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Aspects of Tomb Architecture in Petra: a Reflection of Nabataean Craftsmanship and Building Techniques

Introduction

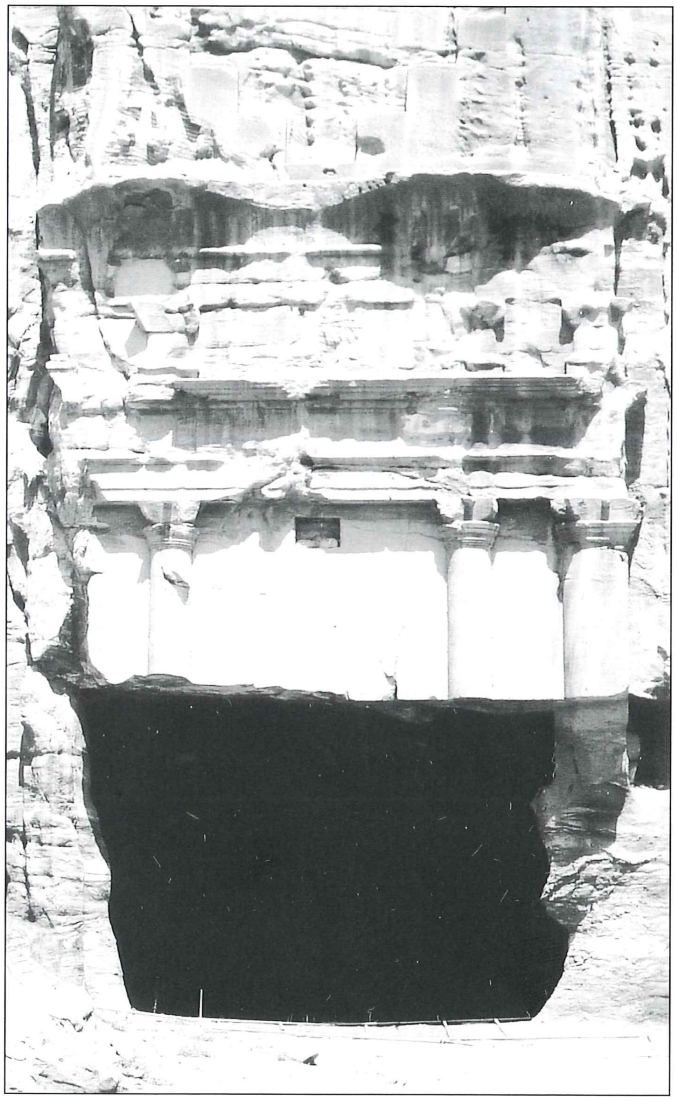
Little is known about the construction methods and materials used by the Nabataeans in carving the rock-cut monumental façades. Additionally, these façades are not presently in their final finished form, since a substantial amount of the original architectural surfaces have long disappeared. By close inspection and as a result of the material analysis of three tomb façades in Petra, some aspects of the architecture can be noted, giving some further insight into the building techniques and culture of the Nabataeans.

The three tombs studied are Tombs 825, 826 and 633. Tomb 633 (also known as Turkmāniya or Qabr at-Turkmān) is located on the eastern rock-side of Jabal al-Mu'ayṣra al-Sharqiya). Tombs 825 and 826 are located next to each another, in the area of the outer as-Sīq.

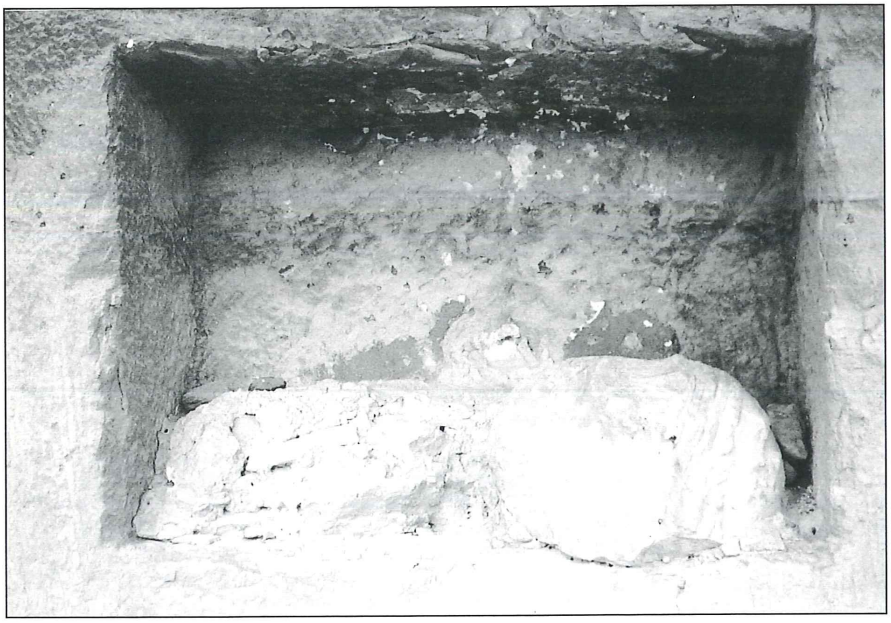
Tomb 633

Brünnow and Domaszewski (1904: 362) classified this tomb as being of the Hegr type. Its façade consists of two sets of large steps, a cavetto cornice, an attic storey with four "dwarf" pilasters, and a classical cornice (FIG. 1). The façade was carved from the natural rock except for most of its lower part that was built up of stone blocks. This is revealed by the presence of tool marks along the bottom of the two right pilasters, indicating that these two rock-cut pilasters were continued with stone pieces. The uppermost right step has been built out of quarried sandstone blocks as have been some parts of the cavetto cornice.

Almost one third of the façade, constituting its lower part, has completely disappeared. Just above the portion of the disappeared part and between the two inner supports is a Nabataean inscription. Above the inscription is a rectangular niche of about 80x58cm, inside of which are the remains of two busts (FIG. 2). The bust to the right has lost the sculptured head, while the one to the left is hardly recognizable, with only its mortar and stone backing remaining intact. Some substantial plaster remains with red and blue colors are evident on the back and side walls of the niche.



1. The façade of Tomb 633 (Turkmaniyah).



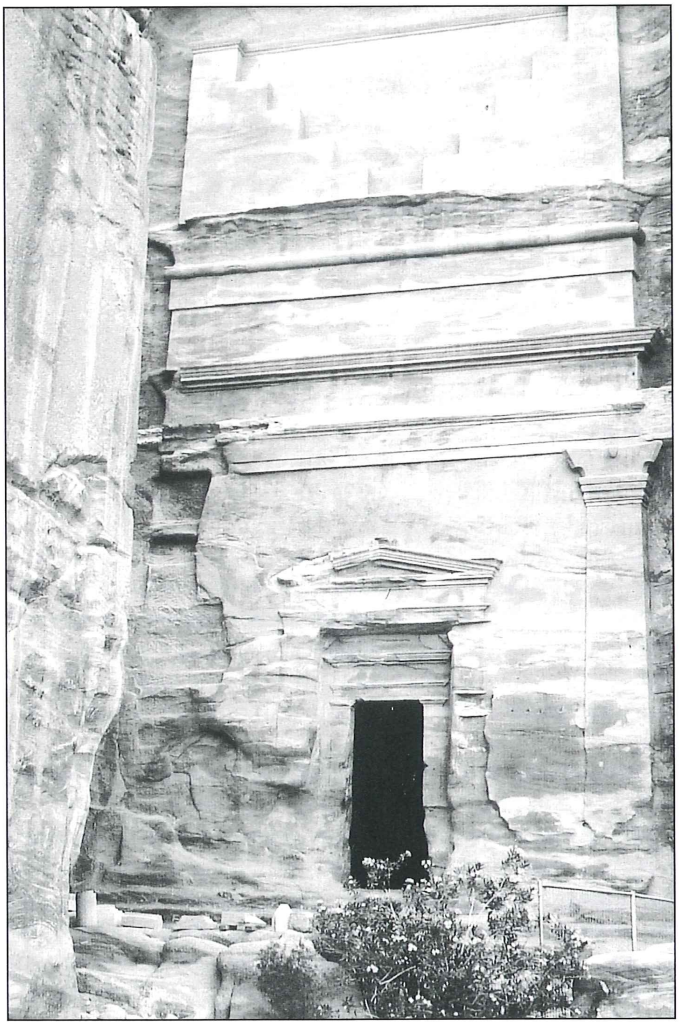
2. Rectangular niche with remains of two busts on the façade of Tomb 633.

The well preserved inscription is one of the few surviving Nabataean funerary inscriptions. Although it does not provide neither the date of the tomb nor the name of the owner, it nevertheless gives insight into the plan of the whole tomb complex. The inscription is sharp and finely carved, with the background very smoothly dressed.

The Nabataean inscription is written in five lines within a rectangular frame of 4 x 1.25m. Each of the right and left edges of the frame have a shape of an axe head in the middle of which are the remains of two patches of a plaster with a faint yellow and grayish blue color, giving the impression of large bolts or screws. The latest interpretation of the inscription was by Zayadine (1991: 282), based on the translation by Milik (1959) — who was the first to translate it — and that of Jobling in McKenzie (1990: 35). According to Zayadine (1970: 46; 1991: 282), the tomb is dated to the reign of Malichus II (40-70AD), on the basis of its style and also by comparing its composition with that of tomb F4 in Madā'n Ṣāliḥ, which is dated to 63/ 64AD.

Tomb 825

Tomb 825 is a Hegr Tomb according to Brünnow and Domaszewski (1904: 406). It consists of two sets of large steps, a cavetto cornice, an attic storey and a classical cornice (FIG. 3). Where the rock is weak and crumbly, carved stone insets were once used by the original builders (Shaer and Aslan 1997: 223). The façade had been at a later stage carved out all along the bottom part of the frieze, where a pipe was inserted. The ceramic water pipe is part of the water system running down as-Sīq and passing through Tombs 824, 825 and 826. This water system is dated to after AD50 (McKenzie 1990: 54, 110). The



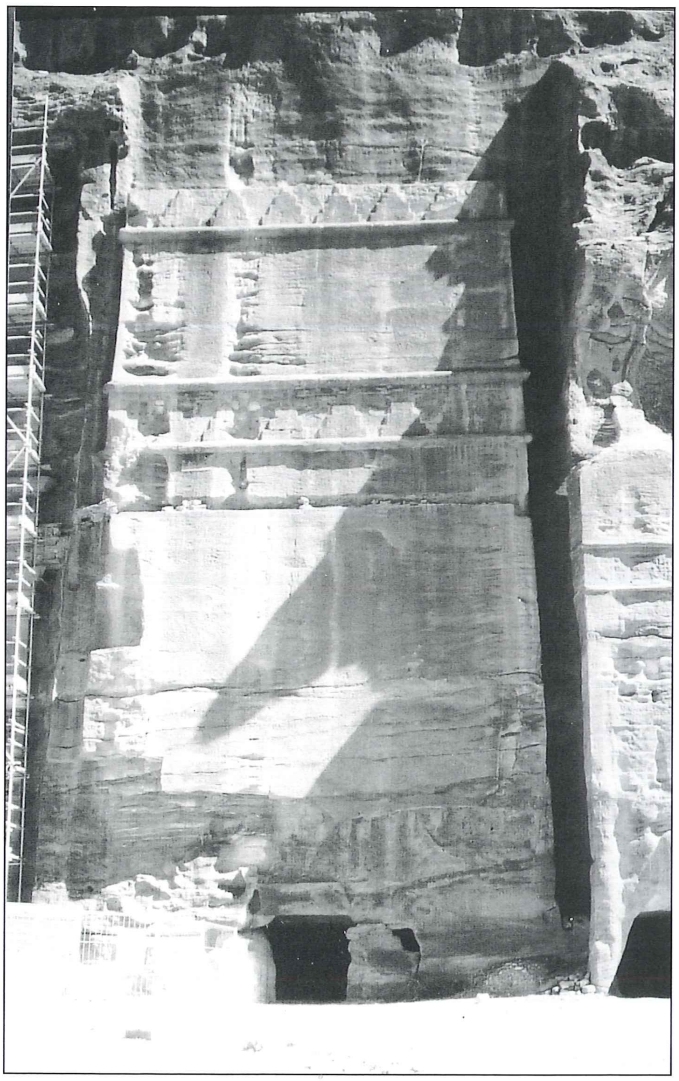
3. The façade of Tomb 825.

façade of Tomb 825 was carved before the ceramic pipe was inserted and hence before the water system.

Tomb 826

Tomb 826 is a Pylon Tomb (FIG. 4). Its façade measures ca 10.5x20m, and consists of two rows of crowsteps, each unit in the row comprising four steps. Below the upper set of crowsteps is a *torus*, as also evident above and below the lower set of crowsteps. To be noted is the absence of a stone carved *fascia* (the horizontal band that can be found usually below the *torus* on other façades in Petra and Madā'n Ṣāliḥ), below any of the *torus* moldings.

Nearly a quarter of the façade, representing its bottom part, is eroded with no recognizable architectural features. The eroded entrance opening is ca 2 x 1.5m above, which is a horizontal carved cavity in the rock where a doorway pediment in stone or in molded stucco insets was inserted.



4. The façade of Tomb 826.

The left part of the façade has carved cavities as well, and these were once filled with stone insets. At the top of the façade is a carved-in water channel that had the function of draining rainwater coming down from the mountain, channeling it to the sides of the monument, and thus preventing the water from seeping on the façade itself. At about 1.2m below the lower *torus*, the façade was carved in and the ceramic water pipe mentioned above was inserted.

Façade Carving

The rock carved façades in Petra are either set in the mountain or protrude from it, and hence there is always a separation between the façade and natural rock. This feature helps to achieve a sense of individuality and monumentality for a building that is in reality part of the natural surroundings.

It has been previously mentioned that the carving procedure was executed from top to bottom, and that as a first step, a flat smooth surface of the façade was created, followed by the carving of details (Hammond 1973: 77). Nevertheless, although this assumption holds true for some cases, it cannot be taken as a general rule. Unfinished tombs found throughout Petra show cases where carving was done at the top and the bottom of a façade simultaneously, or where detailed architectural features were carved at the same time as the carving of the monument from top to bottom. Very often, in order to simplify the carving process, the ceiling was executed following the lithology of the sandstone layers.

Most of the façades have quarried stone insets that have been added to rock carving in order to complete the architectural features of the monuments, especially where quarried stones of good quality were needed to replace weaker parts of the rock. In most cases, insets did not represent stone blocks that have been carved to fit exactly a certain allocated place. The exterior faces of the stones were finely carved and dressed and then fitted by adding smaller pieces of rubble and mortar fillings. Stone insets were used to complete the façades of Tombs 633, 825 and 826. Dowel holes can be seen along the edge of the cavetto cornice of Tomb 633 (FIG. 5). The whole top of the cornice was afterwards laid out with a very hard five-layer coarse lime mortar. This was evidently used in a slope to wash away rain-water and therefore providing some protection to the façade.

In studying the tool marks of the three façades, it seems that the tools used are invariably the pick-axe, as well as the pointed, tooth and flat chisels that are used with the help of a hammer. The pick-axe was used only in carving and a depiction of such a tool has already been noted (Shaer and Aslan 1997: 224-225; Fig. 17). The pointed chisel was used for both, carving and dressing. It was the most widely used type of chisel, by which the

5. The cavetto cornice of Tomb 633 with dowel holes and protective mortar layers.

dressing of long, fine parallel lines — characteristic of Nabataean sandstone surfaces — was conducted. The tooth chisel was used for dressing narrow architectural elements creating diagonal or short horizontal lines, and, the flat chisel was used for making a smooth surface of the stone with marks that are similar to a hatching of successive straight lines along the vertical and horizontal edges of architectural features. Close inspection of the tool marks of Tomb 633 has revealed that two different persons, one right handed, and the other left handed were working simultaneously and close to one another in carving the façade.

Moreover, in addition to the templates that have been found for the façade of Tomb 825 (Aslan and Shaer 1997: 226-227) and carved along the side walls of the tomb, another template incised directly on the façade of Tomb 633 has been found (FIG. 6). Such incised drawings were most probably executed by the architect or master mason as instructions for the stone carvers. The templates give the sequence of cornice elements in their approximate proportions, without exact measurements. This seems to imply that the carvers retained a certain knowledge of the right proportions of architectural elements, and the final product depended very much on their individual skill.

Plastering

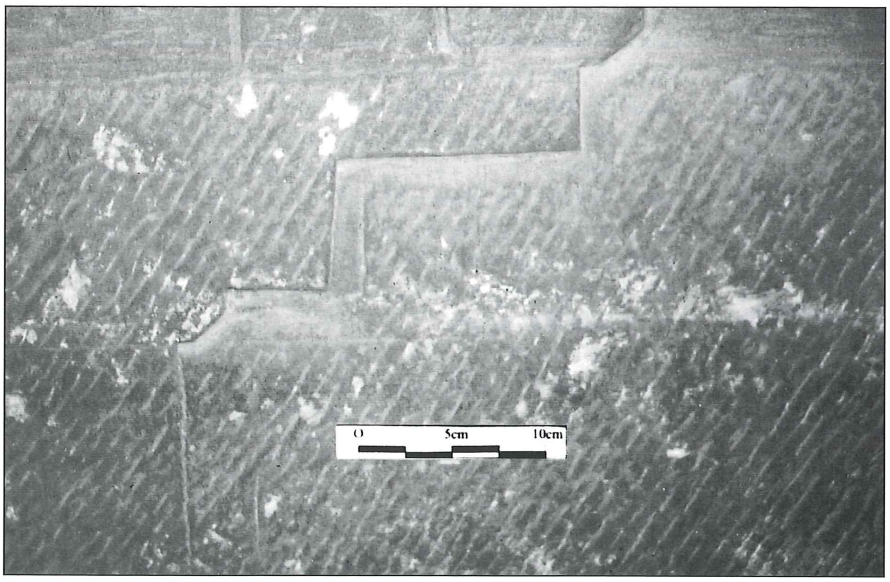
The three tombs investigated retain some plaster remains, which in certain cases still have the originally colored surface. Plastering was considered in Nabataean times as a profession by which the craftsmen could be identified, as attested by an inscription that mentions 2 stelae of al-'Uzza and "Lord of the Temple", the work of which was executed by a certain "Wahballāhī the plasterer" (Cantineau 1932: 7-8).

The façade of Tomb 633 appears to have been once covered with a plaster layer as evident by the few remains under the niche. This plaster is basically a gypsum plaster with very few small quartz aggregates. Although covered by dust, some iron oxide was found on the surface that could indicate a red color.

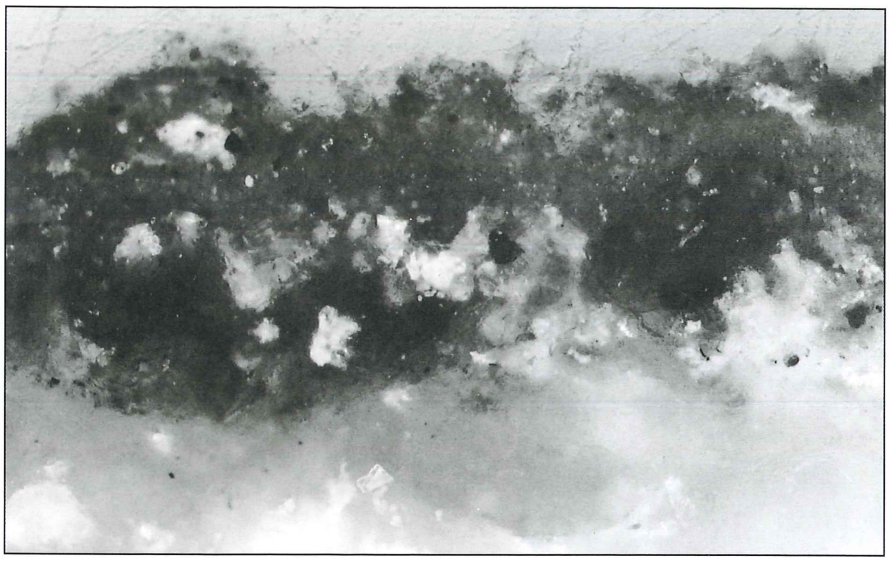
In the niche it is evident that the paint layer was laid on top of a gypsum plaster layer, under which was a ground layer of lime plaster. Regarding the pigment in the paint layer, the one on the back wall of the niche and the underside of the ceiling of the niche consists of red iron ochre mixed with gypsum.

The underside of the ceiling of the niche has a blue color in addition to red, as does the top left side of the niche. In the latter case, a reddish layer is evident over the blue paint surface (FIG. 7). The red layer is a mixture of gypsum and hematite, while the blue below consists of Egyptian blue pigment (cuprorivaite).

Cross section analysis has shown that the sculpture found inside the niche is made up of dolomite stone. The



6. An incised profile on the façade of Tomb 633.



7. Cross-section of a red and a blue colored layers above white gypsum plaster (the thickness of the two paint layers is 200μm).

stone was first laid out with a ground layer of gypsum plaster containing small quartz grains, and painted over with several layers, as would be in a varnish, containing calcite and iron rich, alternating with layers containing the elements phosphorus and magnesium. The actual pigment used could not be identified, though it could have possibly been a lake pigment. Analysis attempting to detect organic binding media revealed the presence of wax, possibly a mineral wax such as ozocerite that can be extracted from bitumen.

Regarding the inscription itself, which appears to have merely a very smooth finish without any plaster or color, it was found to have originally been painted. It seems that the inscribed letters were covered by a fine lime plaster above which a layer of red ochre and gypsum was painted. The frame of the inscription was also apparently painted with a red ochre mixture. One tends to speculate the possibility of the whole inscription tablet being covered with a white lime layer and afterwards the frame and inscribed letters painted red, giving a more pronounced inscription against the white homogeneous background than if it would have been against the sandstone background.

Moreover, from the scientific analysis which was carried out, it appears that the two round circles on both sides of the tablet (FIG. 8) were originally sheets of iron metal placed directly on the stone that gave the impression of large circular bolts holding an inscription tablet on the façade. At a later stage, with the rusting of the metal, it was removed - with some remnants remaining - and a gypsum plaster layer was laid above it and was painted over with yellow ochre. This repair was done simply and cheaply, and probably intended to give the impression of shiny metal bolts. Such an impression was noted by Irby and Mangles (1985: 412) when they visited the site in the beginning of the 19th century: "To return to the inscription; ...there projects, from each of its ends, those wings in the form of the blade of an axe, which are common both in the Roman and Greek tablets, and which would seem to have been in their origin, for the purpose of receiving screws or fastenings, ...there is upon each side a stain of metal, which must be the effect of studs actually driven in, to give the whole tablet the appearance of a separate piece."

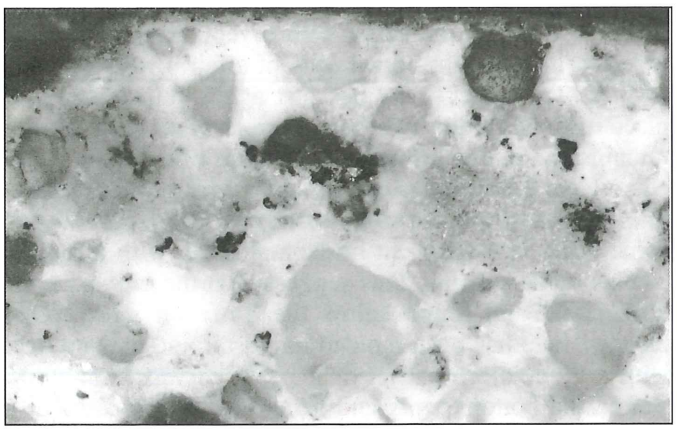
Some very little plaster remains have been found on the façade of Tomb 825. Although scanty and with no original surface, these remains indicate that this façade was at least partially covered with plaster. Analysis of the constituents of the plaster revealed that it was a gypsum based mixture (Shaer 1997: 121; 2000: 144).

Upon close inspection of the façade of Tomb 826, substantial plaster and color remains can be noted. To begin with, several remains of a thin layer of white plaster can be found all over the façade. The architectural features, such as the two rows of crowsteps have thick plaster remains in between the steps, with several remains of dark red color that has the appearance of a fairly well-polished surface. The upper *torus* has just a few thin remains of plastering, while the two bottom ones have thick plaster remains and in one instance the remains of a yellow painted surface. Below the *torus* are again thick plaster remains that protrude from the stone surface of the façade and in some cases is a clear cut horizontal edge, with instances of blue color remains. This suggests that the *fascia*, i.e the horizontal band found below the *torus* on many other façades, here has been molded in plaster and painted over with a blue color, instead of it being carved from stone. Below the bottom *torus* and *fascia* are the remains of a plaster layer suggesting another horizontal band, or *fascia*, that is recessed with respect to the first horizontal band, and in that case, the *fascia* is in two levels.

8. The remains of plaster remains imitating bolts.

The rest of the façade, comprising plain surfaces, has remains of the white layer of plaster, except in the middle of the façade and at ca 3.3m below the bottom *torus,* where there is a patch representing thicker plaster remains. Regarding the plaster layering of the façade, it appears that the plain surface and the protruding crowsteps had originally been white washed with a single layer of 'fat' lime plastering. This layer seems to have been applied as a first coating covering the whole façade, except in a few instances where it has not been detected.

Moving on to the architectural elements, in addition to the thin white layer, there seem to be 2 layers of lime plaster with a lot of aggregates covering the recessed areas between the crowsteps, the *torus* molding, and the moulded *fasciae*. In some instances in the analysis of sample cross-sections, there seems to be a single plaster layer, rather than two layers, above the 'fat' lime layer.



9. Cross-section of a yellow colored layer above white lime plaster that contains a lot of aggregates (the thickness of the top paint layer is 20-50μm).

Above this plaster layering, a paint layer was applied and finely polished. Red was applied between the crowsteps, yellow is found on the *torus* above the second row of crowsteps, and blue on the *fascia* below that *torus*. The painted surfaces appear to be highly polished especially where there is the dark red color.

The dark red layer has hematite as the red pigment. This layer contains lime and hence it can be concluded that the *fresco* technique was implemented in this case. The blue colored layer has Egyptian blue as the pigment. Below the Egyptian blue layer is a layer of black particles that are a kind of soot. This was probably placed below the blue to give a deeper darker hue of the blue color. Here, naturally, there is no lime present in the layer, as typically Egyptian blue does not work well with lime and cannot be used in a *fresco* technique. Alternatively, an organic binder would have been used in the *secco* technique. As for the yellow layer (FIG. 9), the pigment used is yellow ochre.

From the plaster and color remains on the façade, one can deduce that the three primary colors of red, blue and yellow have been used in addition to the white surfaces. To be noted is the lack of secondary colors such as green, orange and pink on the exterior façade surface. The *fresco* technique has been used to apply red and yellow colors by having a wet lime plaster and applying a lime containing paint layer above. Moreover, the white 'fat' lime layer on the façade, in addition to being a white coating of the façade's plain surfaces, it was also a ground layer that helped in closing the pores of the sandstone, providing a uniform substrate surface for applying the plaster layer.

Therefore, we find that in plastering, both gypsum and lime mixes were used. Gypsum mortar was very much

used in Egypt, while lime mortar and the technique of *fresco* painting was widely used in the Classical world, and in ancient cities like Pompeii.

Depiction of Deities

An incised block stele found on the right edge of the façade of Tomb 825 has been interpreted as being a depiction of the Nabataean god Dhu ash-Shara (Shaer and Aslan 1997: 227, 229), as is common in Petra. Similarly, an incised rectangle was found on the rock just above the top of Tomb 826, while at Tomb 633 it appears as a small carved in rectangular niche at the top of the façade. This emphasizes the notion that the masons were from the local population who seeked the blessing of their god.

Concluding Remarks

Regarding the building and carving techniques, it can be concluded that although there were established norms and procedures of work, there was still freedom and individuality in execution. The Nabataean craftsmanship had achieved a certain level of professional standard. Despite the various cultural interactions and influences, the Nabataean identity is evident in the architecture of Petra.

Acknowledgements

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