

## The Nabataeans and Al-Wu'ayra: Archaeological Data, Hypothesis and Questions

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### Abstract

The author presents a summary of the previous notes concerning the presence of the Nabataeans in the site of al-Wu'ayra at the eastern border of Petra in the light of updated archaeological data. The Medieval Petra Mission extended the research to the overall chronology for a better understanding of the short-term Crusader settlement in the entire framework of the history of the site. Beside a number of generic statements, many questions are still waiting for an answer. Among the others: what's the actual consistence of archaeological data and which questions they pose? What can be said today about the use and function of the site during Nabataean period? The author presents the available archaeological data concerning the oldest history of the site and some hypothesis altogether with a correction of some previous interpretation concerning the Nabataean phase of the site on the basis of recent research by the Medieval Petra Mission.

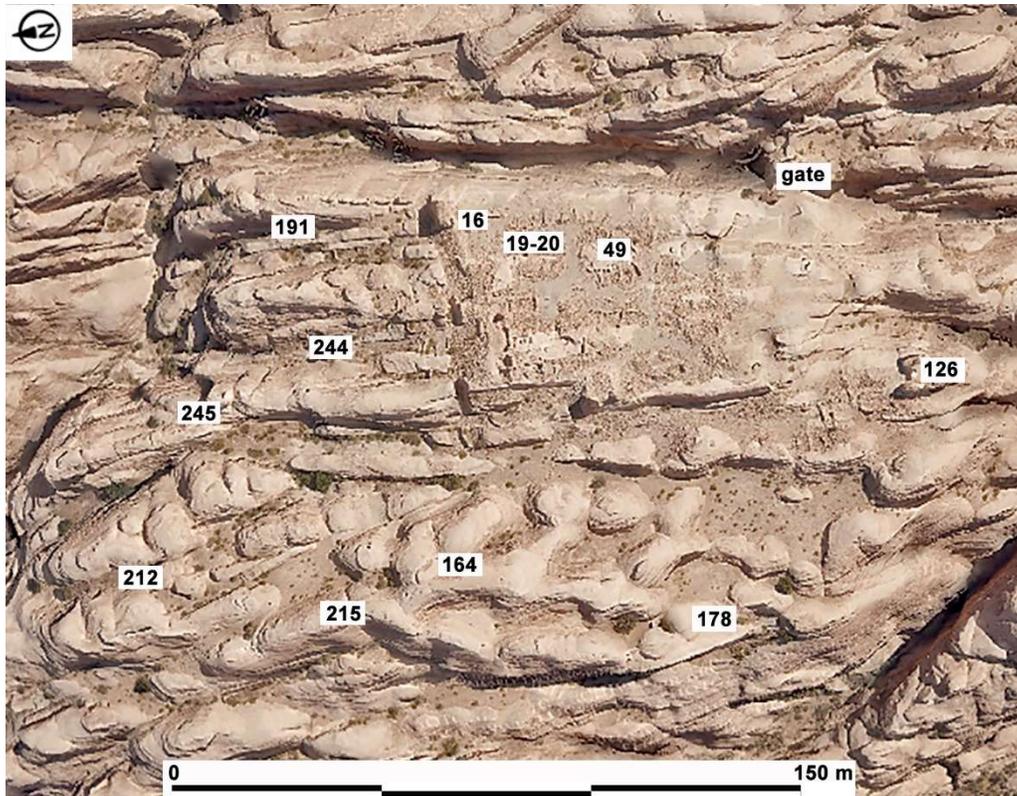
**Keywords:** Nabataean period, Petra, al-Wu'ayra.

### Introduction

The presence of a Nabataean phase at the site of al-Wu'ayra, at the eastern border of the area of Petra along the road from Wadi Musa to Umm Sayhoun, first reported by Musil (Musil 1907), it is not surprising, in consideration of the vicinity to the capital, to Wadi Musa-Gaia and their surrounding several minor settlements (Healey 2001: 45-46). What makes the hypothesis and the character of the settlement difficult to determine is the natural isolation and the conformation of the site, as well as the various later modifications. Eighty years later, Robin Brown mentions a Nabataean horizon in her report on the first archaeological excavations. According to her, this phase is both indicated by “carved staircases and chambers cut into the bedrock folds and outcrops” (Brown 1987: 267, 269) and “reused Nabataean sandstone blocks” individuated in so-called “Nabataean rock-cut chamber” (Brown 1987: 277).

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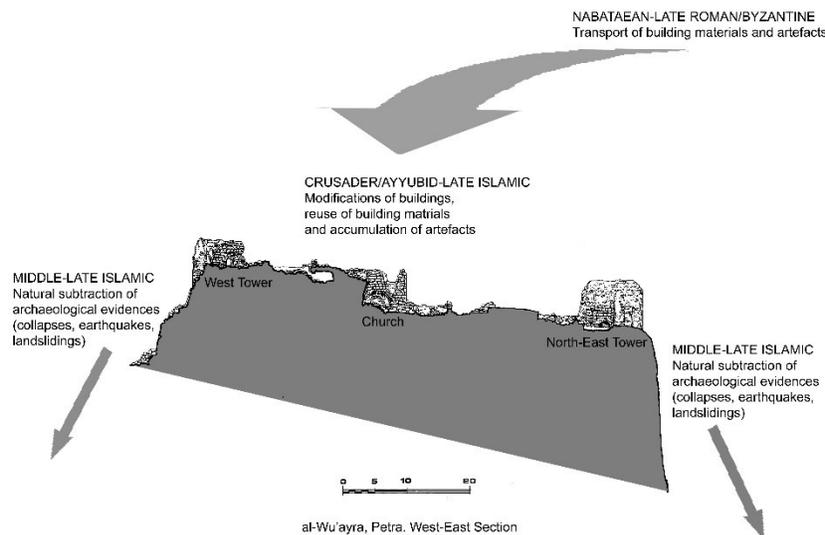


**Figure 1. The site of al-Wu'ayra with indication of the various Topographic Unit (TU) mentioned in the text. Orthophoto based on aerial photos kindly provided by APAAME (in particular APAAME\_20171001\_REB-0599-0613 and APAAME\_20171001RHB-0334-0344).**

### **Specificity of the site**

In order to correctly consider the various kind of mobile artefacts and their documentary value it is worth recalling the diachronic dynamics of archaeological accumulations and losses, reconstructed from the archaeological analyses so far conducted at al-Wu'ayra. As a matter of fact, because of the physical features of the site (and most of all its isolation and altitude), the transport of artefact to al-Wu'ayra from elsewhere could not happen through natural phenomena, such as weathering or landslide. Hence the presence of every artefact on the site, either simple pottery sherds or heavier ashlar, could only be the result of deliberate anthropic transport from outside. Moreover, this is the only possible cause for the accumulation of archaeological levels at the site (Vanni-Desideri and Vannini 2016). On the contrary, the progressive loss of archaeological data it is mainly due to natural or spontaneous reasons, such as collapses or landslides. On the basis of archaeological data collected so far, it is possible to date these phenomena and schematically draw their diachronic development (fig. 2). Most of the archaeological evidence, such as building materials and objects, is accumulated on the site during the early phases (i.e. between the Nabataean and the Byzantine

periods). During the Middle Islamic-Crusader period while most of the building activity seems to reuse materials already present at the site, the income of new materials was limited mostly to particular supplies. This is the case, for instance, of the fine yellow sandstone used for interior architectural decorations (mouldings, capitals) or the special moulded ashlar forming the apse of the Crusader church. Finally, during the Late Islamic period vernacular dry-stone architecture replaced skilled building activity and the occasional dismantling of previously abandoned structures (curtain walls as well as residential and religious buildings), now intended as a convenient supply of building materials, starting a cyclical series of collapses and, as a consequence, the loss of archaeological data.



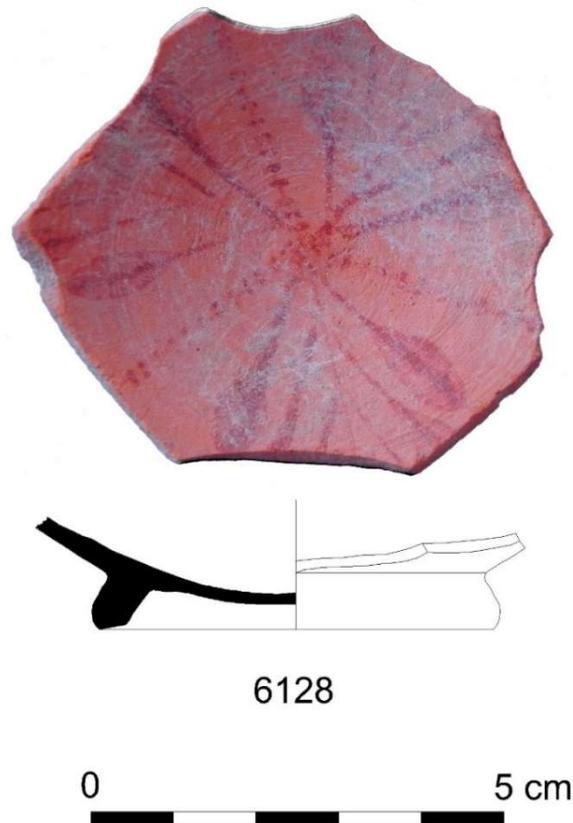
**Figure 2. Diachronic graph of accumulations and losses of archaeological materials at al-Wu'ayra (after Vanni-Desideri and Vannini 2016)**

### **Archaeological data**

Unfortunately, no sondage performed by Robin Brown, who first investigated the site with updated archaeological methodology, encountered any pure Nabataean stratigraphic unit (Brown 1987: 267, 269). In such a condition we have to rely only on residual pottery sherds gathered from later layers. The most abundant and significant assemblage of pottery sherds from al-Wu'ayra is the one from Square 4, corresponding to Topographic Unit (TU) 16 located in front of the entrance to the North-East tower, showing an average percentage of Nabataean pottery types around 10%. Square 1, located in TU 126, which was investigated by the same scholar did not provide any significant pottery assemblage.

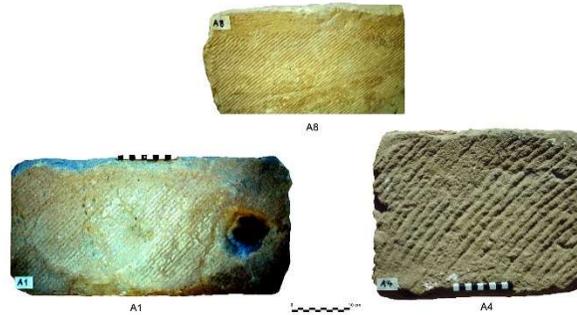
In the meantime, the Medieval Petra Mission of the University of Florence started a new research at the site through survey, archaeological analyses and excavations in selected spot. The surface collection of artefacts confirmed the data already provided by Brown and during following sondages, residual Nabataean

pottery sherds were collected from each stratigraphic level, from Crusader levels up to Late Islamic phases (Vannini and Vanni-Desideri 1995: 529) (fig. 3), mostly dating to the 1<sup>st</sup> century AD (Schmid 2007: 314-316). Further analyses based on a larger quantity of pottery sherds confirmed the presence of Nabataean pottery estimated between 0,32-1,61 and 7% (Tonghini and Vanni-Desideri 2001: 711, 714). In any case, pottery assemblages are not helpful for the solution of the question, being Nabataean pottery sherds residual, because always coming from later layers. In fact, both the excavations by R. Brown and by the University of Florence did not reach any pure Nabataean layer. Also fragments of clay water pipes have been collected in Middle and Late Islamic layers. Their very thick chalk incrustation proves a prolonged use, i.e. the existence of reservoirs and of an effective distribution net as well as certain water consumption, but unfortunately we have no evidence of such pipes still *in situ* up until now.



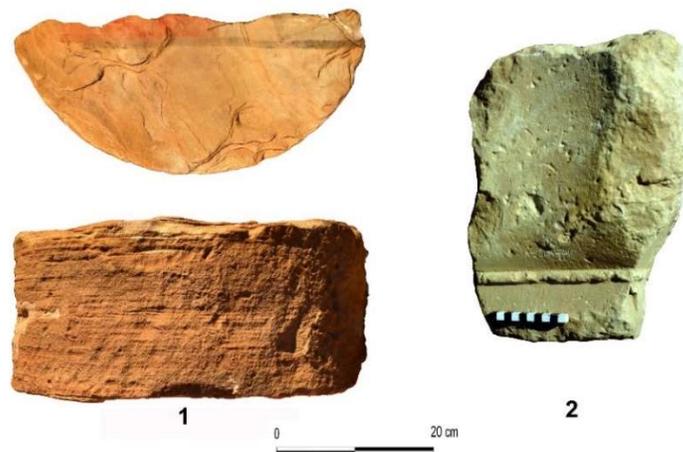
**Figure 3. Example of residual Nabataean pottery sherd from Late Islamic layer (TU 115, Stratigraphic Unit 6).**

As to building materials, different types of ashlar with peculiar Nabataean stone dressing technique are scattered all over the site. Among them, sandstone blocks reused in Late Islamic dry-stone walls show surface finely finished by chisel (fig. 4, types A1 and A8) (Brown 1987: 277) (Bessac 2007: 231, fig. 35, type i; 248, fig. 67) or by pick (fig. 4, type A4) (Bessac 2007: 231, fig. 35, type i).

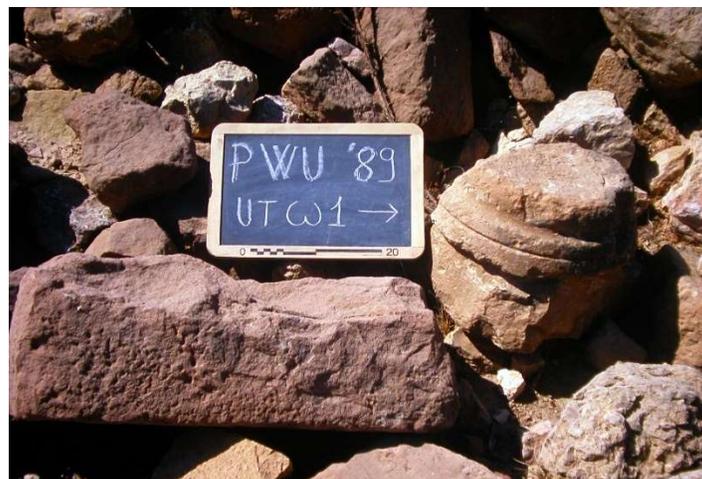


**Figure 4. Nabataean stone dressing technique types from al-Wu'ayra. Photos by A. Vanni Desideri.**

Among the architectural elements, two semi-column drums and a fragment of a capital which may belong to a semi-pillar (fig. 5) have been documented on the site, together with the capital of a freestanding column (fig. 6).

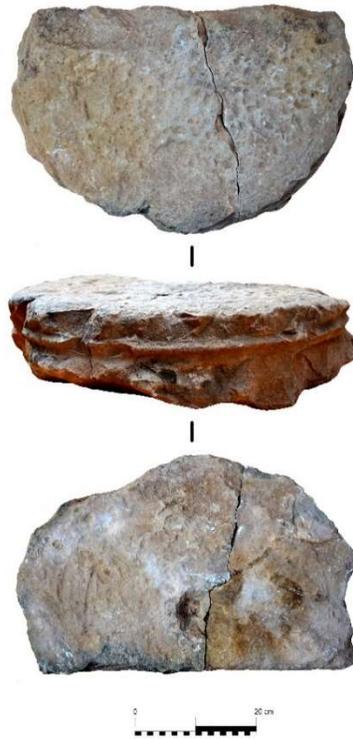


**Figure 5. 1, sandstone semi column drum; 2, capital from a semi-pillar. Photos by A. Vanni Desideri.**



**Figure 6. Capital of a freestanding column. Photo by A. Vanni Desideri.**

A poorly preserved column base, with clear traces of a secondary modification, was gathered recently from the heap of building material in the bottom of Wadi al-Wu'ayra, likely collapsed from the hilltop (fig. 7). It belongs to the turned type (Bessac 2007: 50-51, 250, fig. 70) and shows close formal and technical similarities with better-preserved specimens from the *cardo maximus* of Petra and the Nabataean “Pond Temple” (Lindner and Gunsam 1995: 204, pl. 9). The fragment of a sandstone bas-relief frieze bearing a floral decoration comes from the debris of a Late Islamic dry-stone wall (fig. 8).

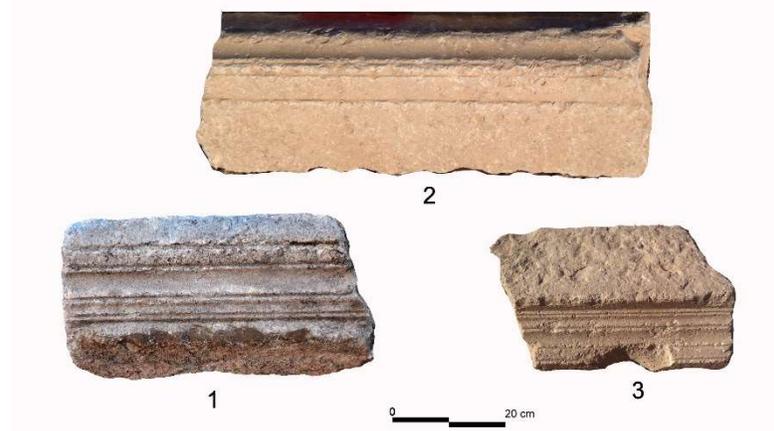


**Figure 7. Sandstone base of a column from al-Wu'ayra.  
(Photo by A. Vanni Desideri)**



**Figure 8. Fragment of a sandstone architectural decoration.  
(3D model by A. Vanni Desideri).**

Other architectural elements, mainly cornices, are sculptured into limestone (fig. 9). This lithotype, containing abundant fossils of gasteropoda, is maybe the one classified as an imported *lumachella* used during Roman period for architectural decorations (Bessac 2007: 38). According to other authors, it could correspond to the so-called coquinoidal limestone component of the “Amman-Muwaqqar” and Middle Jordan formations (Abu Dayyah 2001: 527), possibly coming from quarries identified in the surroundings of Udruh whose cultivation seems to be mentioned in the 107 AD papyrus from Kanaris (Killick 1987: 175).



**Figure 9. Types of limestone cornices.  
(Photos by A. Vanni Desideri)**

Beside a generic pre-Crusader chronology of one item of this type, reused as threshold of the lateral access to the Crusader church, the presence of architectural elements of such relatively unusual material has been noted among the collapses of the so-called “Pond Temple” (Lindner and Gunsam 1995: 205, pl. 12). They could possibly be interpreted as decorative cornices to be originally inset in façades (Shaer and Aslan 1997: 223; Bessac 2007), but are always found in a secondary stratigraphic position, as building materials reused during Crusader time or in the dry-stone walls of the Late Islamic *facies*.

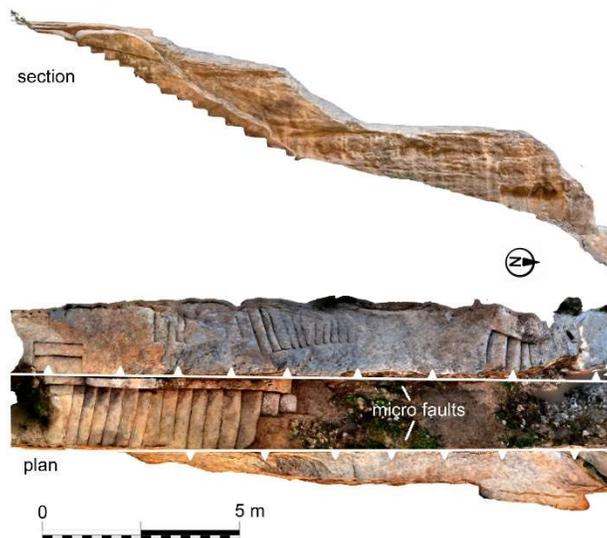
Anyway, the more abundant archaeological traces of a Nabataean presence, and the only one still *in situ*, consist in the rupestrian structures occurring all over the site. They do not show any elaborate or monumental character, which was possibly obtained with the application of decorative elements such as the above listed ones (semi columns, capitals, friezes et cet.).

As already noted by Brown, among these rupestrian structures are a number of staircases carved into the sandstone surfaces (Brown 1987). Their chronology is not homogeneous and indications of their prolonged use is provided by rearrangements or “reshaping” of steps. The complete mapping of these stairways performed during the past two years shows that they were intended for a triple purpose: pathways leading to the site, connecting its different areas or climbing to rectangular platforms. One common feature of these staircases is the procedure of

their realization taking advantage of natural cracks or micro faults in the bedrock in order to facilitate the carving of the stairs.

One stairway could have connected the site with the area of Wadi Musa-Gaia, approaching al-Wu'ayra from the East, i.e. starting from the sandstone plateau close to the Wadi Musa – Beidha road. Being the only access to the site continuously available from antiquity up to modern time, its poor preservation is well visible to everyone visiting the site. But there is a different stairway climbing the site from the northern outskirts of Petra. A two meters wide staircase (TU 191) cut into the sandstone bedrock and reaching the top of al-Wu'ayra has been individuated and partially excavated for approximately seven meters during recent research (fig. 10). While, due to safety reasons, it has not been possible to explore its whole length, the geophysical prospection recently performed by a team from the Archaeological Institute of the Polish Academy of Science,<sup>2</sup> proved the presence of at least another five meters of the staircase. The structure must certainly be intended as an access from the north to the area of al-Wu'ayra but its complete extension is still to be precisely defined.

The rest of the stairways seems to connect the different inner areas and most of them are located on the eastern limit of the site, on the highest spots of al-Wu'ayra, and they lead to artificial platforms located on top of the ridges (fig. 17).

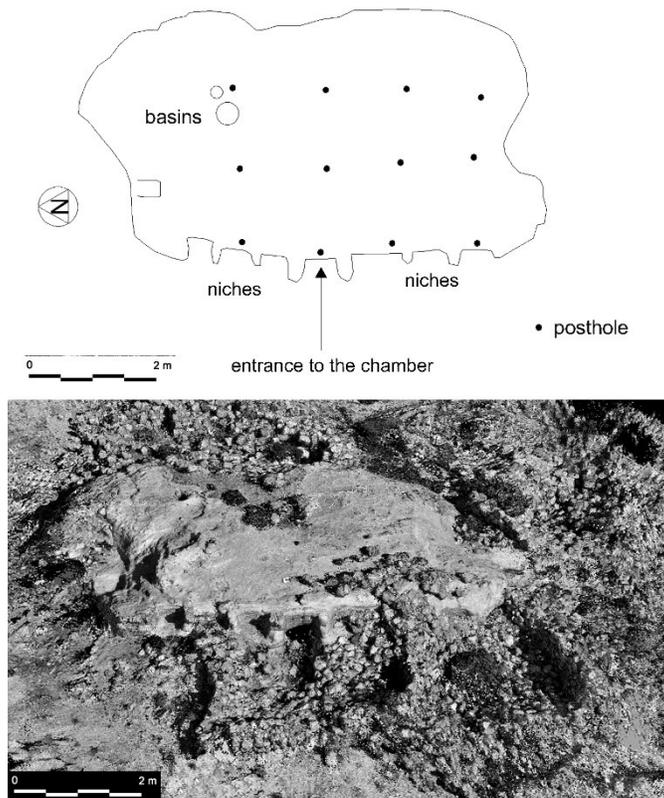


**Figure 10. Section and plan of the 3D model of TU 191. The 2 m wide staircase takes advantage of two parallel micro faults (3D survey by S. Leporatti)**

<sup>2</sup> The team of the PAN (Polskiej Akademii Nauk, Warszawa), led by T. Herbich and A. Buko, is collaborating, altogether with the National Council for Research (CNR-ITABC, Roma), directed by S. Piro, with the University of Florence on different fields, in Jordan and in Italy, for instance in the Semifonte Project dedicated to the identification and the study of the destroyed Italian medieval town of Semifonte, located between Florence and Siena ([www.sagas.unifi.it/cmpro-v-p-643.html](http://www.sagas.unifi.it/cmpro-v-p-643.html)).

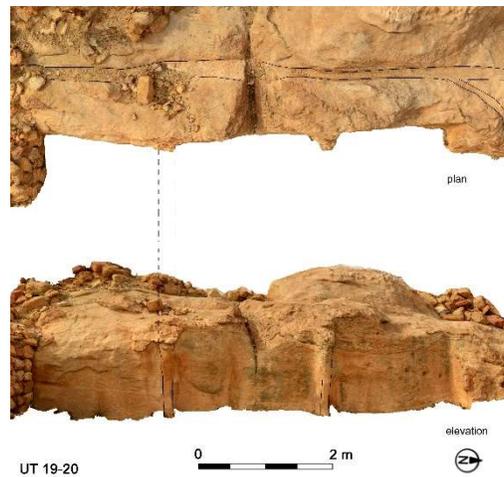
Another kind of evidence are the rock cut chambers simply dug into the rock or part of more or less elaborated façade. They are always provided with draining rock cut channels probably in order to prevent rain from entering the cavity as noted elsewhere (Bessac 2007). The more elaborated examples are TU 49 and TU 19-20. In the first one, the entrance to the chamber is flanked by three niches on both sides while, on the flat surface above the chamber, twelve post-holes, regularly arranged in three rows, indicate the presence of a roof or shelter, maybe in functional connection with the chamber (fig. 11).

UT 49



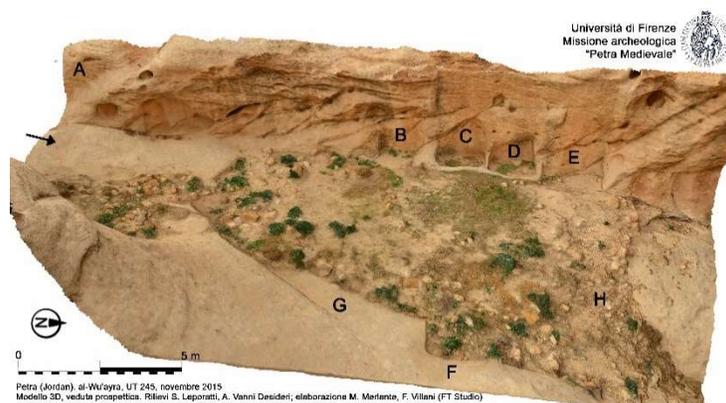
**Figure 11. Birdseye view from the West of the 3D model of TU 49 and schematic plan. (3D survey by S. Leporatti and A. Vanni Desideri).**

TU 19-20, blocked in its lower portion by the collapse of sandstone blocks, has a vertical plain rock cut surface, in the shape of a façade divided in three portions by two projecting semi-pillars. On the northern portion, a row of at least five horizontal post-holes are dug into the rock, maybe during a later period and possibly supporting a shelter (fig. 12). Above the façade a rock cut channel prevents meteoric water from flowing through.

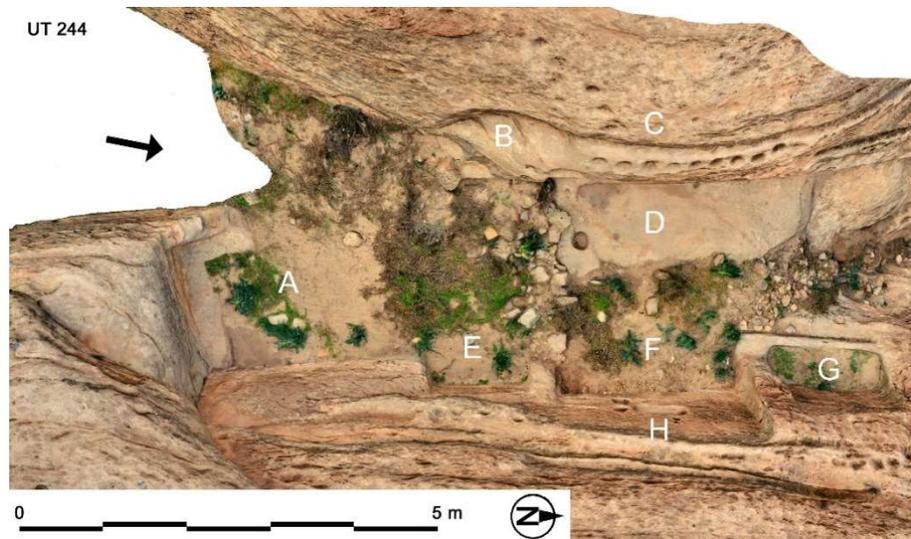


**Figure 12. Plan and elevation of TU 19-20 showing the three vertical rock cut surfaces separated by semi pillars and provided by an upper meteoric water draining channel (3D survey by S. Leporatti).**

A simpler type of structure is the one exemplified by TU 245 (fig. 13). It consists of a rock cut façade whose central portion includes four rectangular cavities at its foot (B, C, D, E), traces of a rock cut bench (F, G) and a short flight of steps (A) leads the top of the rock, right above the four cavities. A different kind of complex is the one exemplified by TU 244 (fig. 14). It takes advantage of a small wadi with a narrow entrance. On the right hand, a L shaped bench (A) is dug into the rock just beside three subsequent vertical cuts determining rectangular cavities or loculi, separated by diaphragms (E, F, G) and provided with three niches of different size (H). In addition, also in this case it is possible to climb on top of the installation through a staircase (B).



**Figure 13. Birdseye view of 3D model of TU 245 from East. A, staircase; B-E, loculi; F-G, rock cut bench; H, collapsed terracing wall. (3D survey by S. Leporatti and A. Vanni Desideri).**



**Figure 14. Top view of 3D model of TU 244. A, rock cut bench; B, staircase; C, postholes (post-Nabataean); D, rock cut floor with cylindrical hollow; E-G, loculi; H, rock cut vertical surface. (3D survey by S. Leporatti and A. Vanni Desideri).**

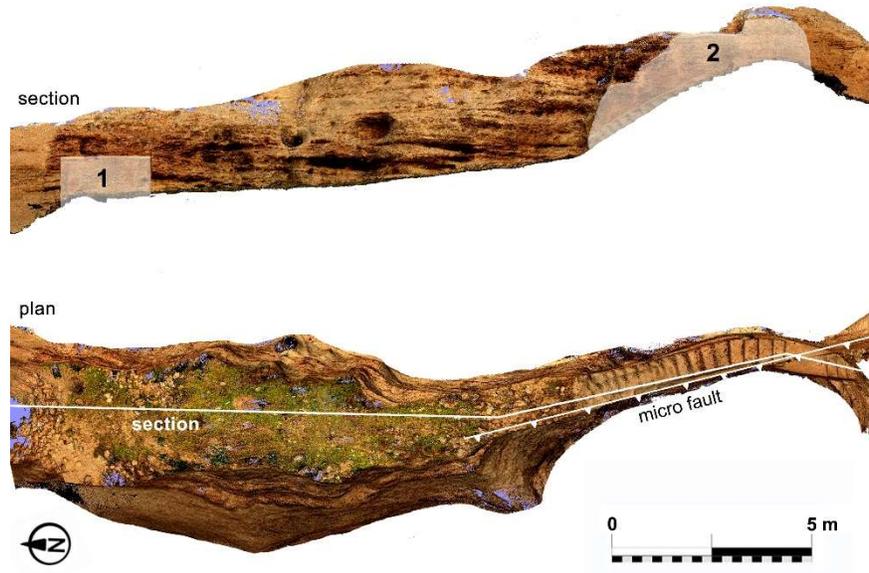
If all these clues point towards the hypothesis of a Nabataean presence at al-Wu'ayra, on the other hand one element, up until now considered as Nabataean must be corrected on the basis of new and more detailed reading and survey. In fact, the so-called Nabataean tomb corresponding to TU 126 in its actual setting has been more realistically reinterpreted as a rupestrian Christian chapel on the basis of its reconstructed apse setting (Leporatti and Vanni-Desideri 2018), even if a previous Nabataean phase could not be excluded.

Traces of the rock cutting procedures are still readable only on few spots, more protected against weathering. TU 212 is a clear example of artificially accommodated wadi, (fig. 15). A long and descending staircase leads to the northern limit of the site where poorly preserved parts of a simple rock cut structure, most probably a rectangular room spanning from one side to the other of the wadi, are still visible on the right hand. Both structures show similar tool marks demonstrating that the staircase is contemporary to the east rectangular panel, also provided with a small rectangular niche. The staircase takes advantage of a north-south natural micro fault and the cutting technique is here more-evident, being more protected against weathering than in most part of the rock cut staircases. It is then possible to reconstruct the cutting procedure.

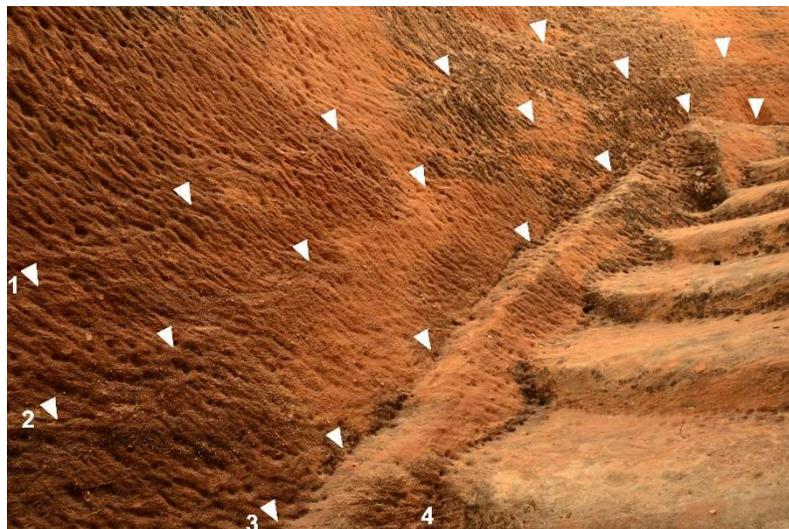
The work started with the determination of the profile and the desired inclination of the staircase, followed by the shaping of the bed rock with a first excavation, whose trace is clearly visible on the east side of the rock (fig. 16,1) showing tool marks produced by a pick (Pflüger 1995; Bessac 2007: 235, fig. 43). Two other successive excavations, always following the planned profile, reach the

needed level, each one maybe representing a working session or day (fig. 16, 2, 3). The final shaping of the steps starts from this level, leaving a lateral bank on each side (fig. 16, 4). This procedure clearly demonstrates a very careful planning and capacity of control of the progressing excavation and at the same time the availability of skilled workers.

Petra (Jordan). al-Wu'ayra, UT 212



**Figure 15. 3D model of TU 212. 1, vertical rock cut surface (room?); 2, rock cut surface with tool marks produced by the excavation of the staircase. 3D survey by (S. Leporatti and A. Vanni Desideri).**



**Figure 16. The East side of the staircase of TU 212 showing the tool marks and the technique used for the carving out of steps. 1-3, progressive cut keeping the profile of the staircase; 4, carving out of steps. (Photo by A. Vanni Desideri).**

In the case of TU 191, two adjacent parallel micro faults facilitate the cutting of the staircase but, as a consequence, lateral tool marks are not visible nor the rock cutting technique, being the lateral limits of the staircase determined by the geological horizontal discontinuity (fig. 10).

Other structures, which do not match with other archaeological phases at al-Wu'ayra, could also be assigned provisionally to a Nabataean phase, mainly because functionally connected to rock-cut staircases. It is the case of the platforms carved into the sandstone on the two highest spots of the site and orientated towards the Jebel Haroun (Alpass 2013: 73). The best preserved among them is TU 215, a rectangular platform, around 2,20 by 3,70 m. The floor bears a couple of roughly rectangular shallow hollows aligned along the east edge of the platform where unknown objects could be inserted. Each slot is surrounded by four postholes perhaps supporting a shelter (fig. 17). The dimension of the platform appears too small for a group or even a single person and the narrow (around 1 m wide) and long staircase leading to it is not appropriate for many people to climb (fig. 18). The whole setting seems to be rather occasional and non-utilitarian purposes, thus to be included in the category of "high places", but the small size of the installation of al-Wu'ayra, which lacks some of the structures normally present (Nehmé 1997: 1038) (hollows, basins, channels et cet.) makes the interpretation difficult. Anyhow the installation suggests a non-participative activity on the platform, such as the temporary ostension of objects placed into the slots.



**Figure 17. One of the rectangular platforms (TU 215) located on the highest spot of al-Wu'ayra. (3D survey by S. Leporatti and A. Vanni Desideri).**



**Figure 18. The staircase (TU 164) leading to platform 215.  
(Photo by A. Vanni Desideri).**

### **Conclusions**

The presence of residual Nabataean material would not be surprising if coming from elsewhere around Petra, but coming from al-Wu'ayra it has a different documentary value, due to the morphology of the site. The interpretation of Nabataean pottery sherds found in every stratigraphic level as the result of deliberate transport at the site during later phases it is unlikely. At the same time their poor average amount is not sufficient to prove a permanent settlement at al-Wu'ayra. Sherds of clay water pipes presuppose the existence of water storages, a distribution net and a corresponding water consumption, i.e. a permanent settlement, which isn't demonstrated for ancient al-Wu'ayra. The water pipes must

then be assigned to a later installation, chronologically located between the antique phase and the Crusader period, most probably contemporary to recently individuated pre-Crusader rupestrian chapel, most probably Byzantine (Leporatti and Vanni Desideri 2018).

Also the building materials had to be transported to the site but the question is: do they come from early buildings already existing at al-Wu'ayra or are they coming from elsewhere? We have here to distinguish between the two main lithotypes used on the site.

The only material supplied by nearby geological formations is the hard limestone (Bessac 2007: 37), which could have been easily quarried and transported to the site from the top of the ash – Shara mountain, facing al-Wu'ayra to the east. Here the limestone level naturally cracks into rough blocks, thus facilitating the quarrying. While this material had been used in the nearby water reservoir of Zurrabah, at al-Wu'ayra this lithotype seems to be used only from the Byzantine period.

Architectural limestones elements, as mouldings or cornices, occur rarely and in Medieval time they are improperly reused as mere building materials, as in the case of the threshold of the Crusader church. This observation doesn't exclude the possibility that they have been collected on the site from collapsed earlier buildings.

Among building materials sand stone blocks of different granulometric classes are absolutely prevalent. They have not been quarried at the site, not even as a result material from rupestrian excavations as it happens elsewhere around Petra (Bessac 2007 passim). Most of them are employed in walls and vaults of Medieval buildings, after being reprocessed according to the new purposes, and as a result their original aspect is not recognisable anymore, apart from the few already listed cases in which Nabataean features, both technique and decorative, are still visible. These sandstone blocks certainly come from ancient buildings, but at least two questions arise. Have they been collected on the site or brought from elsewhere? And in the first case, once theoretically evaluated their overall volume, is it proportionated with a possible built up volume at al-Wu'ayra? One more element must be considered: the maximum concentration of building materials is in the area of the Medieval settlement of al-Wu'ayra and in its close surroundings. Outside the castle keep area only rock cut foundations have been recorded and they seem to have supported walls and arches not existing anymore. The possible existence of ancient buildings at al-Wu'ayra, including built up structures as well as rupestrian ones, should have been mostly concentrated in the areas corresponding to the later Medieval settlement. This observation could also explain the poorly preserved early material and structures at the site.

Unfortunately, no architectural element was found *in situ*, because of the profound transformation which the site underwent during postclassical phases and the rearrangements of previous buildings. On the other hand, it seems also difficult to explain their presence as the result of transport, as mere building material, from

ancient building of Petra or Gaia during early Medieval or later phases.

Some of the rock cut structures are certainly connected with postclassical occupation of the site, either rearranging earlier structures or excavating new ones. They show a large variety in terms of tool marks, rock cutting techniques and formal characters and their chronology ranges from Byzantine to Crusader period. Other structures ('façades' provided with niches, chambers, loculi, staircases et cet.) are not easy to explain if not in connection to an antique phase of the site and in fact they show technical details matching with ancient Nabataean tradition. Staircases and connected platforms on higher spots apparently showing no utilitarian role, are difficult to interpret as remainders of more complex postclassical structures and they show technical features analogous to those documented for the Nabataean period. But judging from the poorly preserved rupestrian structures, they appear to be very simple ones and not comparable even with poorest structures in Petra.

The presence of a Nabataean phase at al-Wu'ayra is realistic but available data are not sufficient to clarify its character. It is then preferable to propose an occasional and limited frequentation of the site, such as the one produced by devotional or funerary activities, rather than a permanent settlement. But even following this proposal we have no sufficient archaeological data supporting such an interpretation, mostly because no excavation reached any pure Nabataean level so far.

If a single archaeological evidence, does not seem to be decisive to prove a Nabataean phase at al-Wu'ayra, the amount of different types of clues (pottery sherds, architectural elements, rock cut staircases, platforms and artificial cavities) converge toward the same hypothesis which anyhow needs further and deeper investigations.

## **Contributor**

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## الأنباط وموقع الوعيرة: معلومات أثرية وفرضيات وتساؤلات

أندريا فاني ديسيديري

### ملخص

تقدّم هذه الدراسة ملخصًا للملاحظات السابقة في ما يتعلّق بالوجود النبطي في موقع الوعيرة على حدود البترا الشرقية في ضوء التحديث الذي طرأ على المعلومات الأثرية. لقد وسّعت بعثة البترا في العصور الوسطى مجال البحث ليشمل التسلسل الزمني بشكل كامل؛ من أجل فهم أفضل للاستيطان الصليبي قصير الأمد ضمن إطار الموقع التاريخي الشامل، وبجانب عدد من الاستنتاجات العامة هناك عددٌ من الأسئلة التي تنتظرُ الإجابة، ومن بين أسئلة أخرى تبرزُ الأسئلة الآتية: ما درجة تماسك المعلومات الأثرية الحقيقي وما الأسئلة التي يطرحها؟ ما الذي يمكن قوله اليوم حول استخدام الموقع ووظيفته خلال الفترة النبطية؟ وعليه، فتقدّم الدراسة معلومات أثرية متوقّرة حول التاريخ الأقدم للموقع وبعض الفرضيات جنبًا إلى جنب مع تصحيح بعض التفسيرات السابقة المتعلقة بفترة الاستيطان النبطي في الموقع بناءً على دراسة حديثة للبعثة الأثرية "البترا في العصور الوسطى".

الكلمات الدالة: الفترة النبطية، البترا، الوعيرة.

## REFERENCES

- Abu Dayyah, A. S. 2001 Selected Roman Stone Quarries in Central Jordan: a Cultural Resource. *Studies in the History and Archaeology of Jordan* VII: 521-530.
- Alpass, P. 2013 *The Religious Life of Nabataea*. Leiden-Boston.
- Bessac, J. C. 2007 *Le travail de la pierre à Pétra. Technique et économie de la taille rupestre*. Paris.
- Brown, R. 1987 A 12<sup>th</sup> Century A. D. Sequence from Southern Transjordan Crusader and Ayyubid Occupation at el-Wu'eira. *Annual of the Department of Antiquities of Jordan* XXXI: 267-288.
- Healey, J. F. 2001 *The Religion of the Nabataeans. A Conspectus*. Leiden-Boston.
- Killick, A. 1987 Udhruh and the Trade Route Through South Jordan. *Studies in the History and Archaeology of Jordan* III: 173-179.
- Leporatti, S., and Vanni Desideri, A. 2018 Una nuova chiesa rupestre a Petra in Transgiordania. Pp. 247-250 in *Atti dell'VIII Congresso Nazionale di Archeologia Medievale VIII.3, Matera 12-15 settembre 2018*, ed. F. Sogliani, B. Gargiulo, E. Annunziata and V. Vitale.
- Lindner, M., and Gunsam, E. 1995 A Newly Described Nabataean Temple near Petra: The "Pond Temple". *Studies in History and Archaeology of Jordan* V: 199-214.
- Musil, A. 1907 *Arabia Petraea. II. Edom*. Wien.
- Nehmé, L. 1997 L'espace culturel de Pétra à l'époque nabatéenne. *Topoi* 7/2: 1023-1067.
- Pflüger, F. 1995 Archaeo-Geology in Petra, Jordan. *Annual of the Department of Antiquities of Jordan* XXXIX: 281-295.
- Shaer, M., and Aslan, Z. 1997 Architectural investigation on the building techniques of the Nabataeans with reference to tomb 825. *Annual of the Department of Antiquities of Jordan* XLI: 219-230.
- Schmid, S. G. 2007 Nabataean Pottery. Pp. 309-326 in K. Politis (ed.), *The World of the Nabataeans, Volume 2 of the International Conference The World of the Herods and the Nabataeans*, British Museum 17-19 april 2001. Stuttgart.
- Tonghini, C., and Vanni Desideri, A. 2001 The material evidence from al-Wu'ayra: a Sample of Pottery. *Studies in History and Archaeology of Jordan* VII: 707-719.
- Vanni Desideri, A., and Vannini, G. 2016 Light archaeology and historical landscape. For the global history of the site of al-Wu'ayra (Petra) in Transjordan. Pp. 195-205 in *Krakow Landscape Monographs 2. Landscape in the Past & Forgotten Landscapes*, ed. P. Kolodziejczyk and B. Kwiatkowska-Kopka, Jagellonian University in Krakow.
- Vanni Desideri, A., and Vannini, G. 2017 Changing water management and exploitation strategies at al-Wu'ayra (Petra). A "longue durée" perspective through light archaeology methodology. Pp. 55-66 in *Precious water Proceedings of the Seminar on Italian Archaeological Missions in Jordan - Amman (Jordan), 18 ottobre 2017*. *Rosapat* 12.
- Vannini, G., and Vanni Desideri, A. 1995 Archaeological research on Medieval Petra: a preliminary report, *Annual of the Department of Antiquities of Jordan* XXXIX: 509-540.