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The construction of tomb group QH31 (Sarenput II) through QH33. Part I: The exterior of the funerary complexes

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Nearly 4,000 years ago, several governors of Elephantine constructed funerary complexes numbered today as QH31, 32 and 33, on the southeast slope of the necropolis of Qubbet el-Hawa near Aswan. The exterior of these funerary complexes can be considered a magnificent ensemble, and includes courtyards for each tomb. This present paper provides a detailed description of the exterior of each tomb and analyzes the building methods used to create them. The methods used to cut the façades are studied, as well as the techniques used to remove the bulk of the bedrock to create the complexes.

Necropolis Qubbet el-Hawa

The governors and high officials of the first Upper Egyptian nome were buried in rock-hewn funerary complexes in a hill on the west bank of the Nile, situated a little more than a kilometre north of the island of Elephantine, during the late 6th and late 12th dynasties. The necropolis, known today as Qubbet el-Hawa, the 'dome of the wind', owes its name to a monument on its top, dedicated to a Sheikh named Ali Abu el–Hawa.

It is very likely that before its use as a cemetery, Qubbet el Hawa might have been a source of sandstone, similar to the area between Gebel Gulag and Gebel Tingar.[1]

The hill rises approximately 180 m above sea level, and about 90 m above the current level of the Nile river nearby.[2]In its stratigraphic section, three geological formations can be recognized, denominated Formation Abu Agag, Formation Timsah, and Formation Umm Barmil.[3]

On its slopes are several terraces formed from soils containing oolithic iron layers which are highly resistant to the elements. The most prominent is the iron layer on top of the Abu Agag Formation, halfway up the hill.

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1 Storemyr (2007), p. 26; Hedal and Storemyr (2007), p. 123; Klemm and Klemm (1993), pp. 271-273, photo p. 373; (2008), pp. 206-207. Concerning the ancient quarries where the sandstone construction material was extracted, see Harrel (2016).

2 Müller (1940), pp. 12-14; Storemyr (2007), p. 12.

3 See the stratigraphic section of the hill of Qubbet el-Hawa, in Hedal, BØE and Müller (2007), pp. 53-54, figs. 1 and 2.

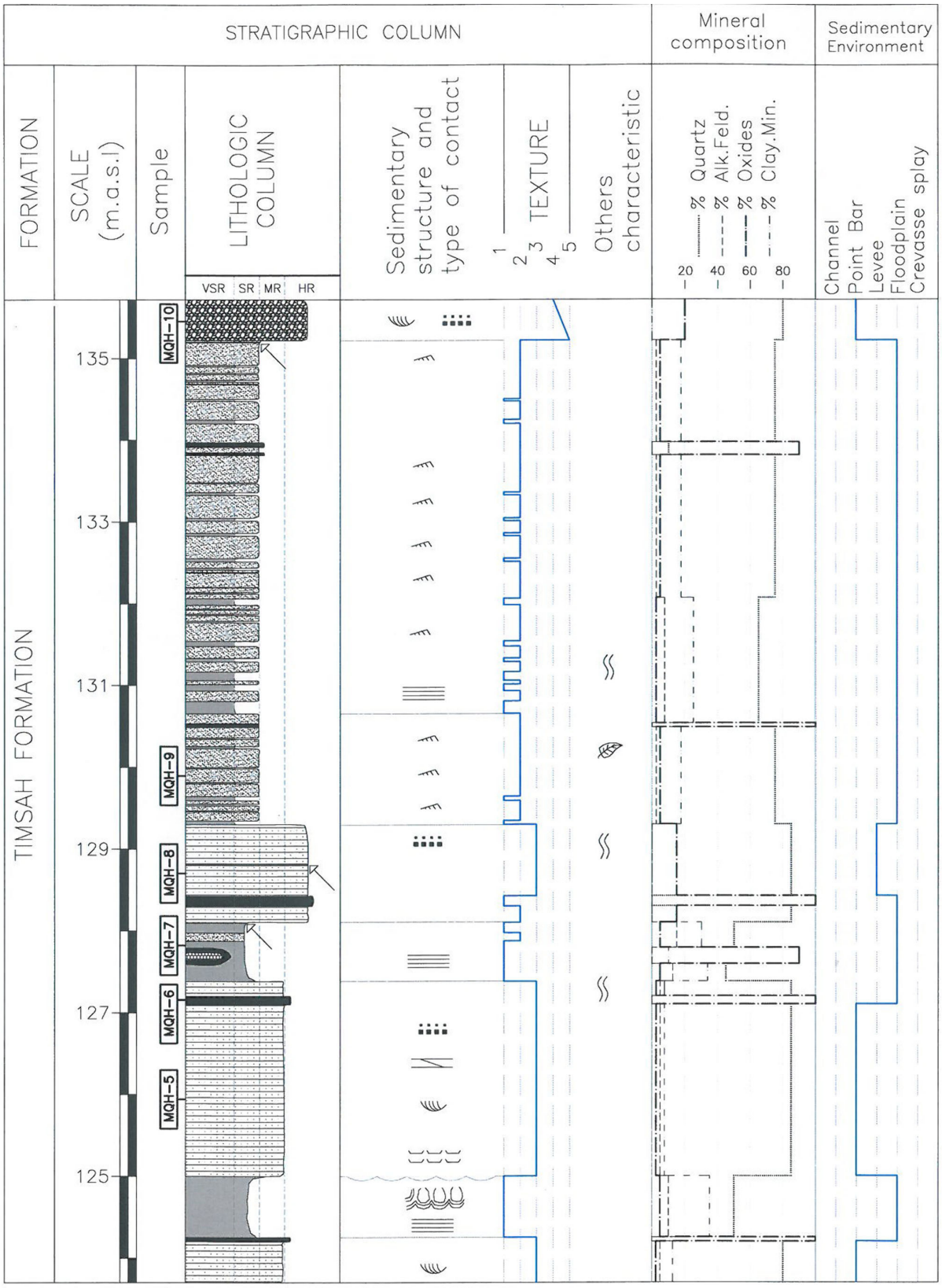

Fig. 1. Stratigraphic section of the terrace where the main tombs of the necropolis of Qubbet el-Hawa are located, by Mellado García (2017). The terrace, between 130 to 135 m above sea level is located between two layers of sandstone of greater column width, which means they are more resistant strata.

LEGEND OF STRATIGRAPHIC COLUMN

LITHOLOGY

- Coarse Sandstone
- Medium grain Sandstone
- Fine–grained Sandstone
- Lutite
- Iron oxide
- Limonite
- Gypsum bed

TYPES OF CONTACT

- Erosive contact
- Net contact
- Irregular contact

TEXTURE

1 Lutite
2 Psammite. Coarse grain
3 Psammite. Medium grain
4 Psammite. Fine–grained
5 Rudite. Fine–grained

SEDIMENTARY STRUCTURE

- Parallel lamination
- Planar cross lamination
- Trough cross lamination
- Convolute lamination
- Water leakage structures
- Normal granoclasification
- Ripples
- Fossils of plants
- Bioturbations (Burrows)

STRENGTH (ISMR,1981)

(The width of the column is proportional to the strength)

VSR: Very soft rock (qc<5 MPa)
SR: Soft rock (5<qc<25 MPa)
MR: Medium rock (25<qc<50 MPa)
HR: Hard rock (qc>50 MPa)
qc=Uniaxial Compressive Strength

MINERALOGIC COMPOSITION

Alk. Feld.: Alkaline feldspar
Oxides: Hematite mainly, with some clay and limonite.
Clay. Min.: Clay minerals

SEDIMENTARY ENVIRONMENT INTERPRETATION

Meandering fluvial system. In the column the different sedimentary environments corresponding to each facies are indicated.

One of the reasons for constructing the hypogea along these terraces may be their elevated positions facing east, which made them visible from Elephantine and the first cataract region.[4]In addition, the choice might also be related to the presence of a thick layer of fine-grained sandstone, which aided construction and the carving of decoration. This layer of sandstone was also under another layer of sandstone, with a greater proportion of iron, which guaranteed the stability of the ceilings of the tombs.[5]

Visible in the vertical section of the tomb façades in this terrace (fig.1), are horizontal strata of sandstone (compacted and cemented sands), 1.20-1.50 m thick, along with layers of lutites (clays and superimposed silts), 0.05-0.15 m thick, and iron oxide (hematite) levels.[6] They can be distinguished by the coloration of the rock, ranging from the light ochre tones of the sandstones, through the darker greenish-red of the lutite, to the dark red strips of the hematite layers.

Erosion has had a greater impact on the soft strata of lutites than on the iron sandstones and iron oxides, both of which have greater mechanical strength. This has led to the formation of furrows in the lutite layers, and projections in the layers containing more iron, that run through the entire thickness of the exposed layers, and gives the façades a multi-layered morphology.

The funerary complexes of the higher officials of Elephantine are distributed across several overlapping terraces,[7] although the largest tombs belonging mostly to the governors are located on the upper terrace,[8] at an elevation of 135-130 m above sea level.[9]

Funerary group of complexes 31-33 in Qubbet el-Hawa

During the 12th dynasty, between the reigns of Amenemhat II (1878-1843)[10]and Amenemhat III (1818-1773), three of the governors of Elephantine built their funerary complexes in an alignment here; QH31 (Sarenput II), QH32 (Khema?, see below) and QH33 (Heqaib-ankh (?) and Heqaib III). These were located on the southeast slope of the necropolis of Qubbet el-Hawa.[11] To this group must be added a smaller tomb, QH34 (anonymous), constructed at the end of this dynasty.[12]

These tombs (fig. 2) became the main part of the burial area of the ruling family of Elephantine and represented one of the most remarkable funerary architecture ensembles of the necropolis.[13] Unfortunately, none of them were completed for various reasons, the main one perhaps being insufficient ruling periods of governors for concluding the works.[14] From the point of view of the history of construction, however, the unfinished state of these tombs is more interesting than other cases that show finished work, because the construction process can be observed and reconstructed.[15]

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4 Giedion (1981), pp. 381-386; Badawy (1966), pp. 163-168.
5 Jiménez Serrano *et al.* (2012), p. 32.
6 Mellado García (2017).
7 Edel (2008), pp. XXVII-XXIX.
8 Vischak (2006), pp. 51-54; De Morgan (1894), pp. 141-143.
9 Edel (2008), pp. 5-265; Jiménez Serrano *et al.* (2008), p. 36.
10 All the chronology used in this article has been extracted from Hornung, Krauss and Warburton (2006).
11 Martínez Hermoso (2015), pp. 613-627; Martínez Hermoso (2015), pp. 160-165, figs. 5.1 and 5.3.
12 Jiménez Serrano *et al.* (2012), p. 112.
13 Martínez Hermoso (2017), pp. 166-176.
14 Harrel and Storemyr (2009), pp. 7-50; Bloxan (2010). On stone extraction techniques in Aswan, see Arnold (1991), pp. 36-40; Clarke and Engelbach (1930), pp. 26-30.
15 Bierbrier (1982), p. 46.

For this reason, the study of the group of the funerary complexes QH31 to QH33 allows us to discern the methods used in the construction of tombs excavated in sandstone during the Middle Kingdom.

Due to the complexity of the works, however, the study has been divided into two parts: work carried out in the area outside of the funerary chapels, and work carried out in the interior of the chapels, which includes the funerary spaces.

Description of the exteriors of the ensemble

The group of funerary complexes was created (fig. 3) with tomb QH32 at the centre, and initially had no neighbouring tombs. The door was in the middle of an area on the hillside where no previous tombs had been excavated. The high quality of the rock there permitted the excavation of a façade 4.50 m in height.[16]

Based on to the most commonly used excavation method, which consisted of extraction by levels (from top to bottom), tomb QH32 must be the oldest of the group (also see footnote).[17]

The next phase of construction included, firstly, the design of the courtyard of QH31, on a slightly lower level with respect to QH32. It extended into the original courtyard of QH32. The third funerary complex, QH33, did the same, which led to a reduction of the QH32 courtyard to a simple elevated platform, 2.10 m wide, that only gave access to the funerary chapel. That pathway also served as a separation wall between the courtyards of QH31 and QH33. From another perspective, it might be interpreted that the QH32 courtyard was integrated with two larger ones after their construction.

To the south of QH32, the façade of QH31 was excavated in alignment and with the same horizontal upper edge, almost 8.00 m high (fig. 4), as the existing tomb. The façade of QH33 was excavated (fig. 5) similarly, but with an imperceptible difference in orientation to the east,

The façades of funerary complexes QH31, QH32 and QH33 were cut deeper into the hill than the other tombs located on the same slope, and were set back in alignment, which gave them a unified appearance (figs. 2 and 3). The complete façade of the complex is approximately 40 m in length, and it is delimited by the magnificent enclosures of QH31 and QH33. Their northern and southern walls are lightly sloped up the inclination which follows the natural line of the slope.[18]

Stone extraction system

On the floor of the courtyard of QH31 is a series of more or less rectangular holes around 11-19 cm on the sides and of variable depth, in some cases up to 5 cm (fig. 6). Equivalent holes on the platform outside QH33 are more abundant and larger, between 25 and 16 cm on the sides and with 14 cm of depth (fig. 7).

At first sight the holes seem to be distributed randomly, but after careful analysis it becomes clear that they are located above natural cracks or fractures of the rock,[19] which permitted them to enlarge these and cause new cracks in the rock.

The size of the holes, somewhat larger in the courtyard of QH33 than in that of QH31, is probably related to the thickness of the stone that was to be cut and removed from the rock, either in blocks or in irregular slabs.

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16 Müller (1940), pp. 52-53.

17 See the section Bulk stone removal from the courtyards below.

18 Martínez Hermoso (2017), pp. 174-175, fig. 5.15.

19 Jiménez Serrano *et al.* (2008), pp. 43; Jiménez Serrano *et al.* (2009), pp. 49-50, fig. 4; Jiménez Serrano *et al.* (2012), p. 109.

Fig. 2. Partial view of the necropolis of Qubbet el-Hawa. In the centre is the exterior of tombs QH31, QH32, and QH33. Photograph by Juan Luis Martínez de Dios (2011/12 campaign).

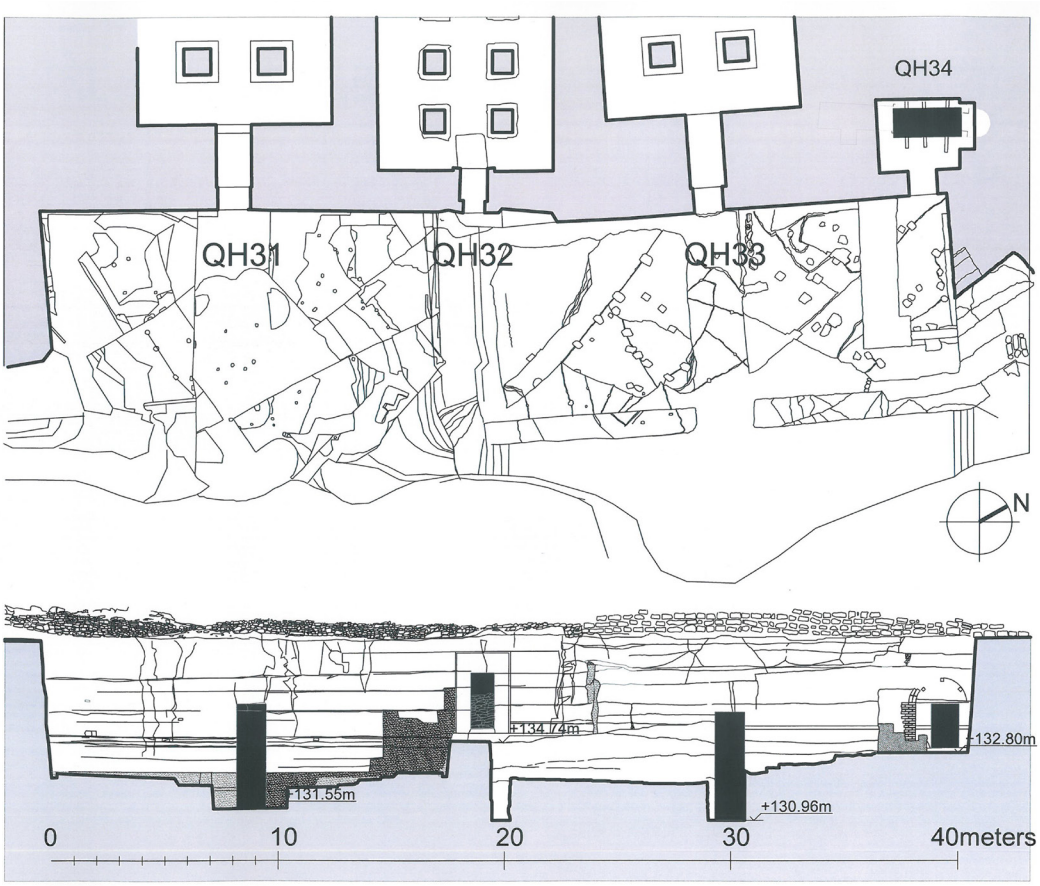

Fig. 3. Plan and elevation of the exterior of the tombs QH31, QH32, QH33 and QH34. Diagram taken from (20), fig. 2, by Juan Antonio Martínez Hermoso.

Fig. 4. Exterior view of QH31 and, on the right, QH32. Photograph by Fernando Martínez Hermoso (campaign 2014).

Fig. 5. Exterior view of QH33 and, on the left, QH32. Photograph by Raúl Fernández Ruiz (2014 campaign).

Near the edges of the courtyards there are a group of cracks oriented approximately N-S with a second group intersecting them, creating an angle of 80-90°. These linear fissures are a consequence of the natural structure of the very rigid sandstone strata, which is a very durable construction material. When internal movements occur, the strata can be broken, creating groups of fractures which might be parallel or perpendicular to the surface of these strata. These cracks extend beyond the courtyards, and also affect the façades and ceilings of the interior of the chapels. A crack which crosses the courtyard of QH31 and continues to the façade of QH33 is clearly visible (fig. 8).

In the façade of QH31, some more or less vertical cracks were repaired in contemporary times (date unknown; probably in the interval from the 1940s to the beginning of the works by the University of Jaén).[20] These cracks in the façades were repaired by sealing discontinuities, with mortar of coloured cement, supposedly to prevent further displacement of the rock.[21]

Channels and contour ditches

The façade and the courtyard of QH31 were constructed following the method used for open cast rock quarries.[22] This consists of the construction of 'channels' separated by an average of 8-11.5 cm, just enough to use a metal tool vertically (picks and/or bronze chisels).[23] These channels can still be observed next to the sidewalls and the façade.

In contrast, outside QH33 the method followed was to cut around the entire perimeter of the courtyard, although in this case the trenches were carved using long picks or chisels cutting down vertically.[24] These channels were about 60 cm wide, probably to enable the stonecutters to work standing in them, or on their knees. This system also allowed them to separate larger blocks from below by using wedges (as in an open cast quarry).[25]

These two different methods were probably chosen depending on the characteristics of the rock and its natural fractures. Thus, the method used to create the courtyard of QH31 allowed the stonecutters to remove the rock progressively up to the façade. In QH33, however, the excavation of stone was carried out using a method aimed at finishing the emptying of the courtyard faster, although as a result it produced a rougher surface.

In both cases, the construction works remained unfinished, either as a result of the sudden death of the owner, or due to other undocumented factors.

Bulk stone removal from the courtyards

The stepped edges in the QH31 courtyard are similar to those seen in an open cast quarry and indicate the method of excavation used by the builders of the rock-cut tombs.[26] On both sides, the rough faces of the stone terraces (fig.4) reveal a rapid removal of the rock. This haste was most

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20 These cracks were not repaired in the photographs that appear in Müller (1940), Taf. XX-XXI.

21 The stability problems are due to the significant opening of the discontinuities rather than their orientation. The problem is solved by connecting the blocks, i.e. by injecting mortar or resin along the discontinuity. To avoid this phenomenon damaging the complex further, it is necessary to reinforce the outer wall and seal the fractures in the roof close to this wall so that no further displacement is allowed. The intervention consists of filling the joints with injections of cement or resin. It is advisable to inject air under pressure to clean the inside of the larger apertures before cementing (any greater than 5 mm).

22 Clarke and Engelbach (1930), pp. 12-22; Arnold (1991), pp. 25-34.

23 Harrel and Storemyr (2009), pp. 7, 29; Hedal and Storemyr (2007), pp. 123, 125; Clarke and Engelbach (1930), pp. 12-22; Stocks (2003), pp. 25-34.

24 Arnold (2003), pp. 232-233.

25 Clarke and Engelbach (1930), p. 16; Arnold (1991), pp. 27-36; Choisy (1904), pp. 53-54, fig. 45.

26 Clarke and Engelbach (1930), p. 15, fig. 12.

Fig. 6. View of the surface of the southern half of the courtyard of QH31. Photograph by Raúl Fernández Ruiz (2014 campaign).

Fig. 7. View of the surface of the southern half of the courtyard of QH33. Photograph by Raúl Fernández Ruiz (2014).

likely the cause of the unfinished appearance of the façade and the courtyard.[27]

The work of rock removal outside QH31 was by excavating the different levels of the rock, from the top to the bottom and from the centre to both sides, horizontally, following the natural stratigraphy of the rock.

The sandstone was cut into small slabs, thin, flat, elongated stones from the ledges within the rock. The strata are not completely horizontal but have a slight downward inclination in the SE-NW direction, from the outside to the interior of the hypogea, and although their surfaces were not finished, they show the natural appearance of the rock; a flat surface with very few irregularities.

Slabs of sandstone of different sizes, more or less irregular, were separated horizontally using hammered chisels, taking advantage of the fact that the stratified surfaces facilitated their extraction.[28] This method is evidenced by the abundance of notches on the vertical faces of the stepped rock fronts, in the area close to the entry to QH31 (fig. 9).[29]

In fact, it is still possible to observe some sandstone slabs obtained by this method in the courtyard of QH33, which, due to the abandonment of the works,[30] were simply left leaning on the exterior face of the wall of the courtyard (fig. 10).

The builders of QH31 quickly excavated the exterior spaces in front of the façade but did not finish them, because when they had cleared to the planned levels of the floor and roof of the tomb, they immediately began the excavation of the interior of the chapel. In fact, it seems that the primary purpose of the courtyard was to reach the level of the chapel entrance, and then to have a sufficiently wide and flat area which would facilitate the work in the interior.[31]

The QH33 courtyard presents a more advanced stage of construction. It is a rectangular space enclosed by a thick wall cut directly out of the rock, about 1.10 m thick, which runs for 8.75 m, parallel to the façade of the tomb.[32]

In this courtyard two rock platforms are separated from each other by a central corridor of variable width that varies between 2.30-2.50 m, and which runs in the same direction as the axis of the main niche of the chapel. The level of the ground in the central corridor coincides with the interior of the chapel.[33]

The southern platform (on the left) is completely isolated from the façade and the courtyard walls by a perimeter trench which creates a passageway. The width measures between 0.60 and 1.0 m.[34] It presents a substantially flat surface rising to about 1.70-1.80 m above the lower courtyard level. The bottom of the passageway was excavated down to the same level as the central corridor.

The northern platform (on the right) is slightly separated from the front wall of the patio, the rest of its perimeter, including the north wall and the façade remain unexcavated. Its surface presents a series of steps towards the northwest corner that forms the façade and the lateral wall of the courtyard.[35] It exceeds the level of the courtyard next to the central corridor by about 2 m, reaching 3 m in the north-western area.

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27 Edel (2008), pp. 423-430.
28 Clarke and Engelbach (1930), pp. 13, 16; Arnold (2003), p. 231; Harrel and Storemyr (2009), p. 29.
29 Hedal and Storemyr (2007), p. 125.
30 Jiménez Serrano *et al.* (2012), p. 109.
31 See longitudinal section of the funerary chapel of QH31 in Martínez Hermoso *et al.* (2015).
32 Jiménez Serrano *et al.* (2012), p. 109.
33 Jiménez Serrano *et al.* (2010), p. 72.
34 Jiménez Serrano *et al.* (2009), p. 49.
35 Jiménez Serrano *et al.* (2008), p. 42.

Fig. 8. To the right is a crack that crosses the courtyard of QH31 and continues, in the background, onto the façade of QH33. Photograph by Fernando Martínez Hermoso (2014 campaign).

Fig. 9. Detail of fig. 8, with notches for the extraction of stone in the terraced outcrops in the courtyard of QH31.

The area outside the walls in front of the courtyard of QH33 (fig. 10) has the same floor level as the interior of the chapel. It is delimited at its northern and southern extents by several steps carved into the rock, but like the rest of the exterior of the funeral complex, these remain unfinished.[36]

36 Jiménez Serrano *et al.* (2012), p. 105.

Fig. 10. Exterior walls, including a group of sandstone slabs stacked against the outer patio wall of QH33, and in the distance, a stepped structure carved directly into the rock. Photograph by Juan Luis Martínez de Dios (2011/12 campaign).

Construction work

If the courtyards of the tombs had been finished, such as was the case for the contemporary funerary complex QH36 (fig. 11), they would each have been delimited by the façade of the hypogeum, the vertical side walls, and the walls of sandstone masonry at the front of the enclosure.[37]

It seems likely that the original design for the enclosure wall of QH33 would have been to raise the wall to the desired height using pieces of irregular unworked stone including blocks of sandstone obtained from the excavation itself, set in place without mortar, carefully fitted together at their interfaces. Later, they would have finished the surfaces of the walls beginning by carving at the top, since this would prevent damage to lower finished surfaces by falling chunks of stone.[38]

Any voids in the core between these two faces would have been filled with rubble and smaller pieces of stone.[39] The entire perimeter would probably then have been topped off with rounded off blocks of the sandstone.[40]

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37 Müller (1940), pp. 16-17.

38 Arnold (1991), 148-164; Clarke and Engelbach (1930), pp. 96-116; Choisy (1904), pp. 53-56.

39 Choisy (1904), pp. 61-63.

40 See Müller (1940), Abb. 3, the reconstruction by Hans Wolfgang Müller of the wall that enclosed the front yard of QH36 tomb (Sarenput I).

Fig. 11. View of the outer wall of the courtyard of Sarenput I's funeral complex (QH36). Photograph by Fernando Martínez Hermoso (2014).

When QH34 was designed, some years after QH33, the available space in that part of the necropolis was almost non-existent. QH34 was designed without a courtyard, most probably because the tomb and chapel were considered to be appended to the unfinished funerary complex of QH33. Although there is no archaeological or textual data, it seems likely that a relationship existed between those people buried in QH33 and in QH34.

The exterior of QH34[41] consists of a corridor 7.10 m long by 2.70 m wide. It was originally covered by a barrel vault supported on the south side by a massive wall of mud bricks and stones, and on the north side by a steep wall carved from the rock of the hill. In fact, the northern side was the original corner of the enclosure of QH33 (fig. 12).

The massive wall on the southern side rested directly on the northern platform of the courtyard of QH33.[42]

Façades cut into the rock

Of the Middle Kingdom funerary complexes studied here, the façade of QH33 (fig. 5) is the one that was left in the most un-finished state. In fact, the complete surface can be described as 'rough'. That is due to the use of long picks and chisels, struck with stone hammers by the stonecutters. It was carved easily, since the cut of the stone depended on the mass of the tool and not the speed with which it was struck.[43]

41 See Jiménez Serrano *et al.* (2009), pp. 53-55, plan 5 by Fernando Martínez Hermoso.
42 Jiménez Serrano *et al.* (2012), p. 112.
43 Harrel and Storemyr (2009), pp. 7-50; Clarke and Engelbach (1930), pp. 96-116; Arnold (2003), pp. 232-233.

The horizontal marks on the façade of QH33 show each phase of the extraction and the size of the blocks that were extracted. The façade was gradually exposed using chisels, from the level of the door lintel of the hypogeum down to the bottom. It is also possible to see a more finely finished stripe, about 10 cm in width, which crosses the north side of the façade horizontally from the door, and continues along the sidewall of the courtyard (fig. 13). This was most probably created by the master workman as a reference line to indicate the final surface level down to which the façade was eventually to be finished.[44] This was never completed.

The façades of tombs QH31 and QH32 (fig. 4), however, were completely re-worked by the stonemasons from top to bottom, as was usually done on masonry walls, creating a façade profile with a smooth surface. The only decoration that stands out is the simple frame of the door of QH32, protruding about 5 cm from the vertical surface of the wall of the façade.[45]

To obtain a flat surface, the façades were probably carved using flat-bladed bronze chisels struck with wooden mallets.[46] There are many marks of these tools, for example in the inferior area of the façade of QH32 (fig. 14), which are still visible due to their short runs and large irregularities in arrangement, running in parallel but having a disorderly appearance.[47]

The flat chisel was useful for rapidly removing large areas of soft stone, particularly when it was not important to obtain a perfectly flat and smooth surface.[48]

The bronze tools, tempered by hammering and heat, cut the soft rocks easily, although they went blunt quickly and required constant re-sharpening with stones.[49] These tools, however, were completely unsuitable for the quarrying of hard stone, where stone tools were much more effective.[50]

In the façade of QH31 protuberances of harder rock sometimes appear in the horizontal strata of sandstones with higher levels of iron oxides, due to their higher degree of cementation. The workers were most likely focused on finishing the hypogeum rather than trimming these nodules, which would have taken some time to accomplish. Once the work inside the tomb began, the priorities changed and the exterior works were postponed.[51]

The finishing of the face was accomplished from top to bottom, in horizontal strips of around 60-90 cm in height (fig. 15). In order to smooth the surface of the rock, rounded stones of silicified sandstone (quartzite), commonly found in the vicinity[52] of the tombs, were probably used to rub the face, using the desert sand that is rich in quartz to create a cutting, friction-based action.[53]

The fine finishing of the QH32 door trim (fig. 10) stands out, however, in comparison to many earlier tombs in the necropolis, the façades of the enormous funerary complexes QH31 and QH33 are notable because all decoration was omitted and more importance was given to the design of their interiors.

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44 Jiménez Serrano *et al.* (2008), pp. 42-43.
45 Müller (1940), pp. 52-54.
46 Harrel and Storemyr (2009), p. 29; Clarke and Engelbach (1930), p. 17; Arnold (2003), pp. 232-233; Arnold (1991), pp. 41-47.
47 In order to date the stone cutting according to the chisel marks on the sandstone, see Klemm and Klemm (2008). They study the dating by chisel marks for the specific case of the Silsila quarries.
48 Stocks (2003), p. 27.
49 Harrel and Storemyr (2009), p. 29; Clarke and Engelbach (1930), p. 18.
50 Harrel and Storemyr (2009), p. 29.
51 Martínez Hermoso (2017), pp. 177-179.
52 Hedal and Storemyr (2007), pp. 18, 70.
53 Choisy (1904), p. 54; Harrel and Storemyr (2009), p. 18; Arnold (2003), pp. 232-233.

Fig. 12. View of the exterior access corridor of QH34. Photograph by Juan Luís Martínez de Dios (2012 season).

Fig. 13. Detail of a finished strip of 10 cm in the façade walls and side walls of QH33 Later, the QH34 tomb was excavated and its barrel-vaulted adobe corridor was built. Photograph by Fernando Martínez Hermoso (2014 campaign).

Fig. 14. Facade of QH32. Photograph by Fernando Martínez Hermoso (2014).

Fig. 15. Detail of the wall in fig. 14, with tool marks on the lower left side of the QH32 façade.

Conclusions

QH32, QH31 and QH33 were excavated successively, following the same façade level, with an equivalent depth of cutting surface and the same horizontal upper edge line, giving the group of funerary complexes a unified appearance. The ensemble stretches for about 40 m in length across the landscape and rises to 8 m above its own floor levels. In addition, this set of façades is set back further into the hill than the rest of the tombs on this side of the hill.

Although the builders quickly excavated the exterior spaces in front of the façades, it was not a priority to finish them. The main objective was to have a sufficiently wide and flat area which facilitated the work inside the chapels. The works remained unfinished, either due to a shortage of time due to the sudden death of their owners during the last constructive phases, or political changes.

The unfinished condition of the exteriors of the set QH31, QH32, QH33 and QH34, in comparison to other contemporary tombs of Qubbet el-Hawa that were fully completed, for example QH36, allows us to determine what tools and methods were used for the construction of the tombs, excavated from the sandstone of the necropolis of Qubbet el-Hawa during the 12th dynasty.

Façades cut into the rock

First, the rock was cut vertically to obtain a profile with a rough surface. In order to accomplish this, the stonecutters simply cut the rock with long picks and chisels, gently beaten with heavy stone hammers to remove the surplus parts of the rock.

Secondly, the rough surface of the rock was carved by stonemasons using flat-tipped bronze chisels struck with wooden mallets, to produce a more or less flat surface, but with many tool marks left behind, particularly in the lower zone of the façades of QH31 and QH32. Finally, the surface of the stone was flattened off and finished, from top to bottom in vertical strips. Finishing of the façade was achieved using silicified sandstone (quartzite) stones with rounded edges that are commonly found in the vicinity of the necropolis.

Excavation works

The bulk excavation works were carried out in levels, from the top to the bottom, and from the centre to the sides in a horizontal direction. The quarrying followed the natural layers of the rock. The horizontal surfaces resulting from the removal of layers revealed the natural appearance of the rock, a fine texture with very few large inclusions.

The stone was separated from the underlying layers using hammered wedges, and by taking advantage of the naturally stratified surfaces which facilitated its removal. In order to obtain blocks and slabs, a number of more or less rectangular holes were carved, taking advantage of existing cracks or fractures in the rock and enlarging them, or directed to cause the appearance of new cracks.

In order to delimit the perimeter of the patio in QH31, a channel was carved with an average width of 8-11 cm, just enough to be able to introduce a metal tool vertically, which facilitated the extraction of the stone in slabs.

To create the courtyard in QH33, larger trenches approximately 60 cm wide were excavated using long picks or chisels hammered vertically. These allowed the stonemasons to work standing or on their knees to extract larger blocks.

Which method was used probably depended on the priorities of the builders when the work was being planned. In QH31 the carving of the façade was carried out simultaneously with the removal of stone from the courtyard, as the stepped stone terraces show. In QH33, however, the stone removal was carried out in order to finish the courtyard quickly, while the cut of the façade was left with a 'rough' surface.

Excursus: On the original ownership of the funerary complex QH32

Grenfell discovered QH32 most probably in the winter of 1885 and 1886.[54] Since then the hypogeum has usually been attributed to 'Aku', who decorated the tomb during the New Kingdom. However, the plan and the architecture of the tomb clearly pointed to the 12thdynasty as the original date of its construction. Hans Müller[55] argued this convincingly some decades later. Unfortunately, no epigraphic evidence survived which would permit an association between the tomb and any Middle Kingdom individual, although this situation may have changed recently (see below).

The present study confirms that the oldest funerary complex in the area where QH31, QH32, QH33 and QH34 were constructed is QH32. This chronological clue adds new data to indicate the original ownership of that funerary complex. The argument at its most fundamental level is that, if Sarenput II constructed the second tomb immediately to the south of QH32, it means that QH32 predates his era.

To date, only two 12thdynasty funerary complexes belonging to governors have been identified: QH36 and QH31, which were constructed by Sarenput I and Sarenput II respectively. Between these two governors of Elephantine we know that there were at least another four governors who ruled under Amenemhat II, Senwosret II, and during the early years of the reign of Senwosret III:[56] They were Heqaib I, Ameny,[57] Ipy,[58] and Khema[59] who was Sarenput II's father. Only in the case of Ipy do we know for certain that he established his tomb at Lisht,[60] not in Qubbet el-Hawa. The burial places of the other governors remain unknown.

In the case of Heqaib I, it seems that he only ruled for a short time[61] because he did not erect a naos in the temple of the mythic ancestor, the deified governor Heqaib. Similarly, Ameny seems to have held office for only a few years.[62]

Based on its architecture, the funerary complex QH32 required a significant period of time to construct and so Khema may be the best candidate for its ownership. QH32 shares many architectonic features with Sarenput II's funerary chapel,[63] which might also indicate chronological proximity to the latter. In this regard, it is notable that Khema was Sarenput II's father, and that Sarenput II succeed his father. Moreover, the place where Sarenput II constructed his funerary complex, immediately beside QH32, supports this interpretation. The burial places of Sarenput I's family (QH35p) and his own funerary complex (QH36) were situated on the northern side of Qubbet el-Hawa. The main reason that Sarenput II constructed his funerary complex in the new location would now seem to be its proximity to the burial of his father, Khema.

In 2017, the University of Jaén began the excavation of the funerary structures of QH32.[64] Although we are still in the first steps of the archaeological work at the site, future study may be able to confirm this attribution.

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54 Budge (1920), pp. 89-93. This author arrived at Qubbet el-Hawa when Grenfell's troops were clearing the tomb of Sarenput II and probably QH32 was cleared some days before.

55 Müller (1940), pp. 52-61.

56 In general (see Franke (1994), pp. 8-29).

57 Jiménez-Serrano and Sánchez-León (2015).

58 Jiménez-Serrano and Sánchez-León (2016).

59 Sánchez-León and Jiménez-Serrano (2016).

60 Jiménez-Serrano and Sánchez-León (2016), pp. 5-6.

61 Jiménez-Serrano and Sánchez-León (2015), pp. 120, 129.

62 Jiménez-Serrano and Sánchez-León (2015), p. 130.

63 Jiménez Serrano and García González (2017), pp. 122-123.

64 Jiménez Serrano *et al.* (2017), in press.

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