who were under the direct authority of the vizier (Bohleke 1991). Hence Nakhtmin and Useramun (see section 2) were closely related to each other.

15 Guksch 1995: 14–15. The suggestion of dating is based on the type of tomb (Vd, according to the typology established by Kammp 1996) and the decorative style.

16 Virey (1891: 314–321) published the first description of the scenes decorating the above ground structures of TT 87, but he did not notice the presence of a shaft in the courtyard of TT 79 (see following note).

17 The usual layout of New Kingdom Theban tombs has the shaft located in the courtyard of the monument. The singularity of Nakhtmin's case, with the underground burial structures dug into a terrace situated one level above his tomb-chapel and in the courtyard of the funerary monument prepared for his son, has been highlighted by Guksch 1995: 71–72 and Heye 2008.

18 Mond 1905: 75–76, fig. 11, pls. iv–ix. Later archaeological works were restricted to the courtyard of TT 87 (Mond and Emery 1927: 33). Between 1907 and 1916, preventive measures were undertaken (fitting of a metal door, cleaning of structures) and further documentation by means of photographs took place, both tasks centred on the above-ground areas of the tomb (Weigall 1909: 133; reports of Mackay: Gardiner MSS 18.2.1–3, 19.2.6, 19.2.15, 19.2.17, 19.2.26, 19.4.29–30, 19.5.2; Mond MSS 4, 27–28; Mond Photos 17000–151; see Kaczanowicz (2020: 46) for the intervention of Jelf, who assisted Weigall in 1909–1910 in his work in the Theban necropolis under the auspices of Mond).

19 Guksch 1995: 71–87, Abb. 29, Taf. 14–18.

20 Guksch 1995: 76.

1.1 | Epigraphic Study

The painted burial chamber of Nakhtmin had its wall decoration divided into three panels of unequal sizes, largely covered with spells drawn from the Pyramid and Coffin Texts corpora and with two vignettes depicting the tomb owner.[21] The epigraphic activities undertaken had two main objectives: the identification of scribal hands and comparison between the models (ostraca)[22] and the final product (walls), given that the former bear the copies of the funerary spells that were transcribed onto the latter.

The identification of three scribes working on the decoration of the burial chamber has been one of the main results of the epigraphic work.[23] The scribes (named A, B and C) differ considerably in the quantity of texts copied: two complete panels and c. 85% of the third and longest panel were penned by A, whereas scribes B and C only copied parts of the third panel (9% and 6% respectively). The identification of the scribal hands was based on noticeable differences in several features of the *mise en page* of the texts, the technology and morphology of signs and scribal practices. These elements can be summed up as follows:

1. Size of graphemes, their relative proportion and distance to the column lines. The size of signs differs not only between the three copyists, but also within the texts penned by the same scribe. Since scribe A wrote the vast majority of the compositions, his signs also present a wider variety of measurements. The size could be affected by several constraints such as space limitations or uncomfortable body positions. Additionally, the relative proportions of the signs differ between the scribes and also their distance to the column lines. In the case of scribe B, he left blank margins on either side of the text's vertical framing lines.
2. Grapheme kerning. The separation between signs on a vertical axis, which is also different from one scribe to another, can create on the beholder an impression of an aerial or compact text.
3. Morphology of signs, including their outline, inner details, and degree of elaboration. The most common signs have been compared in a palaeographic analysis. Whereas some signs may look similar, others are clearly distinctive, such as the most elaborate signs that were penned by scribe B.
4. Inclination of signs and slant. The different angle of inclination of signs –such as the bodies of birds– is a distinguishing criterion between scribes. This is also true of the slant, i.e. the direction or orientation of vertical signs (e.g. straight or tilted to the right or left) and is especially conspicuous when compared to column divisions.
5. Ductus. This is the technological aspect of a sign, which takes into consideration the

21 To the work of Guksch (1995: 75) and Lüscher (2013: 11–24) on the description of the decorative programme, add Russo (2016: 52–57). Nakhtmin was the owner of a funerary papyrus decorated with spells from the Book of Going Forth by Day, which is in a poor state of preservation (Guksch 1995: 78–81, Abb. 21).

22 Published by Lüscher 2013, 2015. They are currently kept at the Louvre Museum in Paris (under the inventory numbers E 22394, AF 230, N 684, N 684bis, AF 496 and AF 13420), the Fitzwilliam Museum in Cambridge (E.56.1946), and the Petrie Museum of Egyptian Archaeology in London (UC 13248). The whereabouts of oTT87 is unknown.

23 For an in-depth study on scribal hands in this burial chamber with abundant images and palaeographic tables, see Díaz-Iglesias Llanos and Méndez-Rodríguez 2023.

number, direction and order –or form of overlap– of strokes composing a grapheme. Some signs with a similar morphology were built in the same way by all scribes, a circumstance that may point to a shared educational background.

6. Inclusion of hieratic signs. The intrusion of hieratograms in texts written in cursive hieroglyphs is a frequent circumstance. Scribes differ in the quantity of hieratograms used in their texts, which may be the result of various material and human factors.
7. Stroke thickness. This is the result of both how the tip of the writing tool is manufactured and the pressure with which it is applied against the wall. The analysis has shown that scribe B used the thinnest rush to enable him to write the most detailed signs (see under 3 above).
8. Refilling of writing tools. Dips of the brush are sometimes visible through the change from darker to lighter ink as the colour faded. The pattern of re-inking suggests how often a scribe would need to refill his writing tool and might indicate working conditions. In this sense, scribe A refilled his rush frequently while working on the last section of panel 3 and produced a visually homogeneous text with signs of equal blackness.
9. Correction of mistakes. A mistake may be amended by completely erasing signs, which became unidentifiable, or by a light deletion, which allows the recognition of the underlying form. In the case of scribe C, he did not make any mistakes and therefore produced a text without amendment.

The comparative analysis between the ostraca used as models for the texts and the walls of the burial chamber was another aim of the epigraphic work.[24] It should be considered that the case of Nakhtmin is exceptional, since there are very few examples attested where the intermediate models and the final product have both been preserved. In the comparisons between *Vorlage* and copy, diverse phenomena have been identified that can be related to a scribe's education, working conditions and idiosyncrasy:

1. Change of signs' arrangement. The position of the signs might undergo a reorganisation within the imaginary square or quadrat.
2. Substitution of equivalent graphemes. This phenomenon occurs mainly with the phonemes *s/z* (𓋴/𓊃) and the phoneme *w* (𓅱).
3. Mechanical mistakes of different nature: omissions (of one or several graphemes), confusion/substitution of signs (usually because of morphological and/or typological similarity, for example between some birds), additions (occurring when a sign is mistakenly added to the final text) or reverse orientation.
4. Corrections of different kinds: erasing and rewriting, overwriting without erasing, secondary addition (sign written in a smaller size or off-centred); and hypercorrection of terms (lexical/spelling correction of the original).
5. Cursivisation or hieratisation of the script. These phenomena entail changes from cursive hieroglyphs to hieratic, from hieratic to cursive hieroglyphs, and from cursive hieroglyphs to hieroglyphs. We have also noticed the case of hieratic signs in the models that were copied without modifying their script.
6. Intentional additions to the text. These comprise extension and/or inclusion of titles, filiation and epithets of the owner, but there are also cases of additions of classifiers and phonetic complements to words.

24 A specific publication on this topic is under preparation by Díaz-Iglesias Llanos and Méndez-Rodríguez. The phenomena listed below will be described in more detail in this upcoming work.

Figure 1. State of the first part of the corridor before and after removal of stones and cleaning. Photographs: A. Jiménez-Higueras and A. Gómez Laguna.

In conclusion, the epigraphic research conducted in TT 87 has allowed us to identify how many scribes were engaged in the tomb decoration and also to highlight some features personal to the copyists and others shared that can be regarded as class characteristics. The methodology devised through the analyses is being applied to the burial chamber of TT 61 and may result in some refinement or new categories (see section 2.1). Finally, we are concluding a study on a series of phenomena that occurred during the transfer of textual materials from one medium of transcription (ostraca) to another (tomb walls), a process that Ramadan Hussein has described as 'remediation'.[25]

1.2 | Clearing Work and Digital Documentation

The main aim of the archaeological work in the underground structures of the tomb of Nakhtmin was cleaning its corridors and burial chamber –after carefully checking the tasks undertaken by previous scholars– and generating new plans and sections. As stated in the introduction, Robert Mond was the first archaeologist to work in the shaft of Nakhtmin in 1903–1904.[26] He built a wall inside the corridors leading to the burial chamber using stones found there, with the intention of clearing the space in order to make the excavation of the shaft easier. This wall would also contain the debris generated by the excavation. The stones themselves were probably cut from the bedrock in antiquity to build the shaft and burial chamber and, at the same time, were most likely used

25 Hussein 2017.

26 Mond 1905: 76.

Figure 2. State of the third part of the corridor before and after removal of stones and cleaning. Photographs: A. Jiménez-Higueras and A. Gómez Laguna.

to block the latter after the owner's body was buried.

It was not for almost seven decades after Mond's work that the tomb was excavated again, on this occasion by Heike Heye in the late 1970s and 1980s.[27] The German mission relocated the stone wall made by Mond along the walls of the corridors in order to clear the space, leaving the stones inside the shaft. The removal of these stones from the tomb has been the objective of our project, with the intention of completely clearing the corridors and the burial chamber to make them easily accessible (figs. 1–3).

The number of stones is very high and their size varies from small chips to big boulders. The majority are limestone, but fragments of sandstone, *muna*, and limestone with remains of *muna* have also been found. Every fragment was thoroughly checked before taking it out of the tomb by a mechanical tackle system. Additionally, all the stones

27 Guksch 1995.

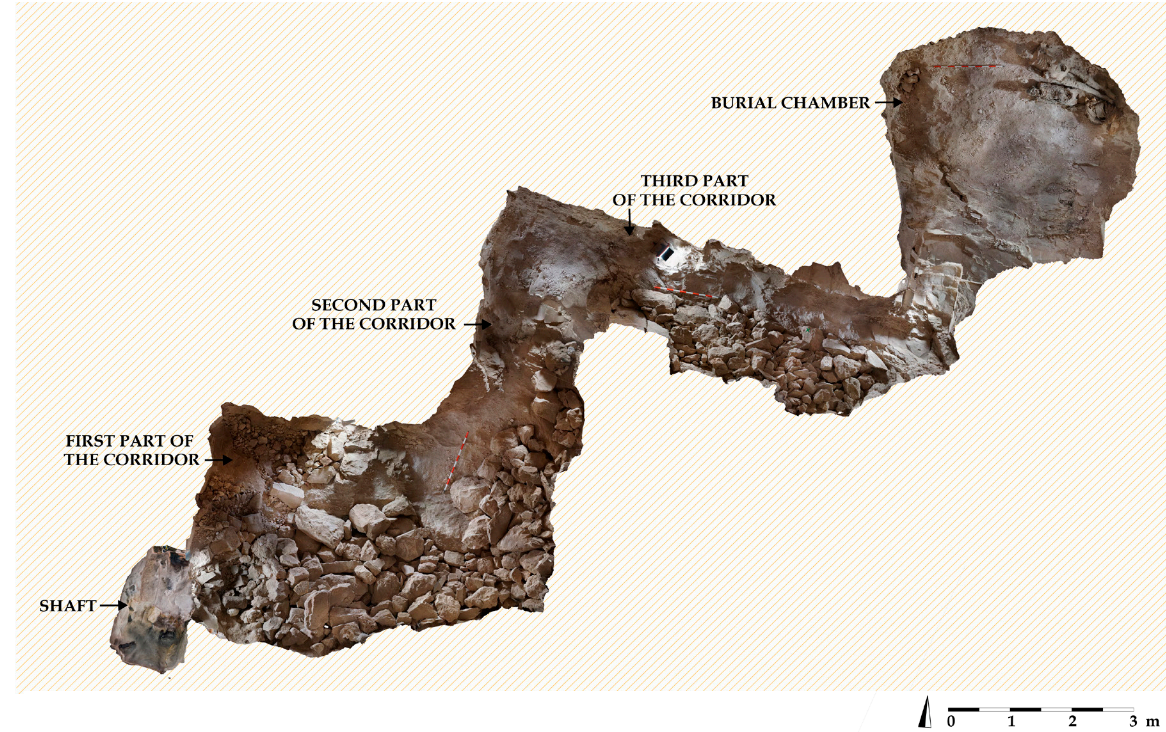

Figure 3. Plan of the underground structures in TT 87 before cleaning activities. All stones pilled against the walls and the debris were removed. Photogrammetry: D. García González and A. Gómez Laguna.

were checked outside under natural light to confirm that they had no traces of texts belonging to the decorative program from the burial chamber or the ostraca used by the scribes as models to decorate the walls (see section 1.1). As a result of this process, no fragments with texts were found. Several fragments of limestone with *muna* and remains of stamps appeared close to the burial chamber. They were probably part of the original closing wall of the burial chamber and have been already published by H. Heye in 1995 (see below).[28] These fragments of limestone and *muna* have been stored inside the burial chamber of Nakhtmin, together with a couple of mummies that were already there when our project started. The rest of the stones have been temporarily moved outside the shaft and used to rebuild the walls of the courtyards belonging to TT 79 (owned by Menkheperraseneb) and TT 80 (Djehutynefer). Likewise, the shaft located in the courtyard of TT 80 has been temporarily filled with the debris excavated at the entrance of the shaft of Nakhtmin. A plastic net has been placed under the stones to separate the original material of tombs TT 79 and TT 80 from the new wall made with the stones of Nakhtmin's corridor. The plastic net was also placed

28 Guksch 1995: 73, Abb. 30.

Figure 4. Painting marks, indicative of carving processes, are clearly visible on the ceiling of the first part of the corridor. Photograph: A. Gómez Laguna.

over the shaft in the courtyard of TT 80 before filling it with the debris from Nakhtmin's shaft.

Some of the stones that filled the shaft of Nakhtmin have traces of painting, marks, *muna*, and oil stains[29] that are probably related to the process of tomb building and decoration, all of which have been photographed and recorded. In the shaft and corridors leading to the burial chamber of Nakhtmin, painting marks on the walls and ceiling associated with the building of the tomb are very well preserved (fig. 4, see also fig. 12). Capitalising on previous works on these marks,[30] our project aims to study their relation with the stones found in the corridors containing similar marks.

29 The spectra acquired from the dark stains found in some stones retrieved in the tomb substructure revealed the presence of lipid materials (oils and fats) degraded over time: low alkylic bands, the presence of carboxylic bands at 1676 cm^{-1}, and possible carboxylate bands at 1397 cm^{-1}. Rests of proteins were also detected, so that the mixture of oils/fats and proteins (animal glue, casein, or egg white) is similar to the binding agents found in the inks used to write the texts in the burial chamber. A possible explanation for their presence on the stones is that the products were mixed before adding the pigments and fillers needed to manufacture the inks. Most likely, they were mixed in a now lost container, from which they dripped on the stones. It remains to be proven if the heating of the materials, a process that was needed in the case of using fats and animal glue, caused some alteration of the proteins.

Figure 5. Identification of *muna* remains on the walls of the second part of the corridor, which point to the existence of a second closing wall. Photograph: A. Gómez Laguna.

In addition, thorough research to find parallels and to compare the building process with other tombs in the area is currently being carried out.

Heye[31] recorded part of the original closing wall of the burial chamber[32] consisting of remains of dark brown *muna* on both walls and part of the ceiling just before the entrance to the chamber, fragments of *muna* with traces of stamps,[33] and limestone fragments with adhered *muna* –the latter two being found on the floor. The NKS Project has documented remains of another original closing wall in the second part of the corridor (leading to the west), after the identification of *muna* remains on both walls and ceiling of the aisle (fig. 5, see also fig. 10).[34]

30 Remains of tape used by the German mission to locate the marks are still in place (see fig. 4). For information about these marks, see Guksch 1995: 73–75.

31 Guksch 1995: 73, 74.

32 Guksch 1995: 72, Abb. 29: V.

33 Guksch 1995: 73, Abb. 30.

34 Additionally, there are remains of *muna* on the floor of the burial chamber and several black spots, identified as remains of bitumen/tar (see plan in fig. 7).

Figure 6. A newly found graffito inscribed on the ceiling of the burial chamber, close to the entrance area. Photograph: A. Gómez Laguna.

In this same area of TT 87, the German mission also documented three graffiti (RM 67 and RM 68)[35] located just after the remains from the closing walls of the second[36] and third parts of the corridor. However, it is worth highlighting the discovery by our project of a new graffito –similar to the three already published– at the entrance of the burial chamber of Nakhtmin (fig. 6, and see also fig. 12). This fourth signature strengthens the reading of the name of a workman supervising the construction tasks as *Nfr-ḥb=f* from the three possibilities suggested by Heye for the anthroponym, since the masculine singular personal pronoun is clearly visible at the end and no plural marks could be detected.[37]

Modern materials have been found during the cleaning of the corridors of Nakhtmin, mixed with the stones and the debris accumulated at the entrance: tobacco and match packets, sweet wrappers, fragments of Arabic newspapers, rifle cartridges, juice cans, etc. It is very

35 Guksch 1995: 72, Abb. 29, 74, Abb. 31.

36 This is the closing wall recently discovered by our project. See fig. 4.

37 Guksch 1995: 74.

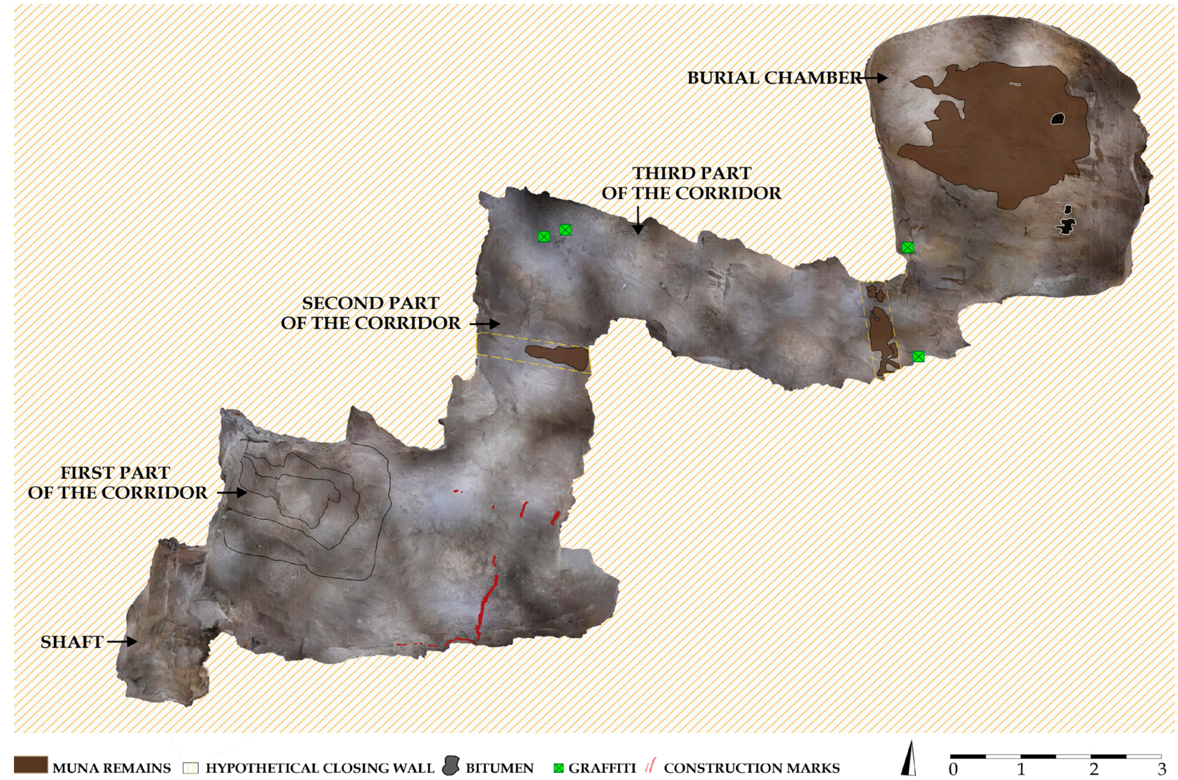

Figure 7. Plan of the underground structures in TT 87 after clearing activities. A. Gómez Laguna.

likely that this material fell down the shaft as it remained opened while the modern town of Qurna was still located at the necropolis until its demolition during the winter of 2006–2007.[38] Likewise, some material from the German excavations –such as archaeological file cards, film rolls, pens, etc.– have also appeared and been photographed. These objects were probably abandoned during the German mission's archaeological work in the tomb in the 1980s. All modern materials were registered in photographs and afterwards discarded.

After completing the cleaning of the shaft, corridors, and burial chamber, photogrammetry was used to record the subterranean structures of Nakhtmin's tomb in order to generate accurate plans, sections and a high resolution photographic archive of these spaces (figs. 7–12). This documentation, which begins from the courtyard on the surface and ends in the burial chamber, supersedes the existing plans[39]

38 For the relationship between the villagers and the archaeology, see: Bednarski and Tully 2020 and Tully and Hanna 2013.

39 Mond 1905: 76, fig. 11; Guksch 1995: 72, Abb. 29, Plans 1 and 2.

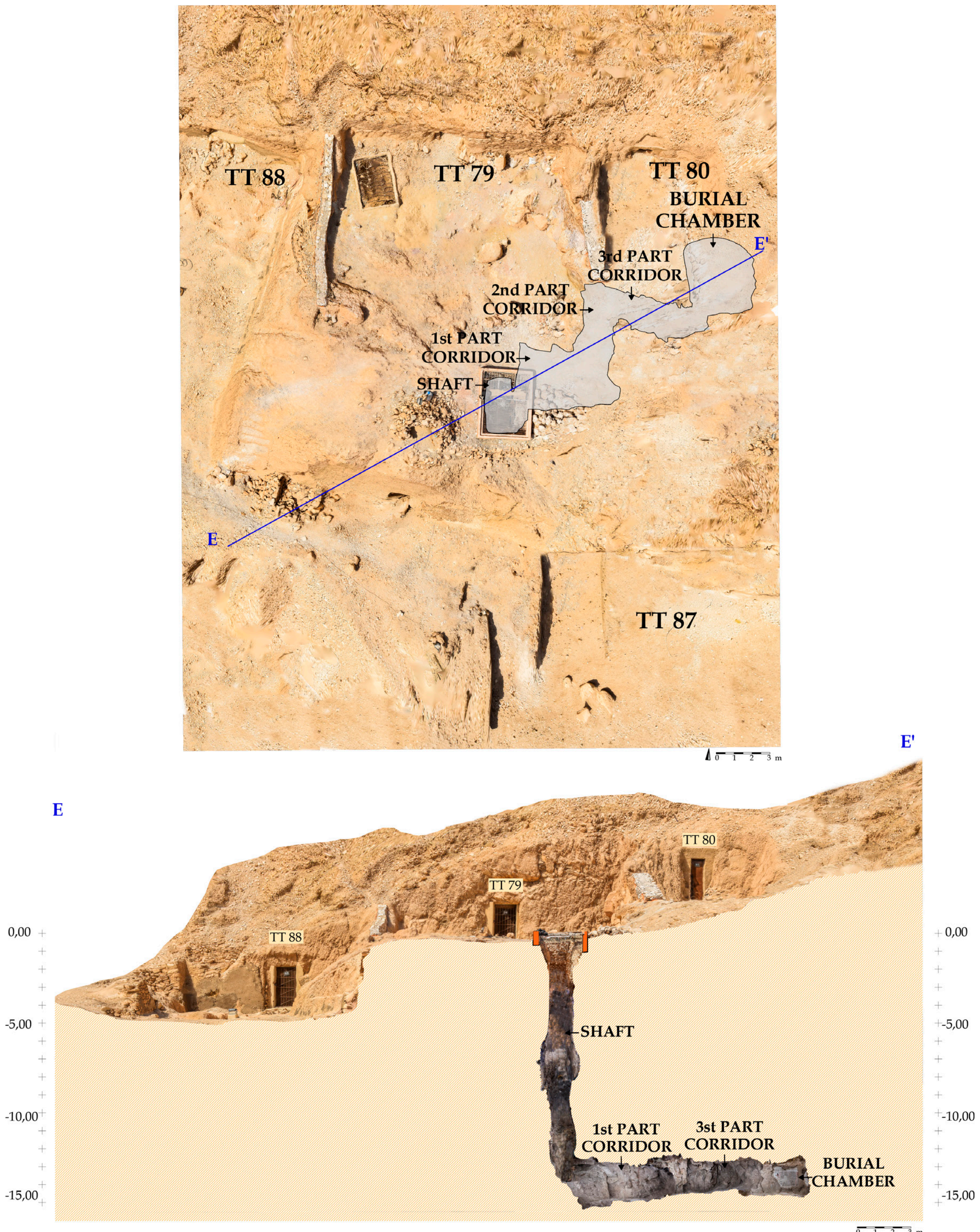

Figure 8. Aerial exterior view and North–South section of the underground structures in TT 87. A. Gómez Laguna.

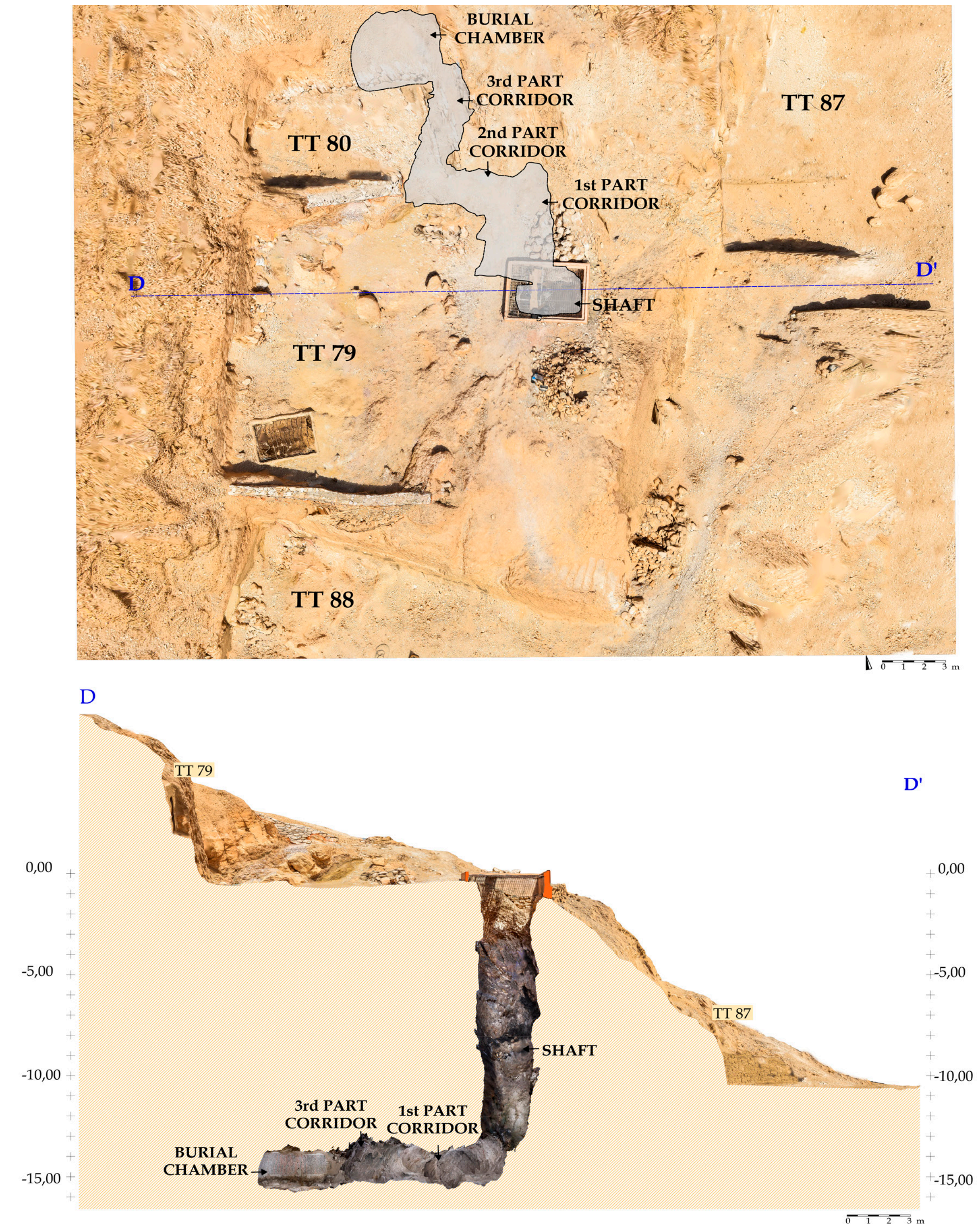

Figure 9. Aerial exterior view and East–West section of the underground structures in TT 87. The curb of Nakhtmin's shaft is located in the courtyard of the tomb belonging to his son (TT 79). A. Gómez Laguna.

Figure 10

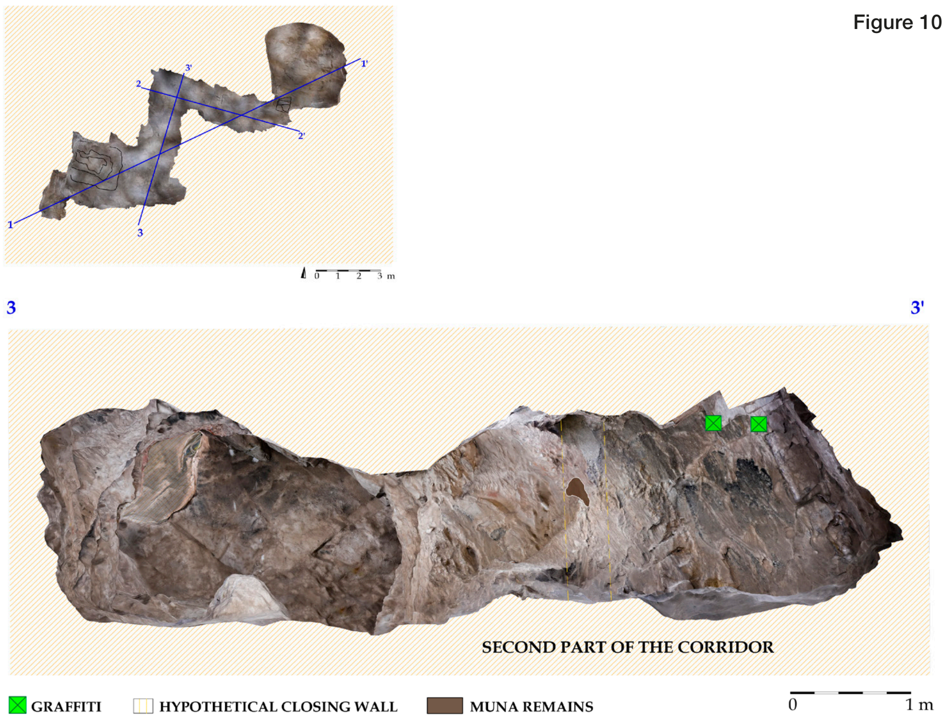

Figure 11

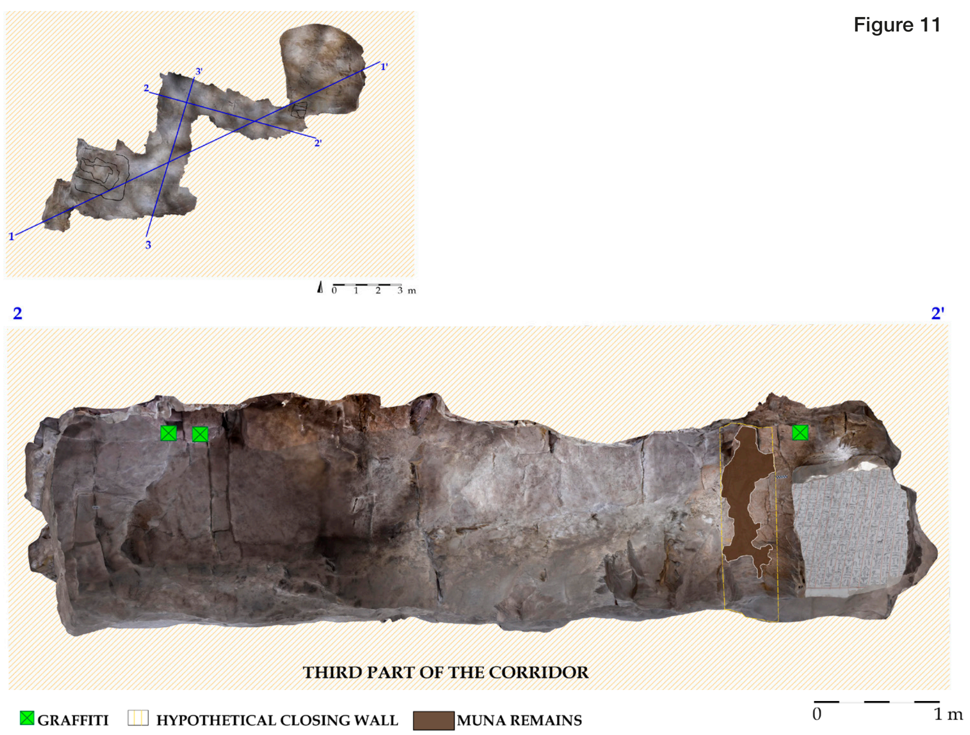

Figure 12

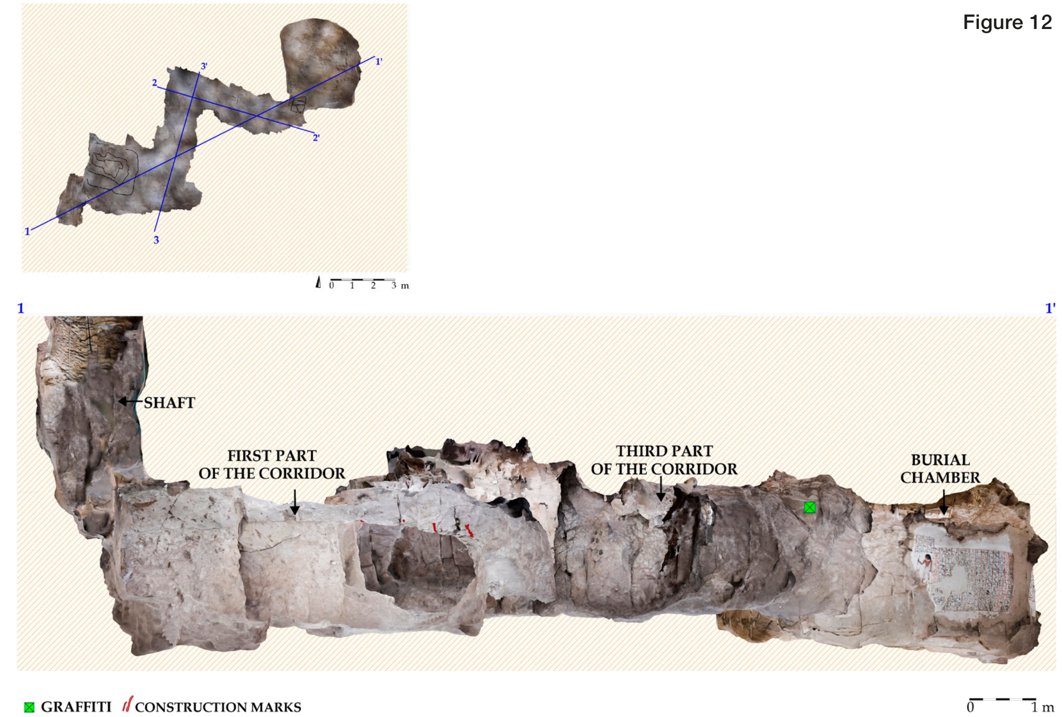

Figure 10. Section visualising a portion of the first and second parts of the corridor. The position of two graffiti (already identified by the German mission led by H. Heye) and remains corresponding to a newly identified closing wall are indicated. A. Gómez Laguna.
Figure 11. Section of the third part of the corridor, with indication of the position of two graffiti and remains of the closing wall system located closest to the burial chamber (all features already identified by the German mission led by H. Heye). A. Gómez Laguna.
Figure 12. Cross section of all underground structures in TT 87, with indication of the position of the newly discovered graffito inside the burial chamber. A. Gómez Laguna.

drawn before the clearing of the debris and limestone blocks and before modern digital technology was available or widespread.

For the photogrammetry, the following equipment and software were used: Nikkon 5600 camera (with Tamron 10–24 mm, Nikkon 35 mm, and Nikkon 18–105 mm lenses), portable white light halogen spotlights, and Agisoft Metashape, a software that allows the generation of digital three-dimensional models from which the orthophotographs –images geometrically corrected with a uniform scale– are obtained. Nearly 2200 images with an average size of 2.7 MB per unit were necessary to complete the documentation.

The main challenge in the digital documentation process was lighting up subterranean spaces of reduced dimensions, with steep slopes and marked by numerous irregularities of the ceiling, walls and floor. Since fixed spotlights would have generated many shadowy areas, portable ones were used in order to homogenously light broad areas. Additionally, fixed spotlights mounted on top of tripods served as fill light.

1.3 | Conservation and Restoration

The aims of the conservation and restoration tasks were to determine the phases of preparation of the decorated surfaces[40] and their state of preservation (highlighting the major factors of deterioration), to test cleaning and consolidation procedures, and to execute those that proved to be more efficient and non-harmful to the monuments.

The burial chambers corresponding to TT 87 and TT 61 present considerable differences, both structurally and in their state of preservation. Working on both at the same time provides a broad vision of the techniques and procedures applied in their construction. It also offers a complete panorama of how the intrinsic characteristics of the work and deterioration factors operate together to determine a cultural good's preservation condition.

The bedrock from which the chambers were excavated was levelled to apply the pictorial decoration. In the case of Nakhtmin, this levelling of the limestone was restricted to the precise areas where the texts were copied, and we were able to inspect the subsequent overlapping of strata in the rest of the chamber with a naked eye. The first layer placed on top of the bedrock is composed of mud with straw (a mixture called *muna*) and, possibly, some addition of plaster bearing calcite and gypsum. It is a thick layer of a brownish hue that was applied quickly, neglecting its final appearance and generating a continuous but irregular surface in which the marks of the workmen's fingers are clearly visible. In addition to saving time in finishing a medium that would later be covered, these irregularities generate a texture that favours the mechanical grip of the following layers. However, the mixture of straw and mud has lower adhesiveness, bonding and hardness in comparison to plaster mortar and consequently displays a worse performance in the long term.[41]

On top of the *muna*, a thinner layer with a lighter tone was more carefully applied. This mortar is composed of coarsely ground plaster and loaded with soil particles, and its surface was smoothed with the palm of the hand and a trowel. Finally, a layer of finer ground gypsum was applied, loaded with lighter coloured aggregate of less granulometry than in the previous layer. This last coating of preparation seems to have been worked with some tool to generate a completely smooth surface throughout. In contrast, there was no care in preparing the ceiling, since several protuberances emerge at different points and the marks of palms and fingers are clearly visible.

Once the walls of the chamber were smoothed, the pictorial decoration was applied. The white background on which the texts were written is a paint composed of a pigment (calcite) and a binder that mixes protein substances (such as animal glue or casein) with some wax or oil (see section 1.4). Again, this white background is restricted to areas that were afterwards decorated, although part of the vignettes depicting the tomb owner and even some of the texts fall beyond it.

Once the technical characteristics of the chambers had been observed, it was possible to establish their state of conservation, for which damage maps were drawn. In TT 87, the effects of human action are practically negligible. However, there

40 A full account of the *chaîne opératoire* that stands behind the preparation of writing surfaces in the burial chamber of TT 87 can be found in Díaz-Iglesias Llanos and Méndez-Rodríguez 2023: 5–12. The results of *in situ* studies conducted in 2022 through non-destructive techniques are incorporated in this section and 1.4.

41 Compare the state of the burial chamber of Nakhtmin with that of Useramun (section 2.3), where the surfaces were prepared in a different manner.

Figure 13. Damage map, with indication of the different types of alteration factors, corresponding to the east wall in the burial chamber of TT 87. I. Bermeja Gigorro.

was a delamination of the wall's preparation layers due to the technical characteristics described above and the natural movement of the bedrock. This set of factors led to the appearance of cracks and detachments, the most striking of which are located on the east wall (fig. 13). Small perforations of anthropic character and unknown origin were observed. It is possible that they are just incidental and not a consequence of plundering attempts. Salt efflorescence and fungus were occasionally detected on the south wall but, in general, the alterations related to the existence of humidity are minimal. The pictorial layers were in good condition, although the black colour was somewhat powdery.[42] The walls were covered by a light layer of dust. On the east one, the gradual slope towards its lower

42 As will be seen in section 1.4, the black pigment derives from charcoal, a material that is characterised by the small size of its particles, while the red pigments that come from hematite have a more crystalline structure.

Figure 14a. State of the east wall before restoration. Photograph: C. Ruiz Sánchez de León.

Figure 14b. East wall after restoration (relocation of fallen fragments and fill of lacuna). Photograph: D. Méndez-Rodríguez.

half has favoured the accumulation of dust, giving rise to concretions and a slight superficial alteration of the white background tone, which is less luminous in this area. Splashes have also been detected here, probably due to bird or bat droppings.

The first step of the conservation treatment was to stabilise the preparation layers of the wall in those areas where there was a risk of detachment, either because of their intrinsic characteristics or because of the damage suffered. To improve the adhesion between layers, Acril 33 (a pure acrylic resin in aqueous dispersion characterised by an excellent resistance to atmospheric agents and chemical stability) was injected. PLM A mortar was also injected to fill detected voids, while minor cracks and perforations were sealed with plaster. Once the whole was stabilised, lime mortar and stones from the surroundings were used to fill gaps, either original or caused by damage, in particularly unstable areas.[43] In addition, naturally detached fragments with decoration, preserved inside the chamber by the German mission, were repositioned in an area where a large void had to be filled with mortar and medium size stones (figs. 14a and b).

Since the walls were in a fairly good condition, a superficial cleaning with soft brushes and *wishab* sponges was executed on the pictorial layer. The black ink of the signs was powdery. Given that the consolidation tests (with Klucel G in ethanol and Paraloid B72 in acetone, both by brush impregnation and spraying) altered their original appearance and that their state of preservation after 3500 years was reasonably good, no intervention was deemed necessary.

The environmental conditions inside subterranean monuments and their relation with the exterior play an important role in the conservation state of the substratum (rock) and the materials used in the decoration (mortars). In order to monitor the environmental conditions, two Hobo dataloggers were installed at the bottom of the shaft and in the innermost part of the burial chamber.[44] They are programmed to measure temperature and relative humidity every five minutes during fieldwork and every hour during the rest of the year. Thus, we can record the seasonal fluctuations in the environmental conditions and the impact of our (anthropic) presence and design preventive conservation programmes to diminish deterioration factors in accordance with the team of geologists. A device to measure the presence of Radon gas, which serves to indicate the presence and scope of ventilation, was also installed inside the burial chamber.[45]

43 In the case of gaps left by ancient Egyptian workers at the bottom of the walls, the mixture of mortar and rocks was applied under the criteria of minimum intervention (only when needed for structural reasons) and easy identification (a pattern of oblique parallel lines was drawn on the final layer to distinguish it from the ancient mortars). The overlapping of layers is still visible in many areas for future research.

44 They were activated on 22.02.2022, and the data they provide is supervised by the geologists Sergio Sánchez-Moral (CSIC) and Soledad Cuezva Robleño (Universidad de Alcalá).

45 Launched on 23.02.2022.

1.4 | Study of Inks and Materials

The main aim of the archaeometric study of the materials used by ancient Egyptian scribes in the burial chambers of TT 87 and TT 61 was identification of the components in the inks (pigments, binders, and fillers)[46] and in the background colour of the walls.[47] In relation to the analysis of the decoration of TT 87, understood as a process with several stages, and of the three scribal hands identified (see section 1.2), the following research questions were also pursued: Can differences in the ink composition be detected in the sections copied by each scribe? Was the same ink used for writing texts and drawing vignettes?[48] The archaeometric study is also important for the development of conservation strategies (see section 1.3).

Two procedures were used for the study of the mentioned materials: DRIFT (Diffuse reflectance infrared Fourier transform) and Raman spectroscopy. While the former is more suitable for the identification of fillers and binders, the latter gives better results in the identification of pigments. The results obtained can be illustrated through two representative DRIFT spectra, derived from black and red signs written on panel 3 (fig. 15). The spectra show only small differences, with the similarities of the red and black sections arising from the fact that the same filler and binders were used to prepare the respective inks.

The main fillers revealed by the DRIFT spectra were carbonate produced by calcite (C) –evidenced by the bands appearing at 680 ($C\nu_4$), 880 ($C\nu_2$), and the combination bands at 2540/80 cm^{-1} ($C\nu_1+\nu_3$)– and sulphate coming from gypsum (S) –revealed by the presence of bands at 617 ($S\nu_4$), 1120 ($S\nu_3$) cm^{-1}, and the overtone and combination bands at 2125 ($S\nu_1+\nu_3$) and 2220 ($2S\nu_3$) cm^{-1}. The amount of calcite was found to be higher in the case of the black pigments than in the red ones.[49]

The main difference between black and red pigments is seen in the low wavenumber region for the latter, where a clear band corresponding to the νFe-O vibration in the iron oxide (Hematite, H) is seen at ca 495 cm^{-1}. Another clear difference is the presence of broad absorption bands corresponding to clay (CY) seen at around 1000 cm^{-1} and the narrow bands appearing at 3694/3648/3620 cm^{-1}.[50] Black pigments were identified as charcoal through Raman spectroscopy (spectrum not shown here). The presence of less intense bands in fig. 15, in the 1400–1800 cm^{-1} interval for red pigments, indicates the use of a lesser amount of binder than in the case of blacks. We attribute the greater amount of binders in black inks to the larger specific surface

46 The pigments are the compounds that generate the colour, but cannot be used in their pure state, since they are very dark. Fillers are used to thicken the ink and separate the crystals of the pigments so that the use of the ink can be extended. The binder is the medium in which the other components (pigments and fillers) are suspended, serving as a fixative element that also intensifies the colour and contributes to the malleability of the final product. Ink is considered to be the mixture of all these elements.

47 These analyses are part of a growing interest in the study of ancient Egyptian materials and technologies through a variety of means (laboratory and in situ analysis, experimentation, and ethno-archaeology). A recent overview is offered by Nicholson 2020.

48 A more detailed study of the inks and comparison of the results with other roughly contemporary tombs where analyses have been undertaken is in preparation by Sánchez-Cortés, Martínez Ramírez, and Díaz-Iglesias Llanos.

49 Rosi *et alii* 2016; Alberghina *et alii* 2020; Wei *et alii* 2020.

50 Germinario *et alii* 2018.

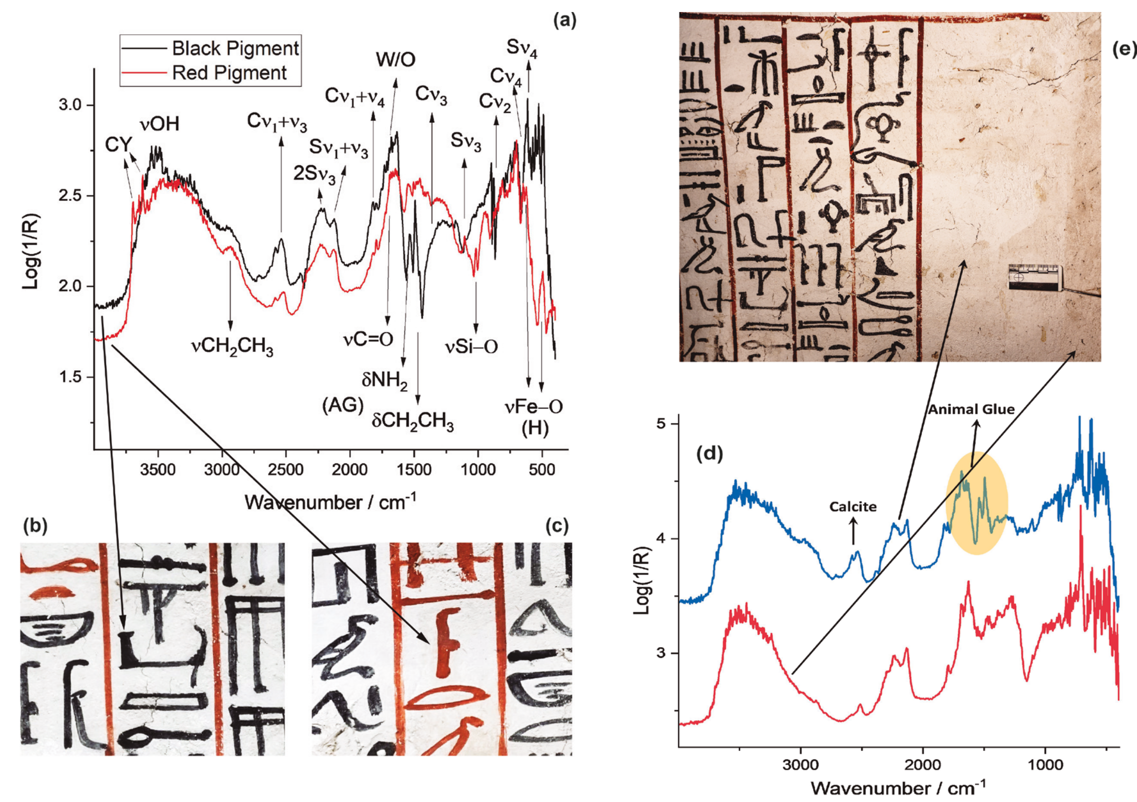

Figure 15. (a) Representative spectra of black and red texts with the assignment of bands registered on the signs indicated in (b) and (c). Assignments: S = sulphate (Gypsum), C = carbonate (Calcite), H = hematite, CY = clay, AG = animal glue, W/O = wax/oil. (d) Spectra registered on two different points of the white background of the writing surface (e). S. Sánchez-Cortés, S. Martínez Ramírez, and D. Méndez-Rodríguez.

of charcoal particles, which in turn is due to their finer grinding.

One characteristic of the materials studied is the fact that they display distorted bands, with the presence of derivative-like bands (so-called Christiansen effect) and Reststahlen bands (inverted bands) due to the optical effects resulting from the complex structure of the inks (i.e. the mixture of organic and inorganic components and the different sizes of the particles).[51] The perturbation produced on the DRIFT spectra is due to the high absorbance of IR radiation of carbonate and sulphate ions.

In addition, the presence of binders could also be identified by infrared spectroscopy. The existence of protein-based materials is revealed by the presence of animal glue, evidenced by the appearance of features in the 1400–1700 cm^{-1} region.

51 Miliani *et alii* 2012.

This binder induces a stronger perturbing effect on the infrared absorption, leading to the appearance of derivative-like features centred at 1460, 1547 and 1640 cm^{-1}.[52] Based on previous analysis of similar pigments in Egypt, we have attributed these features to animal glue (AG), but we cannot discard the presence of other proteinaceous substances (such as casein or albumen) until further research is done. Other binders identified in the inks were organic compounds of the lipid family. Thus, the existence of beeswax/oil (W/O) is proven by the presence of a weak band at 1725 cm^{-1} due to the ν(C=O) vibration of ester groups. The bands appearing in the 2800–2900 cm^{-1} may also have contributions from the $\nu(CH_2)$ and $\nu(CH_3)$ vibrations of the aliphatic chains in lipids (wax, oils), but also from protein-based binders.[53]

Regarding the final layer of preparation and the pictorial layer of the panels (see section 1.3), the following conclusions could be drawn. The matt white surface has a predominant content of gypsum, revealed by the strong positive bands at 2125 ($S\nu_1+\nu_3$) and 2220 ($2S\nu_3$) cm^{-1}, as well as the negative band at 1140 cm^{-1} (ν_3). The bright white area, forming the pictorial layer or background to the decoration, is characterised by a significantly higher content of calcite used as pigment, represented by the band at 2540/80 cm^{-1} ($C\nu_1+\nu_3$).[54] One can also notice the presence of distorted bands due to the addition of animal glue together with bands due to wax/oils as binder.

The recognition of differences in ink between the three identified scribes rested on the study of black pigments, given that all three individuals copied texts using this colour but passages written in red are only attested for scribes A and B. For establishing differences between scribes, the following spectral markers that were found to vary in the texts penned by each individual were identified: a) The C(ν1+ ν4) / S(ν1+ ν3) ratio (R1), b) the intensity of the S(ν3) band, c) the intensity of the 1600 cm^{-1} group of bands, d) the C(ν3) / S(ν3) ratio (R2), e) the ratio between the 3600 and 3400 cm^{-1} family of bands (R3), f) the intensity of the band at 1685 cm^{-1}, and g) the intensity of the band at 1725 cm^{-1}.

The Principal Component Analysis (PCA) is a multivariate statistical method used to reduce the amount of data. The PCA analysis applied to the DRIFT spectra obtained from different points that are related to scribes A (SA), B (SB), and C (SC) is shown in figure 16. The results indicate that the ink used by scribe B is characterised by a lesser amount of filler and binders, a higher amount of binders in comparison to fillers (R2), and the different relative composition of the fillers, with a higher relative amount of calcite (R1). A lower intensity was also observed in bands corresponding to lipids (oil and wax). The section penned by scribe C is characterised by a higher amount of gypsum, used as filler (1100 cm^{-1} band), and a prominent band due to the presence of degraded oil. Finally, the texts copied by scribe A show a higher R3 ratio, which in principle indicates a higher amount of calcite regarding gypsum used as filler. This is corroborated by an inverse effect in R1 (the calcite/gypsum ratio for the combination bands).

52 Brøns *et alii* 2018.

53 Rosi *et alii* 2009. All these organic compounds are subjected to degradation processes (produced by natural aging, the oxidative effect of certain materials like iron or the attack of microorganisms like fungi or bacteria), which hinder the identification of the specific products used.

54 A similar study conducted on the white background of TT 61 showed a higher amount of calcite was used than gypsum, whereas the last layer of TT 87 exhibits a higher proportion of gypsum than of calcite. The finer grinding of the calcite particles in TT 61 can be seen with a naked eye.

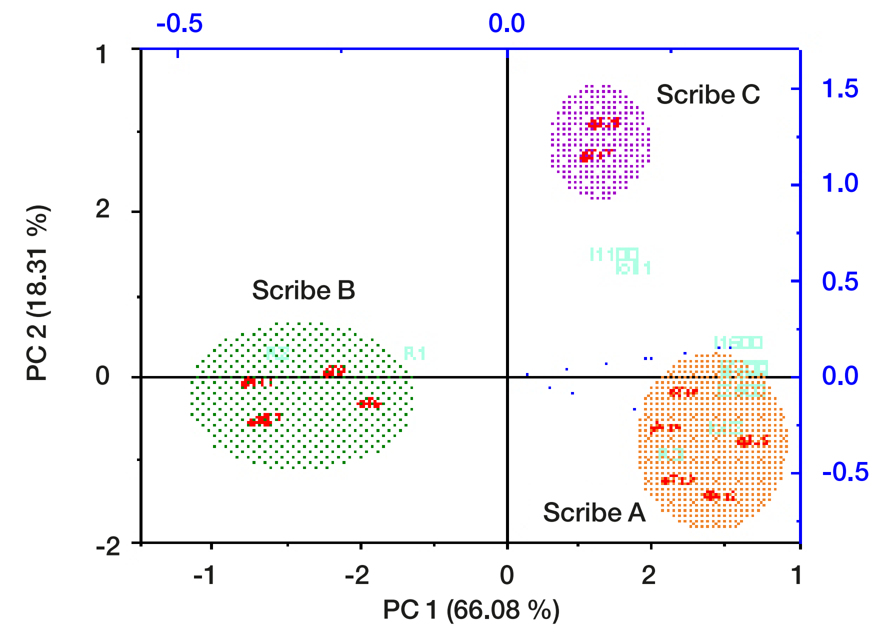

Figure 16. PCA analysis made taking into account all the spectra markers defined for the three scribes in panel 3 of Nakhtmin's burial chamber. S. Sánchez-Cortés and S. Martínez Ramírez.

Finally, the two vignettes representing the tomb owner going forth and entering the burial chamber were examined. The FTIR spectra of the images suggest that the mixture was prepared with a different content of the necessary elements (pigment, filler, and binders). The vignette that closes panel 3 was simply executed with black traces in a very sketchy manner. The black ink was prepared with a higher amount of organic binders, in particular animal glue. The vignette that stands at the beginning of panel 1 (see fig. 14) has a high content in red pigment (H). Likewise, the red colour has a higher content of calcite when compared to the rubrics in the texts. As for the white pigments, they seem to have a high content of fillers (gypsum and calcite), together with an appreciable amount of binder (AG).

To sum up, the application of non-destructive analytical techniques to the study of ancient materials has yielded interesting results. Instead of the more widely used gum arabic, the ink documented in the burial chamber of TT 87 was produced with animal glue as binder, which might entail a different procedure of fabrication through heating the mixture (especially if substances other than casein and albumen were used). A second relevant outcome of this study is that the identification of scribal hands based on the epigraphic examination found support in the non-destructive examination of inks, since the latter detected differences in the inks used by scribes A, B, and C. Variations are visible in the quantity of the components used (pigments, fillers, and binders) and in the size of the particles, and may indicate that the ink was produced separately by each of the individuals. Finally, differences have also been spotted between the ink used for writing texts and for drawing vignettes, with the latter showing more organic elements (in the case of the black colour), more pigment (in the case of reds), or more fillers (in the case of whites). These differences may owe to the fact that the images spanned across large surfaces and perhaps to a desired effect of intensifying their colours.

2 | The burial Chamber of Useramun

Useramun started his career in administrative positions in the temple of Amun under Thutmose I. He was bestowed with a large series of titles during the joint reigns of Hatshepsut and Thutmose III and the sole reign of the latter, amongst which the following stand out: *jmy r njwt ṯ3tj; jmy r njwt mḥr; jmy r ḥwwt wrt 6; jry Nḫn; ḥm-nṯr M3ʿt* 'town overseer, vizier, overseer of the pyramid town, overseer of the six great enclosures, mouth of Nekhen, priest of Maat'.[55] He was the son of the vizier Ahmose-Aametju[56] and paternal uncle of the vizier Rekhmire. He ordered the construction of two tombs for himself, one of which was destined to function as an offering chapel (TT 131) while the other was conceived as a resting place for interment (TT 61).[57] For the latter, he re-used a Middle Kingdom tomb hewn at one of the highest points of Sheikh Abd el-Qurna and looking towards the temple of Millions of Years of Thutmose III.[58] Construction works took place between regnal years 22 and 28 of the aforementioned king.[59]

The first exploration of the burial chamber in TT 61 was done in 1903–1904 by Robert Mond,[60] who only published some lines of his cleaning activities in the 'pit' and the findings thereof.[61] Afterwards, the tomb attracted little attention,[62] until E. Dziobek started to work there on behalf of the German Archaeological Institute in the late 1980s.[63] While no conservation treatment was then applied to the decorated surfaces of the burial chamber, despite their notorious damage caused by fires and looters (see section 2.3), the analysis of the texts was entrusted to E. Hornung, who

55 His titles have been predominantly studied by Dziobek 1995, 1998: 85–164.

56 His wife, Taametju, was a sister of Ineni (TT 81), the mayor of Thebes who oversaw the construction of the first tomb in the Valley of the Kings (Dziobek 1987: 69; Shirley 2010a: 91–93), that of Thutmose I, which was decorated with the Amduat (Mauric-Berberio 2001; Abdel Ghany 2018 and 2019). Ineni was therefore an uncle of Useramun and he might have contributed to the education of the latter at Karnak, given that Ineni also occupied positions in the granaries and magazines at Amun's enclosure (Dziobek 1987: 70).

57 The phenomenon of double tomb ownership in the early Eighteenth Dynasty has been studied by Dorman 1995. See also Dziobek 1989: 118–120, Abb. 5 and Shirley 2010b.

58 Dziobek 1994: 16; Roehrig 1995: 259; Karlshausen and Dupuis 2014: 267, n. 20, 268, 272. The shaft seems to be a New Kingdom addition (Kampp 1996: 279).

59 Dziobek 1994: 100.

60 The burial chamber must have been previously accessed by looters, since one of the magical bricks (from the lot of four deposited in niches carved in the walls of this chamber) was sold on the antiquities market in 1836 and bought by the Musée Calvet in Avignon (Régen 2002: 991–992).

61 Mond 1905: 73, fig. 3, pl. III. Mond excavated the shaft and burial chamber of Nakhtmin (see nn 18 and 26) during the same season. Thereafter, the reports of Weigall (1909: 128) and Mackay (Gardiner MSS 18.2.1–2, 19.1.1) only mention the cleaning of the above-ground structure in TT 61 and its furnishing with an iron door. See Kaczanowicz (2020: 45) for the intervention of Jelf.

62 The burial chamber must have been visited during the 1920's by Norman de Garis Davies, who recorded a description of the shaft, the burial chamber and some of the objects found in the latter room (Davies MSS 1, 46; 6, 83). Francisco Bosch-Puche assisted us in reading the notebooks written by Davies, for which we are grateful.

63 Dziobek 1994: 42–47, Taf. 9–16, 28–35, 49.

published several studies and hand-copies (see section 2.1). The German team concluded that the above-ground structures were reused after the Eighteenth Dynasty,[64] but no reference is made to the underground chambers, which were likely subjected to looting activities both in antiquity and more recently. The future clearance of these spaces and the study of the material culture found therein will help determine their use life.

2.1 | Epigraphic Study

The decorative compositions of the burial chamber of Useramun were exceptionally drawn from the repertoire of royal afterlife texts and, more specifically, those that were also used for the decoration of the tomb belonging to the reigning king Thutmose III: the Book of the Hidden Chamber (so-called Amduat, including its summary or "abrégé") and the Book of Venerating Re in the West (also known as Litany of Re).[65] There seems to be a further meaningful connection between the texts of the great Litany of Re copied on the tombs of Useramun and Thutmose III, since those copied on the walls of the former end where those destined for the latter begin.[66] Quite remarkably, the Amduat texts preserved in the tomb of the vizier rely on a better preserved master copy than that used for the king.[67] Furthermore, Useramun included himself or members of his family –whether as images or as textual additions– in the solar bark as it navigates through the underworld, in the text of the hours, or between and in the end of the list of solar forms that runs through the lower part of two walls.[68]

Significantly, the texts of the burial chamber of TT 61, which are amongst the earliest and most complete versions of the Amduat and the Litany of Re, are hitherto only known through few general photos and in the handwritten version published by E. Hornung.[69] This documentation is not suitable for a study of scribal hands and practices, prompting us to start the detailed recording of the surfaces using digital techniques (see section 2.2) and a palaeographic analysis.

The epigraphic analysis, in combination with conservation and archaeometric study, tries to elucidate how the written surfaces were prepared (see section 2.3) and how many scribes participated in the decoration. Previous descriptions

64 Dziobek 1994: 17.

65 See the recent study of the decoration in the burial chamber of TT 61 by Russo 2016: 47–52. The use of royal compositions by private individuals is quite exceptional in the New Kingdom. Useramun, however, also drew from the more widespread Book of Going Forth by Day repertoire for his afterlife concerns. Thus he was the owner of a partially preserved papyrus decorated with several spells (pEdinburgh 1956.315, Munro 1990) and four magical bricks bearing chapter BD 151 (Régen 2002).

66 Hornung 1975–1976, II: 9–10; Hornung, in Dziobek 1994: 45, 46; Dziobek 1995: 137. Den Donker (2017: 344) ventures that Useramun was in charge of works in the tomb of the king (KV 34) and could gain access to royal documents. Werning (2007: 1937) posits that in the case of the Litany of Re, the same *Vorlage* was used by Thutmose III and the vizier.

67 Hornung 1961: 105. Most likely, the Amduat version of Useramun is the same as that used in KV 20 (the tomb of Hatshepsut or Thutmose I), according to Werning 2007: 1937–1940.

68 Hornung 1961: 105–107, 114–115; Hornung 1965.

69 Hornung 1961: Taf. II and III; Hornung 1975–1976; Hornung 1987–1994.

of the burial chamber walls consider the yellowish hue of the surfaces as an intentional attempt to mimic the background colour of a papyrus.[70] However, a close inspection of the medium with magnifying glasses and non-destructive techniques (section 2.4) has shown that a layer composed of animal glue and wax was used before, after, or even before *and* after writing the texts over a layer of white calcite and gypsum. The use of such a product may have been intended to prepare the surface by sealing the gypsum pores, if it had been spread before the decoration was added. It might have also served as a sort of varnish to protect and enhance the colours of the texts and vignettes, if it had been spread after the decoration was executed. Originally, this layer added on top of the white surface was meant to be transparent, but under the effect of fires lit inside the burial chamber, it has darkened and turned into a yellow or brown colour (see section 2.3).

The texts copied onto the walls display sections with signs of different sizes. The largest (vertical or large signs up to 4 cm high) and more detailed ones were used in captions to the forms of the sun-god in the Litany of Re. Signs of medium size (ca. 2.5–3 cm high for vertical graphemes) appear in the texts of the Litany, those of the hours in the Amduat (heading, introduction, and conclusion) and its abridged version. Captions to representations of the Amduat are copied with small signs, whose sizes (from 2 to less than 1 cm) depend on the space available. The implements used to pen them barely measure more than 2 mm, contrasting with the wide strokes seen in TT 87 produced by a pen with a broader tip, that in the case of scribe A could leave strokes of up to 8 mm.

Departing from the features we have used to identify scribal hands in TT 87 (see section 1.2), we have also started an investigation of the texts in the burial chamber of Useramun to determine how many individuals were involved in the decoration. By comparing the signs' morphologies, which are best visualised through a palaeographic table (table 1), the grapheme kerning, and the angle of inclination of birds, five individuals could be thus far differentiated. This is a preliminary identification, given that all features pertaining to the *mise en page*, the technology and morphology of signs, and scribal practices should be studied in conjunction. A new aspect that can help differentiate between scribal hands is the way in which graphemes are spatially arranged within quadrats.[71] In table 1, in the cell corresponding to M17+G43, differences can thus be seen in the size and position of the signs in relation to each other. Future seasons of epigraphic study will serve to identify the sections copied by each of the five scribes and, perhaps, to identify new individuals. The presence of many qualified copyists in a single burial chamber ties in well with the high position occupied by the vizier in the administrative structure of Egypt.

2.2 | Digital Documentation

In the initial visual inspection and documentation of the internal structures (chamber, sloping passage, and burial chamber) through photogrammetry, large quantities of fragmentary human and material culture remains (pottery, coffins, cones, limestone blocks, and mummy bandages) were spotted. Some of the cones

70 Hornung 1961: 101, 107; Hornung, in Dziobek 1994: 43.

71 See the categories defined by Polis 2018: 316–327.

Table 1. Palaeographic table comparing the morphology of signs in different textual sections, which point to the work of five different scribes. D. Méndez-Rodríguez.

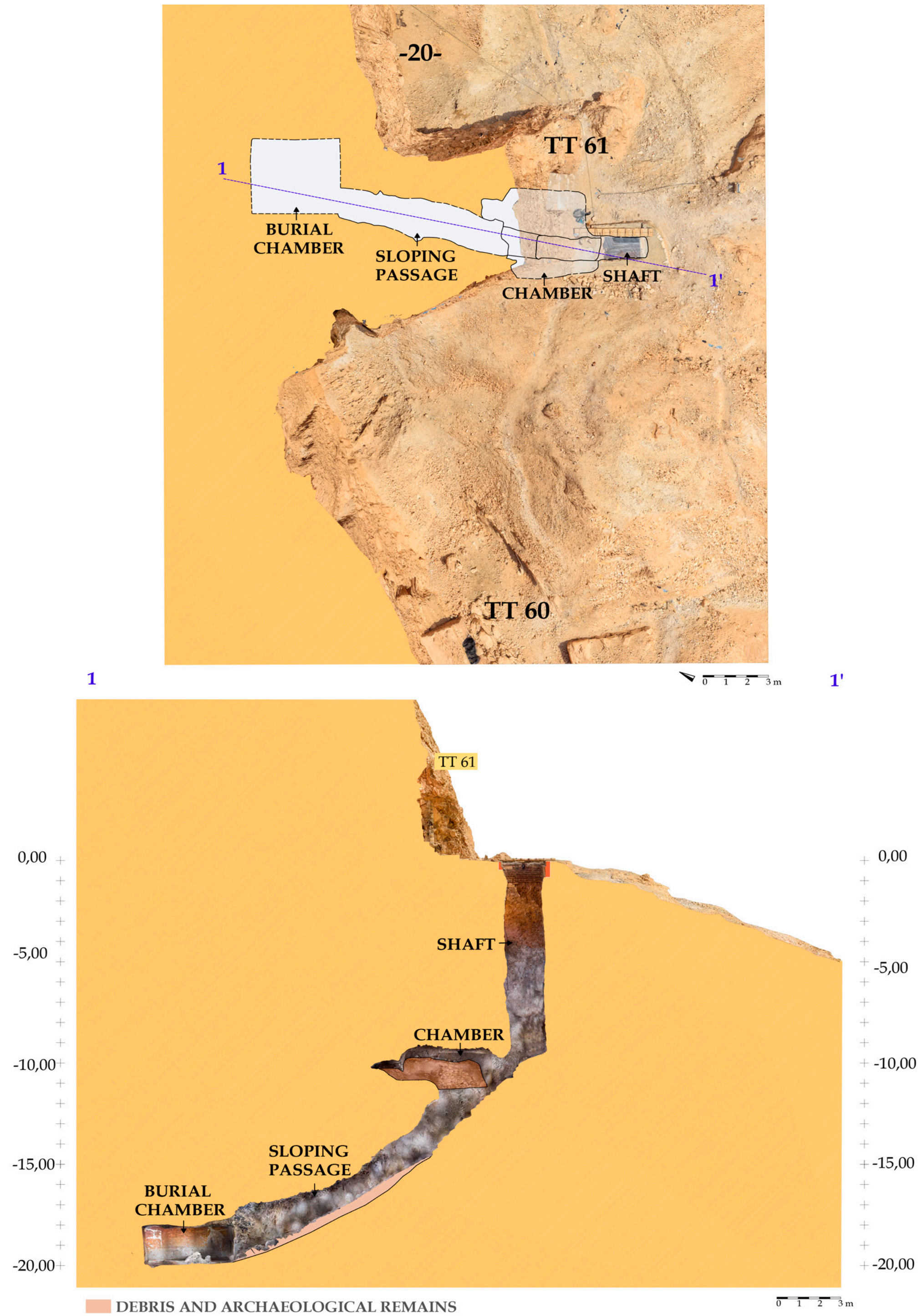

Figure 17. Preliminary West–East section of the underground structures in TT 61 before clearing activities. A. Gómez Laguna.

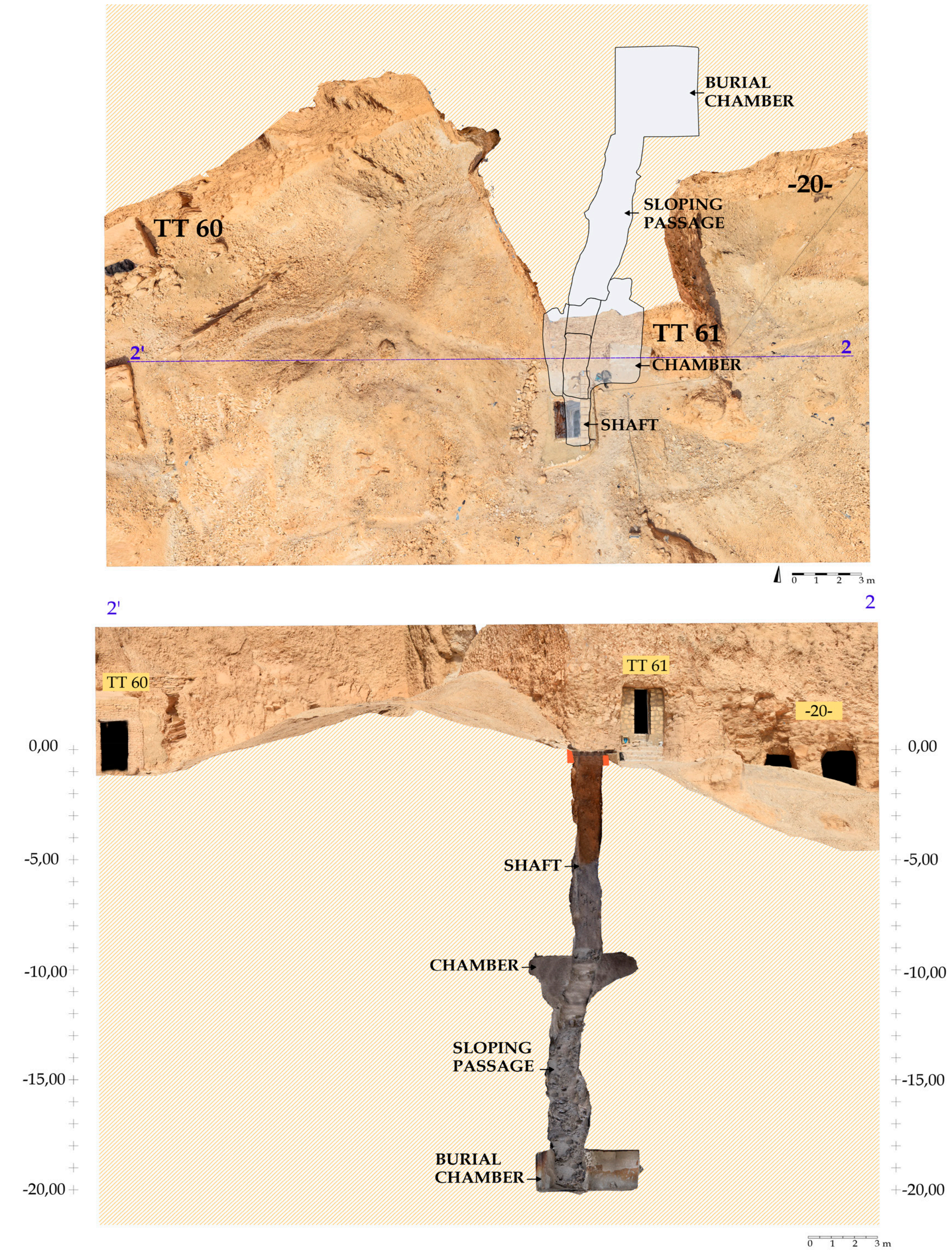

Figure 18. Preliminary North–South section of the underground structures in TT 61 before clearing activities. A. Gómez Laguna.

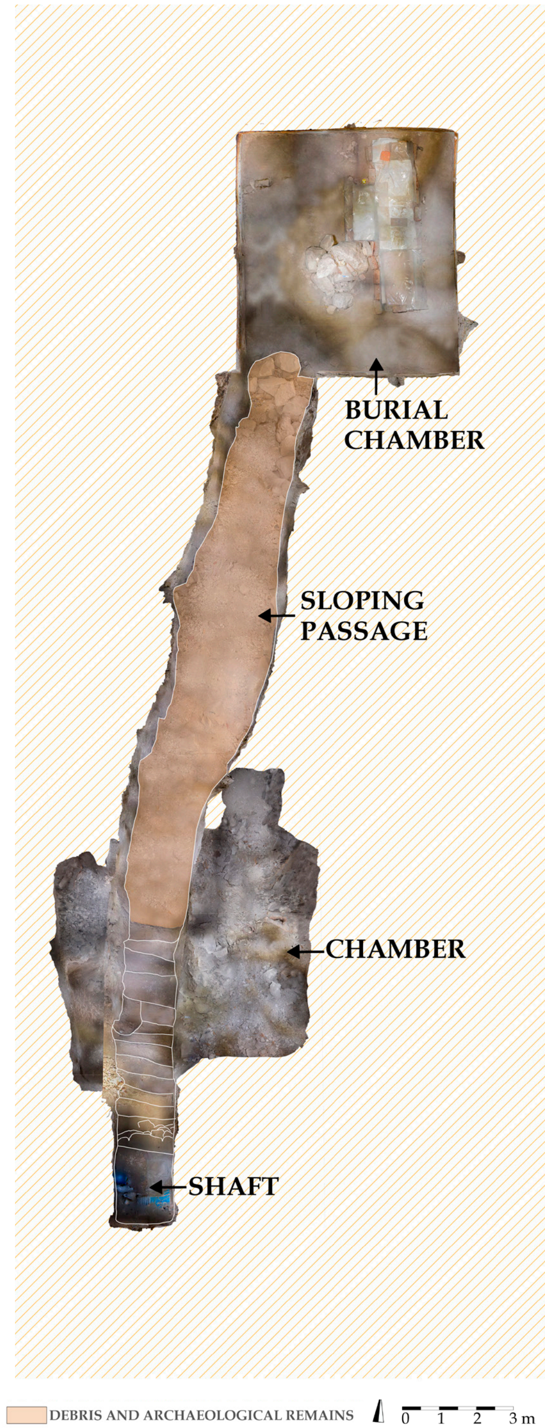

Figure 19. Plan of the underground structures in TT 61 before cleaning. A. Gómez Laguna.

and limestone blocks can be traced to the period in which the tomb owner lived, given that his name or titles were identified on them. The creation of new and precise plans and sections (figs. 17–19) before the cleaning takes place in 2023 will allow us to calculate the exact dimensions of all architectural elements and document the findings. Photogrammetry will again be executed once all archaeological activities are finished.

The documentation process in TT 61 was more complicated than TT 87 given its complex morphology, the steepness of the sloping passage, and the existence of a chamber, both of which still contain archaeological remains. More than 2400 photographs were needed to complete the recording of these parts, the burial chamber, and the shaft and its curb.

Additionally, infrared photography was used to document areas of the walls where fires and smoke have practically obscured the decoration (see section 2.3). Although ultraviolet and multispectral photography were also tested, the best results were obtained by the first procedure, which revealed the texts and figures standing behind the layer of soot and degradation of the pictorial layer (fig. 20). Infrared photography captures a spectrum of light that is invisible to the human eye, with wavelengths that range from 720 nm to 1200 nm. Digital single lens reflex cameras have a filter that blocks the infrared light, which can be removed. For the project, we used a Nikkon 5300 camera thus prepared and infrared spotlights to block the visible light and ultraviolet spectra. The pictures were taken in RAW format in complete darkness and were processed with a software where several filters are available to develop the images. The data revealed will allow us to continue with the epigraphic study and will ensure that the cleaning of the walls by the restorers is achieved in optimal conditions, given that they know what to expect below the black layer.

Figure 20. A section of the decoration in the burial chamber of Useramon as seen with normal photography and infrared photography (colour and black/white image). Photographs: A. Gómez Laguna.

2.3 | Conservation and Restoration

The aims of the work are already stated in 1.3, since the conservation and restoration of the burial chambers belonging to TT 61 and TT 87 were undertaken in conjunction. Technically, the decoration of both chambers is similar, although different procedures were staged in each case, probably due to the divergent social status of Nakhtmin and Useramun. Given that the latter occupied the position of vizier and was therefore second only to the pharaoh, he probably had access to more qualified workmen and higher quality materials than the overseer of the Double Granary Nakhtmin. This situation is reflected in the careful finish of his monument: the chamber is completely levelled on the limestone matrix, leaving no irregular surfaces as in the case of TT 87. As a result of several attempts at plundering the decoration,[72] holes and fractures on the wall allow us to see how the layers of preparation were applied. In the fragments left on the floor by robbers, one can also see how the different strata are superimposed on the sides and back.

The first layer of *muna* on top of the rock is less thick than in TT 87 and is also lighter in colour. This indicates that the amount of plaster added was greater than that of mud, so more

72 The plundering and partial destruction of some decorated surfaces must have taken place between 1971 and 1974. Erik Hornung undertook two seasons of fieldwork for copying the texts of the Litany of Re in these two years and sadly discovered the damages suffered in the burial chamber as he went back to work in 1974 (in Dziobek 1994: 43). As part of the tasks of the NKS Project, we have started to contact the institutions that may keep photographs commissioned by S. Schott or E. Hornung (Universität Basel, keeper of Hornung's legacy; Universität Trier, responsible for *Das Digitale Schott-Archiv*) and taken before the destructions took place. We would like to thank S. Bickel and S. Schips for attending our requests.

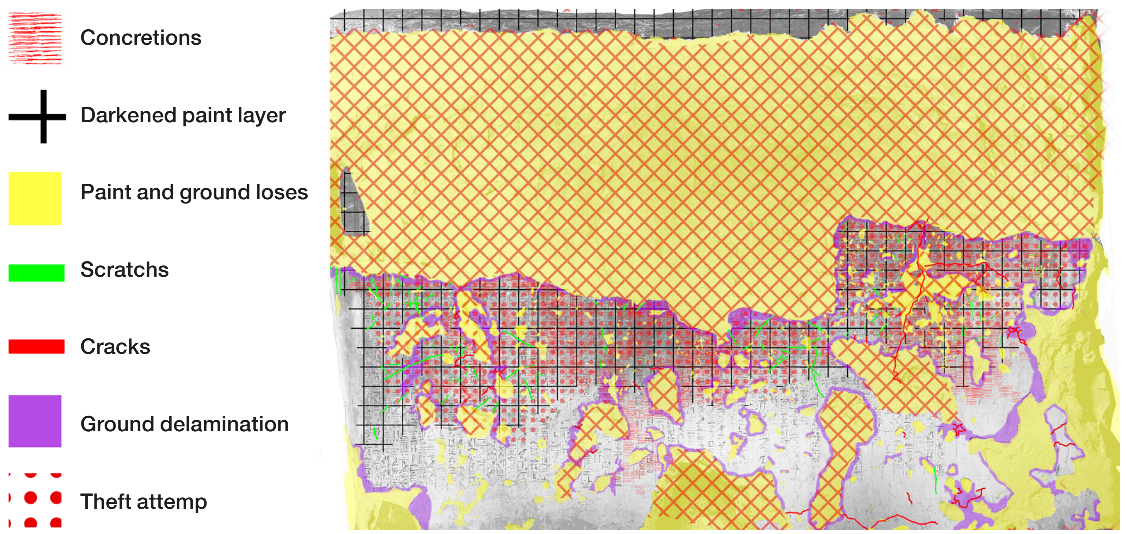

Figure 21. Damage map, with indication of the different types of alteration factors, corresponding to the east wall in the burial chamber of TT 61. I. Bermeja Gigorro.

expensive[73] and resistant materials were used in TT 61 already from the first layers of preparation. Then a thinner layer with a lighter tone (approximately 2–3 cm thick) and a more careful finish was applied with a trowel. A last layer of finer ground gypsum of 2–3 mm was added on top and carefully smoothed with a trowel. Film-forming layers have been detected composed of a mixture of protein and wax or oil that completely cover the walls of the chamber. It is difficult to know if this product was applied before or after tracing the signs and it remains possible that it was not part of the initial decoration but added after its completion. As for the ceiling, although it has not been flattened with care and protuberances of the bedrock are perceptible, an effort has been made to leave a continuous layer.

In spite of the striking damage suffered, the burial chamber of TT 61 is in a fairly good structural condition. The deteriorations that affect it are registered in damage maps (fig. 21). These are fundamentally anthropic in character but, thanks to the high quality of materials applied and to the previously described careful technique of execution, these damages have not completely ruined the decoration. The various preparation layers of the wall are perfectly bonded. Moreover, by spanning the mortars all the way from the floor to the ceiling and forming a unit with the ceiling, a very resistant body was generated. Delaminations and detachments were therefore avoided to the point that, probably, the looters gave up their attempts when they realised how difficult it was to extract significant decorated

73 To obtain a plaster mortar it is necessary to burn the raw material, an input of work and energy that makes the resulting product more expensive. On the contrary, straw and mud were easier to obtain, store and work, and therefore cheaper.

fragments in good condition that could be sold on the black market. These mortars even resisted the effects of the high temperatures that the wall suffered on account of fires lit inside the chamber.

Cracks on the walls, caused by the natural movement of the bedrock, are superficial and delamination only affects the contours of pilfered parts of the decoration on the last preparation layer. This situation is occasionally observed also in areas particularly affected by the high temperatures caused by fires. The parts where the preparation layers had been exposed by attempted acts of plunder show a certain degree of instability. The same occurs at the juncture of the floor and walls. The pictorial layer is in good mechanical condition and its damage is mainly due to the oxidation and calcination caused by high temperatures and smoke generated by fires lit inside the chamber. The ceiling is completely covered by a soot deposit that is also visible on the wall. In addition, oxidation of the layer of primer or protection has completely altered the original colour of the chamber and rendered the signs illegible in some zones. Finally, there is a deposit of greasy dust on all the walls.

As in TT 87, the first conservation step was to stabilise the preparation layers of the wall, reinforcing their adhesion by injecting Acril 33 in cracks and PLM A mortar to fill voids. Once the whole was stabilised, lime mortar and stones from the surrounding area were applied to fill gaps in particularly unstable zones (lower part of the walls and jambs of entrance to the burial chamber). As for the hundreds of fragments fallen to the floor (a result of theft attempts) and currently stored in trays, their repositioning is more complex than in the case of Nakhtmin, given that it requires a thorough previous epigraphic study. Moreover, their replacement has not been considered a priority since, and despite the striking visible damage, the mortars are much more stable in TT 61 than in TT 87.

In the case of the pictorial layer, the main problem was heavy darkening produced by the fires at some point lit inside the chamber. The surface deposits of soot and greasy dust could be removed mechanically using *wishab* sponges, since the paint beneath was in perfect condition. Very good results were obtained with this procedure (fig. 22), favouring the legibility of the signs and demonstrating the different degrees of oxidation of the film-forming materials that covered the walls. More problematic was the treatment of the film-forming layers discussed above. Although presumably transparent in origin, at present they show tones going from yellow to black and passing through a whole range of reddish or orange brown hues. The current colours vary depending on the wall's degree of exposure to the smoke provoked by the fire or to the heat generated by it. The alteration is more intense where the brush application left greater accumulations of product, so that it can be totally opaque, black and even shiny in some areas. In some cases, this layer seems to have retracted on the surface, giving rise to small spots.

Solubility tests were carried out, proving that the binders of these film-forming layers coincide with those used in the inks of the signs traced on the wall. As a result, removing or lightening the layers without damaging the decoration is very complicated. Cleaning tests were executed in areas without inscriptions to minimise risks. These tests included the procedures and products successfully used in the cleaning of ancient Egyptian paintings,[74] checking the results on the use of different pH, different polarities and procedures with free solvents and contents in

74 Abd el-Tawab Bader and Ashry 2016; Al-Emam *et alii* 2021.

Figure 22. Cleaning of surface deposits of dust and grease using wishab sponges. Photograph: I. Bermeja Gigorro.

pouches.[75] As free solvents, we tested ammonium bicarbonate diluted in an aqueous solution and Vulpex® in ethanol, rinsed with white spirit. Although the results obtained with the latter procedure were positive, we decided to limit the work to the darkest areas where the decoration was nearly obscured by the black layer, thus meeting the criteria of minimum intervention and priority to the legibility of the signs. Cleaning with this procedure must continue during future seasons.

Monitoring of the environmental conditions is achieved by three Hobo dataloggers, installed at the entrance to the corridor of the above ground

75 Tests were done using AB57 pouches, both with cellulose and Carbogel®. Vulpex® and Carbogel® pouches, diluted in water and ethanol, were also used.

structure, the bottom of the shaft and in the innermost part of the burial chamber, along with a device for Radon gas.[76] The former are programmed to take temperature and relative humidity measurements as those installed in TT 87, hoping to achieve the same aims (see above, end of section 1.3). The micro-environmental conditions in the burial chamber of TT 61 are complicated by the fact that two holes on the ceiling and a wall create air currents, the strength of which will be measured by the Radon gas device. In the future and in cooperation with geologists, we will evaluate if sealing these holes can modify the conditions in which the decoration has been hitherto preserved and if this would entail any risks for the cultural heritage.

2.4 | Study of Inks and Materials

The study of the inks used in the burial chamber of Useramun was greatly influenced by the wall's state of conservation, which is marked by blackening caused by fires and the degradation of the film-forming layer applied below and/or on top of the decoration (see section 2.3). This layer hindered the DRIFT analysis of the inks due to the interfacial character of this analysis.

The study focused on the identification of the black and red pigments used in the pictorial sections of the Litany of Re, which run across the lower part of the walls and are not affected by the degradation and blackening seen elsewhere. A distinction must be made between the captions, mainly executed with black ink, and the representations, composed of a succession of figures painted with black or red colours. Amongst the black colours used for the figures we could distinguish two distinct elements, a very thick layer of bright black and black-grey. Although the appearance of the black material in the former could point towards the presence of bitumen, the bands identified in the DRIFT spectra indicate that the thick black layer instead corresponds to resin-like products, such as resins of vegetal origin or tar. For instance, the intense absorption band at 1746 cm^{-1} (ram) can be related to the high content of carbonyl groups from terpenoids, which were also detected in embalming vegetal resins.[77] Additionally, the presence of aliphatic groups in these resins is demonstrated in the DRIFT spectra (fig. 23) by the presence of the $\delta(CH_2)$ band at 1470 cm^{-1} and the negative bands at 2850 and 2920 cm^{-1}, which are also typical of terpenoid compounds existing in vegetal resins.[78] Nevertheless, the simultaneous existence in the mixture of oils and waxes as binders, giving rise to similar DRIFT bands, is not ruled out. The spectra registered on other figures (beetle and prisoner) revealed a slightly different composition of the pigment mixture with a higher Christiansen effect, due to a different organic material composition or a different grinding.

Red inks/colours generate weaker IR intensities compared to the results obtained in Nakhtmin's burial chamber. The signal from the iron oxide is not visible in some points, whereas that for the organic compounds or binders is stronger in this case. The binder is predominantly animal glue, while the proportion of wax seems to be low. As for the fillers, the binder/filler ratio is strong and the calcite signal is stronger than the gypsum one, so that a higher amount of the former

76 They were activated on 28.02.2022 and the data they provide is supervised by the geologists Sergio Sánchez-Moral and Soledad Cuezva Robleño.

77 Vandenbeusch, Stacey and Antoine 2021.

78 Vahur *et alii* 2016.

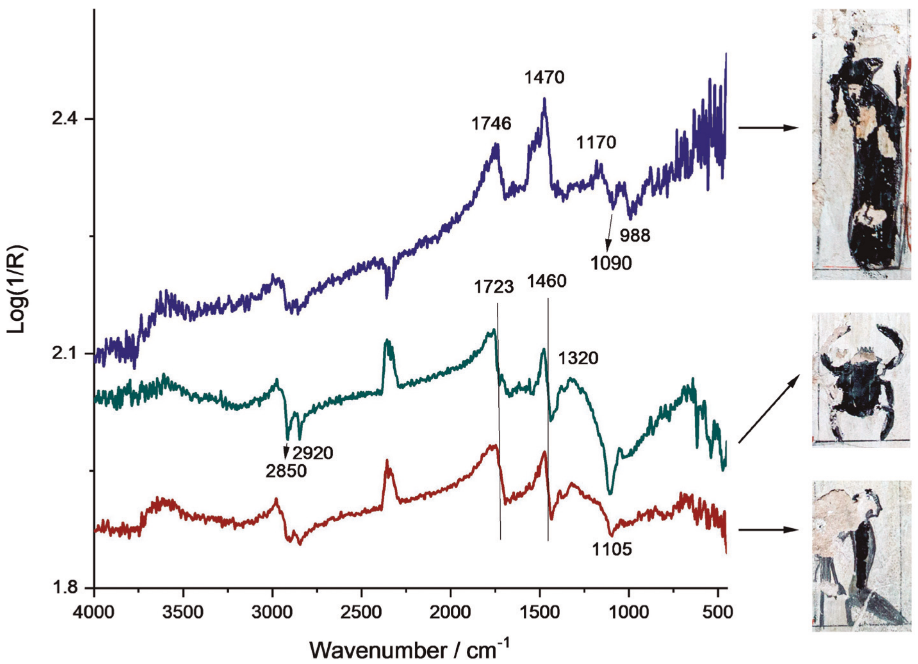

Figure 23. FTIR spectra of black areas corresponding to several figures from the Litany of Re overlaid with vegetal resins. S. Sánchez-Cortés, S. Martínez Ramírez, and D. Méndez-Rodríguez.

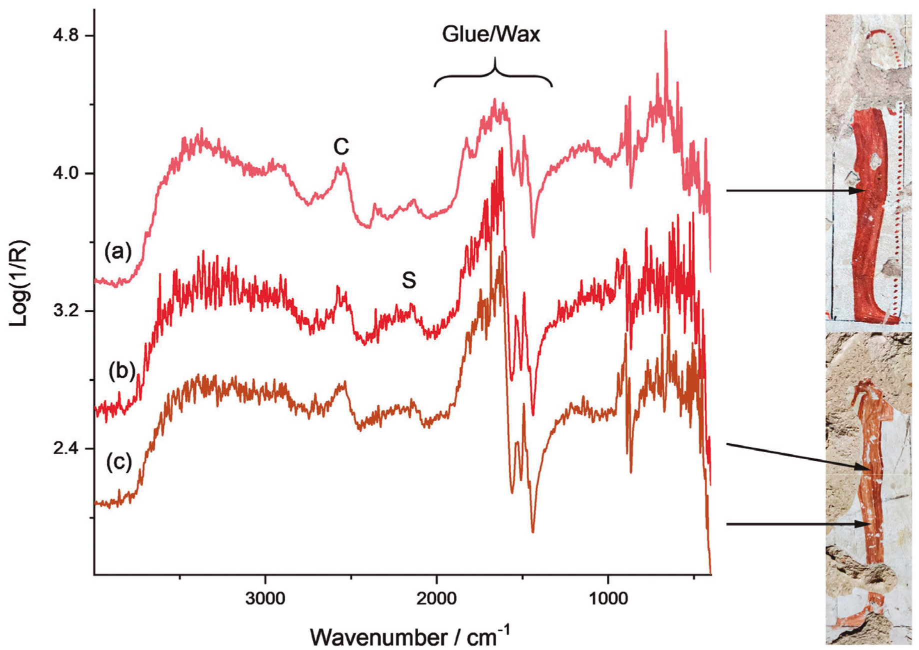

Figure 24. DRIFT spectra registered in different points of the images accompanying the Litany of Re indicating the presence of gypsum (S), calcite (C), and organic binders (glue and wax). S. Sánchez-Cortés, S. Martínez Ramírez, and D. Méndez-Rodríguez.

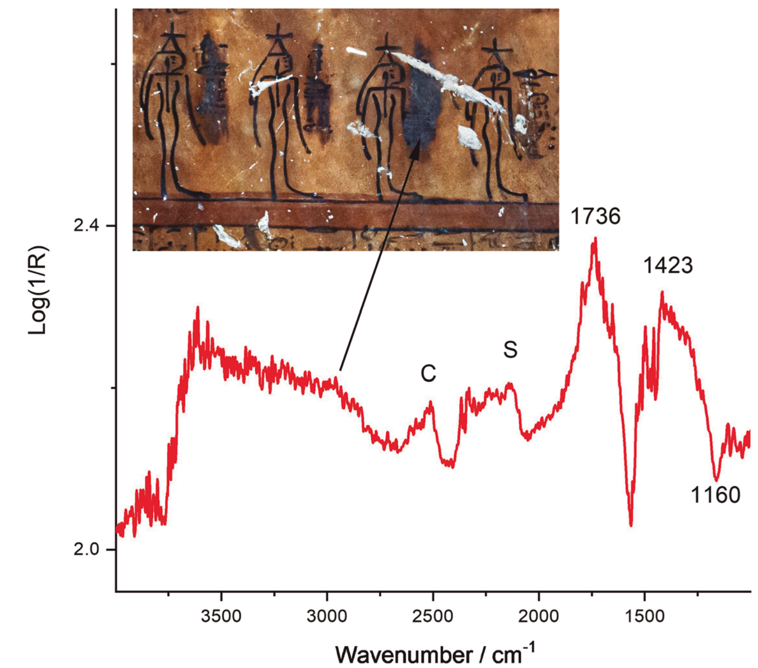

Figure 25. DRIFT spectra registered in a section of the Amduat on the east wall indicating the presence of gypsum (S), calcite (C), and organic binders (glue and oil/wax). S. Sánchez-Cortés, S. Martínez Ramírez, and D. Méndez-Rodríguez.

was used. The presence of calcite is even higher in some of the pictorial representations (fig. 24).

Finally, several DRIFT spectra were registered in areas of the Amduat where traces of ancient corrections were clearly visible in the form of dark patches (fig. 25). All spectra revealed the presence of bands corresponding to calcite and gypsum as fillers. In addition, bands corresponding to organic molecules were identified as binders, comprising mainly animal glue and oils/beeswax, although the amount of the lipidic components (bands at 1736, 1423, 1160 cm^{-1}) is higher than that detected in the inks of the same chamber.

In summary, the examination of ancient materials in the burial chamber of TT 61 has resulted in the discovery of anomalous substances in the coloured areas of vignettes (resins) and for the correction of mistakes in texts (a complex mixture of oils/beeswax, animal glue, gypsum, and calcite).

Conclusions

The third and fourth fieldwork seasons of the New Kingdom Scribes Project have been an important boost to reach our goals. Works have greatly moved forward in the burial chamber of Nakhtmin (TT 87). The tasks of epigraphy and conservation, started in 2019, are almost finished with the identification of three copyists, the study of scribal practices, and the stabilisation of the preparation and pictorial layers. Minor restorative actions, with more of an aesthetical than a technical purpose, remain to be undertaken. In 2022, we have accomplished the cleaning of the underground structures, thus finishing tasks started by archaeologists more than a century ago. This has allowed us to complete the digital documentation through photogrammetry, producing accurate plans and sections. Finally, the *in situ* application of non-destructive techniques to the study of inks has revealed unexpected details about the materials used by ancient Egyptian workmen and scribes.

In the burial chamber of Useramun (TT 61), the epigraphic study has progressed with the experience gained from the analysis of Nakhtmin's monument. Thus far, five individuals have been identified in the execution of the decoration, meaning that a larger number of human and material resources than in TT 87 were mobilised. This is consistent with the higher hierarchical position of the vizier Useramun and is also reflected in the more careful preparation of the writing surface when compared with TT 87 (with more finely ground particles and a wider use of calcite, a material less abundant than gypsum and harder to obtain). In turn, the worse state of preservation in TT 61 entails the implementation of a larger conservation and restoration plan. Whereas the preparation and pictorial layers have already been consolidated, future seasons require cleaning of the darkest areas, bringing back to sight the ancient decoration. We also expect to dig out the debris and archaeological remains left in the underground structures by previous teams and to prepare new digital plans and sections. Finally, archaeometric studies of inks and materials have also yielded interesting results, such as the use of vegetal resin and a correction fluid.

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