The Hanging Baths of Jabal Khubthah (Petra): Preliminary Conclusions Following Archaeological and Architectural Studies (2015-2017)

***Thibaud Fournet*[1], *Nicolas Paridaens*[2]**

Abstract

The Jabal Khubthah summit, generally interpreted as a religious "high-place", remained poorly understood until an archaeological survey initiated in 2012. The new project revised this interpretation, particularly after the discovery of a bath complex built on a breathtaking location, at the very edge of the cliff. After three archaeological campaigns we were able to elucidate parts of its chronology and to reach a tentative reconstruction. The bath presents a rather classical plan, associating a cold area, a tepid one, and a hot room, endowed with two heated plunges. Most of those remains can be dated to the second half of the fourth century AD and will have been abandoned at the end of fourth century or the beginning of the fifth century. However, the excavation revealed that the building was built on an earlier bath complex, poorly preserved, but possibly dating back to the beginning of the second century AD. Connected with other structures, this first bath building seems to be linked to the small naos preserved further south. Altogether with other reexamined bath buildings, in and around Petra, this new discovery sheds new light on the adoption process of Roman bathing practices in the Nabataean world.

Keywords: Romanization; Roman baths; Architecture; Religious practices; Ancient technology.

Introduction

What could be more related to Economy and Culture than a bath building in antiquity? The Third International Conference on Petra and the Nabataean Culture gave us the opportunity, in this double theme, to present the first results of our research on a small but fascinating bath building discovered on the top of Jabal Khubthah, in the frame of the French archaeological mission in Petra[3]. This article

[1] Corresponding author: email, Thibaud.FOURNET@cnrs.fr, (Thibaud Fournet). Orcid number https://orcid.org/0000-0003-4754-1309, Ifpo, Institut français du Proche-Orient, Amman (Jordan).

[2] Second Author: email, Nicolas.Paridaens@ulb.ac.be, (Nicolas Paridaens). Orcid number https://orcid.org/0000-0002-9772-7243, Université libre de Bruxelles, Belgium.

Received on 6/9/2020 and accepted for publication on 24/11/2020.

[3] Dir. Laurent Tholbecq (*Université Libre de Bruxelles*). The project was financially supported by several institutions: the French Ministère de l'Europe et des affaires étrangères (Commission des fouilles), and the

is centered on the architectural outcomes of this discovery, but will also address the preliminary archaeological results, on behalf of Nicolas Paridaens, the archaeologist from the *Université Libre de Bruxelles*, in charge of the excavation.

The baths were studied in 2015, 2016 and 2017[4], in a total of only seven weeks of excavation and drawing. Those excavations allowed us to understand large parts of the building, despite its poor state of preservation. In particular, we were able to elucidate parts of its chronology and to reach a tentative reconstruction of its structure and features. We will first and briefly present the topographical context of the building, located in an unusual position for a bath, underlining the scientific frame of this discovery (fig. 1). We will then present our objectives, the chosen strategy of exploration and the main results of the archaeological and architectural study.

Figure 1. The bath building from the south east, overlooking the city center of Petra (Th. Fournet).

The discovery of this new bath house in Jabal Khubthah, completed by the study of a second one discovered in Wadi Sabra[5], encouraged us to reassess the other bath buildings, private or public, known in the Nabataean kingdom, from Wadi Rum to Khirbat ed-Dharih, and to compare this corpus to those from Egypt and Palestine. This article, in its conclusion, also gives us the opportunity to present briefly the first results of this reassessment.

Université libre de Bruxelles (ULB) through a Research Incentive Fund (FER). The work was carried out jointly by Belgian and French researchers, in cooperation with several institutions, including the DoA, IFPO, and CRea-Patrimoine (Brussels).

[4] 13-28 May 2015, 9-26 May 2016 and 4-19 Oct. 2017.

[5] Fournet, Tholbecq 2015; Tholbecq *at al.* 2016.

Discovery

The bath building was discovered by the team of Laurent Tholbecq in October 2012, during the survey of the Jabal al-Khubthah, a summit located east of the city centre (fig. 2), above the royal necropolis, two hundred meters over the city centre[6].

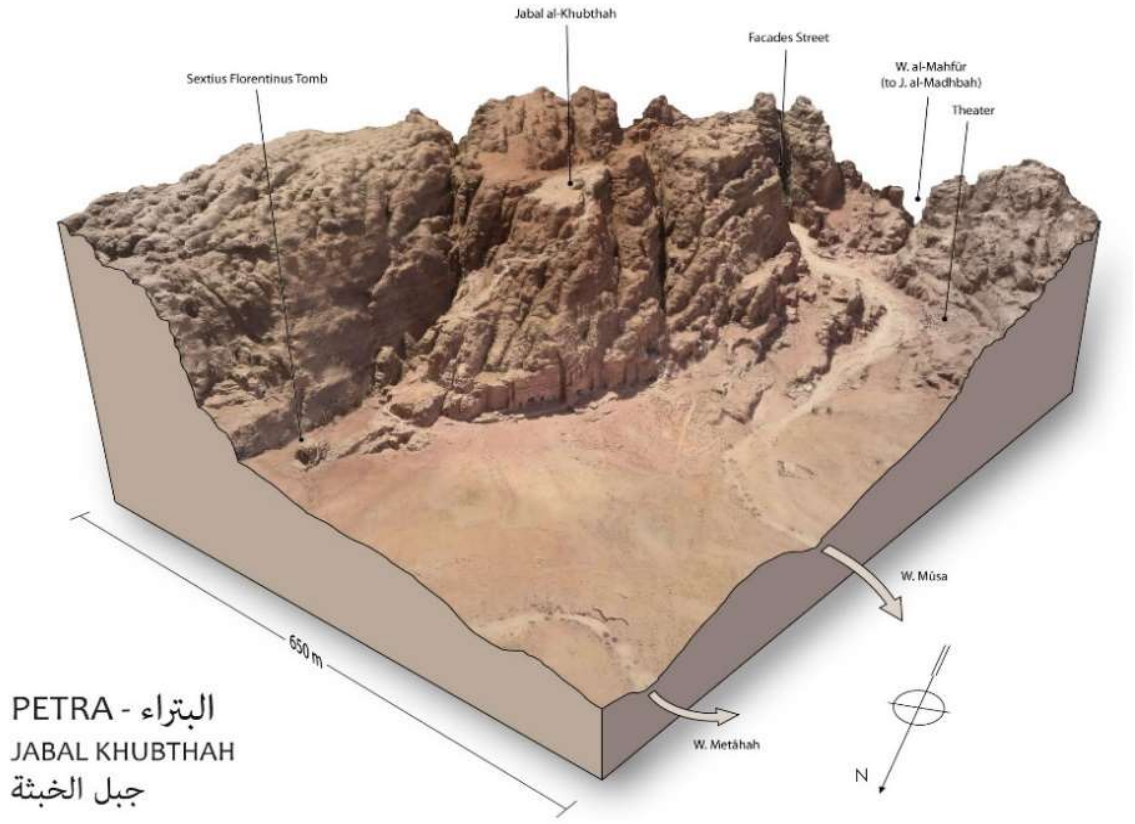

Figure 2. Location of the Jabal Khubthah on a three-dimensional model, from the north-west. (Th. Fournet, after aerial photographs).

This area, which occupies about seven thousand square meters, was described at the beginning of 20th century by G. Dalman[7] and was then considered to be a religious high place, in particular because of a small *naos* cut in the rock. The new survey, with the drawing and description of numerous other remains, completely renewed the perception of the summit plateau (fig. 3): a tower on the highest point, a large cistern covered with arches in the eastern part of the plateau, a square *motab*, a *stibadium* connected with a monumental platform building in the northern part, several constructions, probably dwellings, and, of course, to the

[6] Tholbecq *et al.* 2014.
[7] Dalman 1908: 336-337, fig. 305; Dalman 1912: 38-39, fig. 30.

south, before the *naos*, the bath building.

Since the entire installation of this monument is built on the very edge of the cliff, erosion and slippage have exposed the main parts of it, visible without any cleaning during the first survey (fig. 4). The general organization was clear: the building consists of a main wing, 15 m long, hanging over the cliff, and surrounded by different annexes, a cistern, service rooms, and, on both sides, two aqueducts. The layout of the main wing, especially the northern room, with a cruciform plan, and of course the presence of bricks and hydraulic mortar, were all indicators pointing to a bath building[8].

The main goal of the Khubthah survey was to provide new information about the nature and functioning of an area that looks more complex than just a cultic high place and may have suggested other functions over the centuries. The discovery of a bath building, completely unexpected, fits well with this new interpretation, and deserved more investigation.

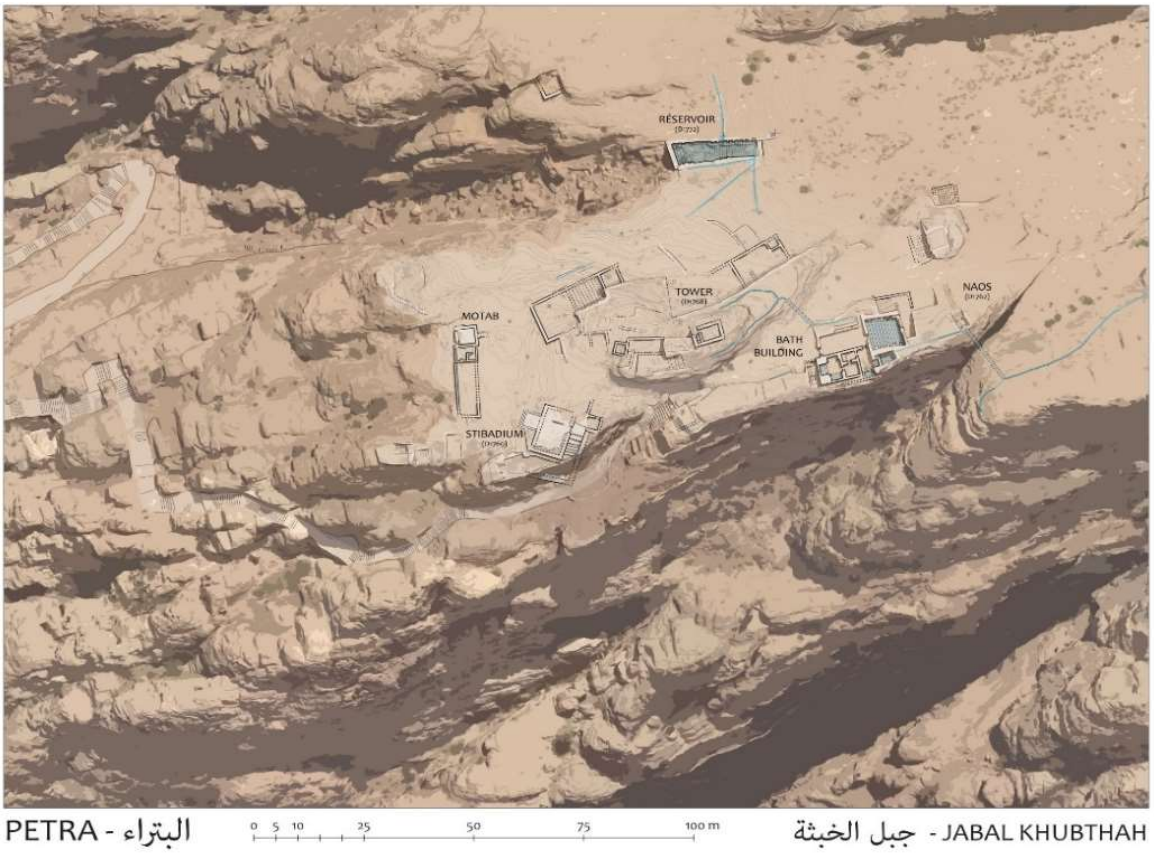

Figure 3. General map with relief of the Jabal al-Khubthah, location of the main remains (Th. Fournet, after a topographical survey from S. Delcros/N. Paridaens 2012 and a photogrammetric model based on aerial photographs).

[8] Tholbecq *et al.* 2015.

Figure 4. The bath building from the north, before excavation (top) and after excavation and preservation woks, in 2016 (bottom) (N. Paridaens).

2015 Season

An excavation was decided on to confirm the identification of a bath building, to determine its precise function and layout and, of course, to fix its chronology (fig. 5). The first campaign, in 2015[9], beside a general clean-up and a detailed architectural survey, focused first on a central area, in order to establish an east-west stratigraphic section, and secondly on the hypothetical service area, north of the main wing (room 6), in the hope of finding one of the main furnaces of the bath.

The main result was the confirmation of the building's identification: beside several observations of the circulation of users and hydraulic network, a hypocaust heating system was uncovered in the first sounding (room 3, sounding 2015-1), connected with furnaces and heating walls (*tubuli*). The organization of the building, including the pathways of its users, was then quite simple to reconstruct:

The entrance doorway was located to the north and leads to a large hall or courtyard (room 1). From this room one could enter the *frigidarium* (room 2), fitted to the west with a pool cut into the rock. From this *frigidarium*, a doorway leads to an intermediate room 4, with a bench, no doubt a *tepidarium*, located between the cold section and the heated rooms (sounding 2015-2). From there, one entered the first heated room (room 3), which must have been a *destrictarium/laconicum*. A doorway opens to the main room of the building (room 4), a massive *caldarium*, with 3 rectangular recesses, two of them probably fitted with collective hot pools. From this *caldarium*, the bathers could go back to the *frigidarium*, by the same path, and then enjoy a cold bath.

The main service room (room 6, sounding 2015-3) is located to the north, and had a furnace directly situated on the axis of the *caldarium*. A narrow service corridor (room 7), on the very edge of the cliff, allowed access to two other *praefurnia*.

The other result of the first campaign was the identification, in the north service room, of an earlier phase of the building (fig. 6), consisting of an oblong depression, cut into the rock. This depression preserves the mouth of a *praefurnium*, indicating that the previous construction was probably also a bath.

[9] Fournet, Paridaens 2015.

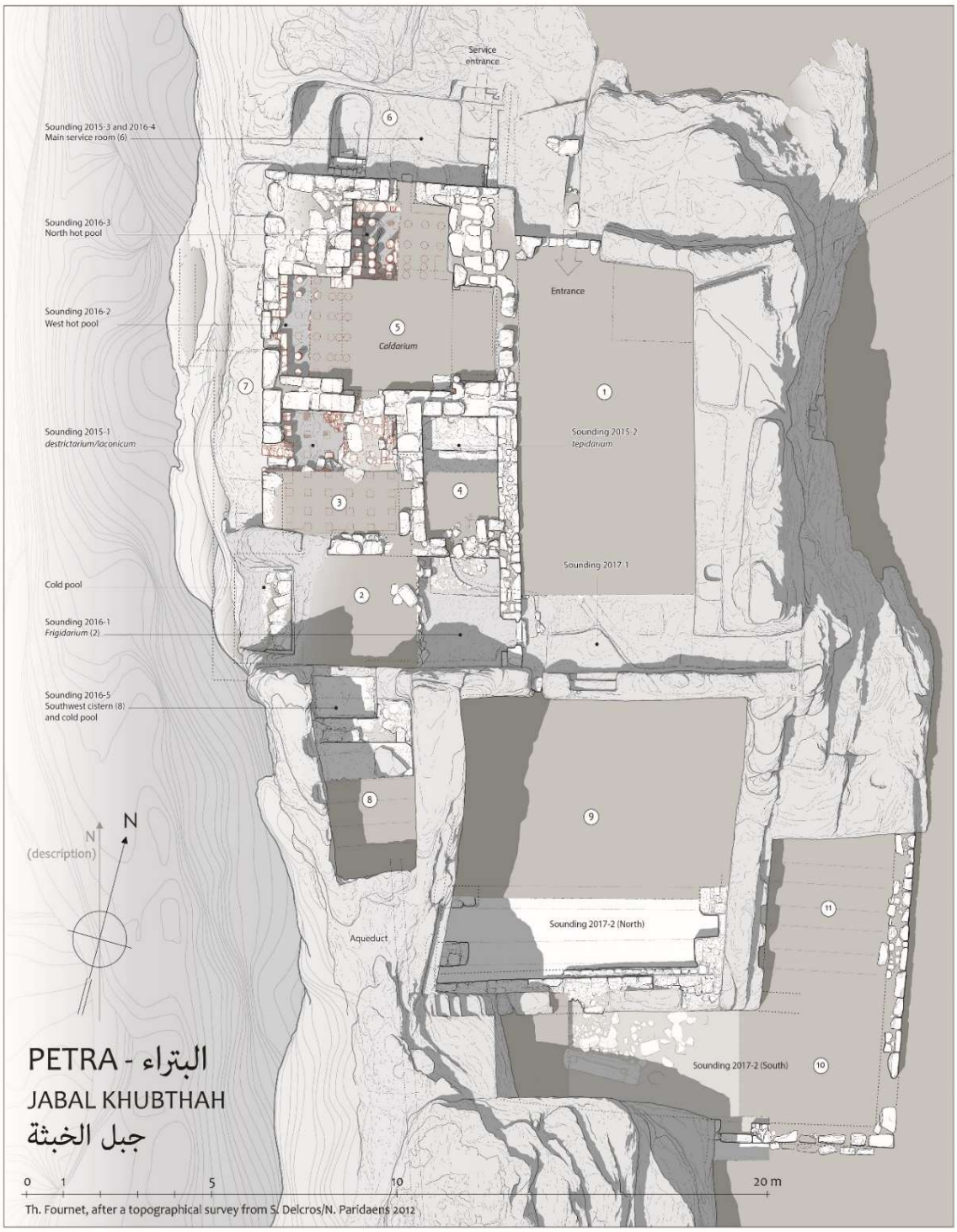

Figure 5. Plan of the Jabal Khubthah bath building after the last excavation season in 2017. Location of the main rooms and of the excavated areas (Th. Fournet 2018, after a topographical survey from S. Delcros/N. Paridaens 2012).

Figure 6. North service room 6 (sounding 2016-4), *praefurnium* of an earlier phase of the building, from the north-east. In the background, the theatre (N. Paridaens).

2016 Season

Beside the discovery of an earlier stage of the building, other clues indicated that the baths underwent several transformations. The second campaign, in 2016, was designed to determine precisely this chronology[10].

The sounding in the north service room was enlarged to the east (sounding 2016-4), and a new sounding was opened to the south (sounding 2016-3), inside the *caldarium*, to provide new information concerning the first stage of the building. Another sounding was opened in the south-west cistern (sounding 2016-5), where a door-like opening in the rock, which looks incompatible with a water reservoir, was puzzling, and perhaps reflects relative chronology.

A third sector (sounding 2016-1), in the south-eastern part of the main building, was opened to get information about the entrance door of the baths. A last narrow sounding (2016-2) was also opened on the western façade of the *caldarium*, mainly to expose the lower part of the wall and to start the conservation works.

This last sounding revealed a well-preserved hypocaust system, heated by a secondary *praefurnium*. It consists of small columns built of circular bricks directly on the rock, and of a rectangular brick lining built along the eastern wall and inside the *praefurnium* opening, to ensure good thermal insulation to the stone walls.

[10] Fournet, Paridaens 2016.

The same system was excavated in the northern sounding on a larger area (fig. 7). The disposition of the small hypocaust columns, with a triple row and a small brick wall, show a reinforcement of the structure on this line, designed to support the parapet wall of a basin in both rectangular recesses of this *caldarium*. The design of the brick lining, interrupted on the small sides of the pools, also confirms the presence of heated walls, made of *tubuli* bricks and connected to a chimney system on the roof.

Figure 7. Hypocaust system of the north pool of the *caldarium* (sounding 2016-3), from the south (N. Paridaens).

The walls and hypocaust of the *caldarium* were built directly on the rock, except in the western part of the northern sounding, where they are built over a strong filling. The excavation of this levelling revealed a depression cut into the rock, corresponding to the oblong depression observed on the other side of the wall, in the service room. The layout of this depression, and the presence of a first abandoned *praefurnium* indicates that a previous heated room had been destroyed by the construction of the new *caldarium*.

Further south, in the *frigidarium*, the sounding inside the water cistern revealed another transformation conducted on the building. The large opening of the cistern towards the *frigidarium*, inexplicable before the excavation and incompatible with our hypothesis, found its explanation by the discovery of a wall cutting off the northern part of the cistern. This wall, lined with hydraulic mortar on both sides,

delimited a small pool, accessible from the *frigidarium*, at the expense of the cistern. The construction of such a pool finds its explanation when we observe the other pool of the *frigidarium*: this basin, cut into the rock and lined with sandstone slabs, preserves, at its bottom, an unexplained layer of stone masonry. It seems clear now that this stone-cut basin, for whatever reason, was destroyed, or fell down the cliff. A new facade wall was constructed on the remaining part of the basin, and the construction of a replacement basin was completed at the expense of the northern third of the cistern.

Chronology

The relative chronology that results from the excavation and the architectural study can be simplified as follows: **Phase A**, a first bath building, visible at various locations, mainly on the northern part; **Phase B**, in which the area underwent a general refurbishment, with the construction of a new bath building over the few relics of the first one. Concerning the first building (Phase A), we can observe an offset in the orientation, of approximately 9 degrees. This orientation allows us to recognize other remains of the first building, in the southern part, and more to the east. The general organization of this original building remains obscure, and we can only suppose that the hot room was located in the north, and that the depression corresponds to the first area furnished with a hypocaust.

The general refurbishment of the building on a completely new plan (Phase B), reusing only a few rock-cut parts, can be explained either by a violent destruction of the original building, or by the wish to replace an old fashioned or too small bath building by a more appropriate one.

This new building itself underwent smaller transformations (grouped into a single-phase C), the most important of which is the replacement of a destroyed cold pool by a new one, built at the expense of the small cistern. Another one is a change of circulation: the door between the *tepidarium* and the *destrictarium* is walled up, and a door is opened between the *destrictarium* and the *frigidarium*.

The question was then to attribute dates to the two main phases of the building, with the support of stratigraphy and dating material. Unfortunately, due to the configuration of the terrain, a slope on the edge of the cliff, the stratigraphic accumulation on the natural bedrock was virtually non-existent, except for a few destruction layers of the last phases along the walls. And, of course, the walls, built on the rock, deprive us of any foundation trench. To summarize, only a few contexts were likely to give us information on the date of the last refurbishment: the filling of the first building depressions, here and there, and small ceramic pieces crushed and preserved in blocks of mortar coming from the floors of the heated rooms, found in the collapsed hypocaust.

The study of those ceramic contexts is still in progress, but a first lecture was delivered by Caroline Durand and François Renel, with quite surprizing results: the reconstruction of the entire building can be dated to the second half of the fourth century AD and will have been abandoned at the end of fourth century or the beginning of the fifth century. The 2018 excavation campaign decisively

demonstrated that this post-363 AD reconstruction is also documented on at least two other buildings on the Jabal.

Architectural reconstruction

The 2015 and 2016 seasons, along with the chronology, give us important results concerning the architecture of the building in its last phase, and allow us to propose a tentative reconstruction of its structure and features[11] (fig. 8). Our open perspective view across the axis of the building allows us to see the heating system of the building (hypocaust and heating walls built of *tubuli*) and the triple row of brick columns under the parapet wall of the hot pool. The main furnace was probably fitted with a boiler or a water heating system, like the *testudo alvei* represented in fig. 8. Restoring the water supply system, and the design of the different pools is not really a problem. As a convenience we have represented both the cold pools in the *frigidarium*, but the left one, to the south, probably replaced the right one, to the east, after the latter's destruction.

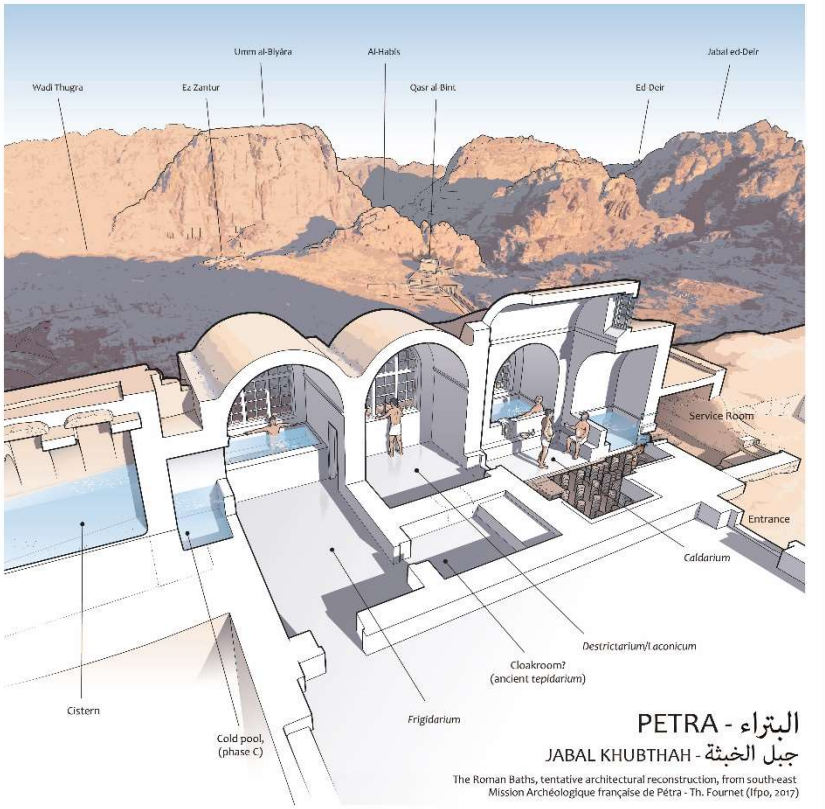

Figure 8. The hanging baths of Jabal Khubthah, tentative architectural reconstruction (open perspective cut off on the axis of the building), from the south-east (Th. Fournet 2017).

[11] Fournet, Paridaens 2017.

Concerning the roofing, several vault key-stones were found during the excavation in all rooms. The presence, on the south side of the *frigidarium*, cut into the rock, of a horizontal ledge, indicates the use of vaults, rather than arches and slabs. Such a vaulted roofing is not unusual in Petra and fairly standard in bath buildings. The *caldarium*, with its canonical cruciform plan, is comparable to many well-preserved examples, for instance the *caldarium* of the Sha'ra bath, a 3rd century bath building in southern Syria, displaying an almost identical plan[12].

The large windows reconstructed on fig. 8 as open on the city center panorama are more hypothetical. The rooms needed natural lighting, and it would be surprising, with this panoramic location, not to take advantage of such a view. There are, however, beside this subjective statement, arguments in favor of such devices. Research conducted by Henri Broise in southern Syria and Italy[13] demonstrated how large glazed windows commonly existed in bath buildings. Some examples even displayed double glazed monumental windows, as attested in Bosra. The reconstructed façade of Khubthah's bath building is directly inspired by that of another bath building in southern Syria, that in Sleim, incredibly well preserved[14]. The inside walls of the semicircular windows preserve the mortises designed to accommodate the wooden parts of the framework bearing glazed panels.

2017 Season & perspectives

After two seasons we reached a good level of understanding of the main wing of the building, the thermal part of the complex itself. The purpose of the October 2017 season was to better understand the annexes preserved east and south of the thermal wing, and to reach more ancient layers, and to attribute a tentative date to the first bath building, completely destroyed and covered by the fourth-century refurbishment[15].

Two soundings were conducted, one in the long space in front of the bath house (Room 1, sounding 2017-1), the other one on the southern façade of the large cistern (Room sounding 2017-2). The first one quickly revealed the bedrock, cut with a drain collecting the wastewater of the bath. The dimension of the room and the absence of intermediate supports indicates a probable open space, a courtyard fitted with a bench, accessible through a main door at the north, and a corridor at the south-west, perhaps a service entrance. Another door, preceded by two steps, open to the south, indicates that the cistern was covered and topped by a terrace or a room, connected to the bath.

The southern sounding (2017-2), on both sides of the cistern façade (fig. 9), revealed rectangular buttresses inside the cistern, that originally supported semicircular arches, spanning more than six meters. The two arches revealed by the excavation are parallel and around 90 cm apart from each other. The excavation of the destruction layers revealed arch key-stones and broken slabs,

[12] Fournet 2005.
[13] Broise 1991.
[14] Fournet 2010.
[15] Fournet, Paridaens 2018.

originally covering the gaps between the arches. This system, well known in Petra, allows us to reconstruct the roofing of the cistern, already indicated by the door leading to an upper floor.

The exposure of the south wall also provided information about the chronology of the cistern. This façade has a first wall cut into the rock and reinforced by thick masonry built with mortar. Surprisingly, this first wall had a large entrance gate, outlined by pilasters. The lintel of this door, 1.40 m wide, was found just in front, where it fell. This discovery indicates that the cistern was built inside a quite monumental room, 7.6 meters wide and long, predating the reconstruction of the bath. The floor of this room was not reached due to the quantity of stones, but an extension of the sounding to the south revealed a door and a threshold built directly on the rock, and giving a good indication of the floor level of the corridor leading to the monumental room. This wall, considering the ceramic sherds connected with the construction layers, belongs to the Late Roman occupation of the area, probably contemporary with the cistern. However, the installation of this wall cut a dark layer of soil containing ceramics from the first century AD.

Figure 9. The 2017 excavation (sounding 2), from the south-east (Th. Fournet).

It is likely that the large room, and its door decorated with pilasters, belongs to the Nabataean occupation of the area. Its position and its opening towards the south encourage us to connect it to the rock-cut *naos*, located a few meters further south. Such a room, if linked with the small shrine, could be a *triclinium*.

Its transformation into a cistern in a fourth century refurbishment of the Khubthah summit plateau is not surprising.

One question remains: could the first phase of the bath (Phase A) be part of the Nabataean religious complex? Stratigraphy brings no evidence but does not preclude it either. Only one sign could indicate a connection: The disposition of the main aqueduct that supplies the baths (fig. 3) seems to be part of the original layout of the *naos*. This is probably not enough, but a look at other bath buildings recently discovered or re-examined may reinforce this hypothesis: four examples of bath buildings, in Sia[16], Khirbat ed-Dharih[17], Wadi Ram[18] and Wadi Sabra[19], are indeed connected with Nabataean sanctuaries, and were built between the end of the first century AD and the mid second century AD. A fourth example, not yet documented, exists north of Petra, on the way to Beida, where a bath building was identified by M. Lindner and E. Gunsam in connection with the "Pond temple"[20].

Another bath building, in Umm al-Biyāra, shares many characteristics with the baths on Jabal Khubthah, especially its location on the very edge of a cliff, overlooking the city center, and was initially built in the second half of the first century[21]. The first phase of the baths near the Great Temple is also dated in the last quarter of the first century[22].

A last example was recently identified in the frame of Laurent Tholbecq's survey of the *stibadia* in Petra[23]. The *stibadium* located on the way to the Deir is indeed associated with a small complex, fitted with bathtubs, *labrum*, and a very typical circular room. This building, described by Gustaf Dalman but not identified as a bath at that time, is connected to the *stibadium*, but also to a small sanctuary.

The link between baths and sanctuaries, and the simultaneity of the bath phenomena in Petra at this period, between the end of the first century AD and the mid second century AD, give us good arguments for the reconstruction of the first occupation of the Jabal Khubthah complex, consisting of a small high-place sanctuary, composed of a *naos*, a large *triclinium* and a possible bath building. The other structures surveyed on this summit plateau, in particular the *motab* and the *stibadium*, are probably part of this first occupation.

Altogether, Petra now counts ten bath buildings, public or private, a good number of them clearly connected with sanctuaries (fig. 10). This renewed corpus allows us to reconsider completely the bathing practices at the end of the Nabataean period. The continuation of this work on the Nabataean Bath will

[16] Butler 1919: 399, fig. 34.
[17] Durand 2015.
[18] Dudley, Reeves 2007.
[19] Fournet, Tholbecq 2015.
[20] Lindner, Gunsam 1995.
[21] Schmid 2012.
[22] Power 2017.
[23] Tholbecq 2018.

probably help to explain why this social practice was suddenly adopted at a late period compared to what occurs in Egypt in Hellenistic times, to allow us to better understand its link with religious practices and how the bath phenomenon gained in importance during the Roman and Late Roman period, with ambitious construction programs until at least the fourth century AD.

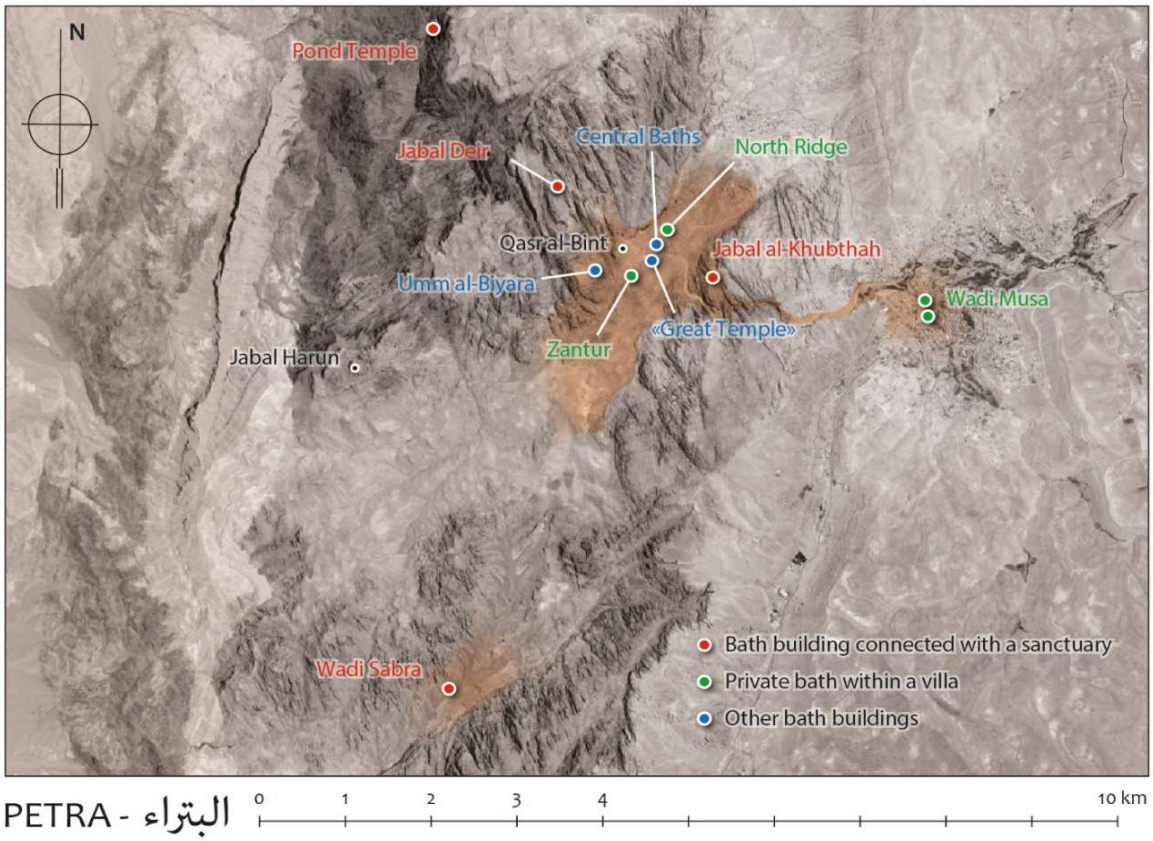

Figure 10. Location map of the bath buildings discovered in and around Petra (Th. Fournet, after GoogleEarth).

Contributors

1) Thibaud Fournet:

An architect and archaeologist (CNRS) currently employed by Ifpo, Amman (Jordan). His main field of research is the architecture and urbanization of the ancient Mediterranean world and, more particularly, the Greco-Roman Near East (Syria, Lebanon, Jordan, Egypt). He has collaborated for many years with French archaeological expeditions in southern Syria and Petra.

2) Nicolas Paridaens:

Nicolas Paridaens is an archaeologist at the Université libre de Bruxelles. He is specialized in Gallo-Roman archaeology and more precisely in sanctuaries and religious practices. He has also participated in many missions in the Near East, in Apamea (Syria) and Petra (Jordan).

حمّامات جبل خبثة المعلّقة (البترا): استنتاجاتٌ أولية بعد الدراسات الأثريّة والمعماريّة (2015–2017)

تيبود فورنيه[1]، نيكولا باريدانس[2]

ملخص

بقيت قمّةُ جبل خبثة غامضةً حتى بداية تنفيذ مسح أثريّ في عام 2012، وقد كان يُنظَرُ إليها بشكل عام على أنها مزارٌ أو مذبحٌ دينيّ. وقد عمل المشروعُ الجديد على مراجعة هذا التفسير، خصوصًا بعد اكتشاف مبنى حمّام مقام في موقع يحبسُ الأنفاسَ على حافّة الجبل الصخريّ تمامًا. وبعد ثلاثة مواسم منَ العمل الأثريّ تمكّنا من فهم أجزاء من تسلسله الزمنيّ ومنَ الوصول إلى إعادة بناء –قابله للتغيير– لتاريخه. ويشتملُ المخطّط الكلاسيكي للحمّام على المناطق الباردة والدافئة والساخنة، معَ حوضين ساخنين. ويمكنُ تأريخ معظم هذه البقايا الأثريّة إلى النصف الثاني منَ القرن الرابع الميلاديّ، وقد هُجِرَت معَ نهاية القرن الرابع أو بداية القرن الخامس الميلاديّ. ومبنى هذا الحمّام مرتبطٌ بمبنى الناوس الصّغير الموجود إلى الجنوب منه. وبالنظر إلى مباني الحمّامات التي أُعيدَ تَفَحُّصِها في البترا وفي محيطها، فإنّ هذا الاكتشافَ الجديد يلقي الضَّوءِ على عمليّة تبنّي ممارسة طريقة الاستحمام الرومانيّة في الحضارة النبطيّة.

الكلمات الدالة: الرومنة، الحمّامات الرومانيّة، العمارة، الممارسات الدينيّة، التقنيّة القديمة.

1 المعهد الفرنسي لأثار الشرق الاوسط ، الاردن. 2 جامعة بروكسل الحرة ، بلجيكا.

تاريخ استلام البحث 2020/9/6م، وتاريخ قبوله للنشر 2020/11/24م.

REFERENCES

Broise, H. 1991 Vitrages et volets des fenêtres thermales à l'époque impériale, in *Les thermes romains, CEFR* 142: 61–78, Rome.

Butler, H.C. 1919 *Syria. Publication of the Princeton University Archaeological Expeditions to Syria in 1904-1905 and 1909. Division II, Architecture: section A, Southern Syria*, Leyde.

Dalman, G. 1908 *Petra und seine Felsheiligtümer*, Leipzig 1912 *Neue Petra-Forschungen und der heilige Felsen von Jerusalem*, Leipzig.

Dudley, D.; Reeves, M.B. 2007 Luxury in the desert: A Nabataean Palatial Residence at Wadi Ramm, Pp 401–407 in *Crossing Jordan. North American Contributions to the Archaeology of Jordan*, Th. E. Levy, P. M. M. Daviau, R. W. Younker & M. Shaer (ed.), London, Oakville.

Durand, C. 2015 Les bains nabatéo-romains de dharih (jordanie), *Syria* 92: 13–21.

Fournet, T. 2005 Les bains romains de Sha'ra, interprétation et hypothèses, *Anales Archéologique Arabes Syriennes* 47-48: 159-78.

2010 Les bains romains de Sleim (*Selæma*), analyse architecturale et proposition de chronologie, Pp 315–34 in *Hauran V. La Syrie du Sud du Néolithique à l'Antiquité Tardive, recherches récentes, vol. 1*, dir. M. al-Maqdissi, F. Braemer, J.-M. Dentzer, BAH 191, Beyrouth.

Fournet, T.; Paridaens N. 2015 Les bains du Jabal Khubthah : la campagne 2015, Pp 43–61, in L. Tholbecq (éd.), *Mission archéologique française "De Pétra au Wādī Ramm : le sud jordanien nabatéen et arabe" : Rapport des campagnes archéologiques 2014 - 2015*, Bruxelles.

2016 Les bains du Jabal Khubthah : rapport de fouille de la campagne 2016, Pp 79–104 in L. Tholbecq (éd.), *Mission archéologique française de Pétra : rapport des campagnes archéologiques 2015-2016*, Bruxelles.

2017 Les bains du Jabal Khubthah : étude architecturale (2016 – 2017), pp 63–68, in L. Tholbecq (éd.), *Mission archéologique française de Pétra : rapport des campagnes archéologiques 2016-2017*, Bruxelles.

2018 Les bains du Jabal Khubthah. La campagne d'octobre 2017, Pp 93–116, in L. Tholbecq (éd.), *Mission archéologique française de Pétra : rapport des campagnes archéologiques 2017-2018*, Bruxelles.

Fournet, T.; Tholbecq, L. 2015 Les bains de Sabrā : un nouvel édifice thermal aux portes de Pétra, *Syria* 92: 33–43.

Lindner, M.; Gunsam, E. 1995 A Newly Described Nabataean Temple Near Petra: The "Pond Temple", *Studies in the History and Archaeology of Jordan* 05: 199–214 (http://publication.doa.gov.jo/Publications/ViewChapterPublic/1201, viewed 28 November 2019).

Power, E. 2017 The Roman-Byzantine Baths next to the Great Temple, Pp 188–202 in *Petra Great Temple Volume 3: Brown University Excavations 1993-2008, Architecture and Material Culture*. Oxbow Press, Philadelphia, PA.

Schmid, S.; Bienkowski, P.; Fiema, Z.; Kolb, B. 2012 The palaces of the Nabataean kings at Petra, Pp 73–98 in *Supplement to the Proceedings of the Seminar for Arabian Studies Volume* 42, ed. L. Nehmé and L. Wadeson.

Tholbecq, L. 2018 Les *stibadia* rupestres de Pétra (Jordanie), *Revue Archéologique* 65: 7–45.

Tholbecq, L.; Delcros S.; Paridaens, N. 2014 The "high-place" of Jabal Khubthah: new insights on a Nabataean-Roman suburb of Petra, *Journal of Roman Archaeology* 27: 374–91.

2015 Les Bains du Jabal Khubthah (Pétra, Jordanie), *Syria* 92: 23–32.

Tholbecq, L.; Fournet, T.; Paridaens, N. ; Delcros, S. ; Durand C. 2016 Sabrah, a satellite hamlet of Petra, *Proceedings of the Seminar for Arabian Studies* 46: 277-303.