THE PETRA GARDEN AND POOL COMPLEX, 2007 AND 2009

Leigh-Ann Bedal, Kathryn L. Gleason and James G. Schryver

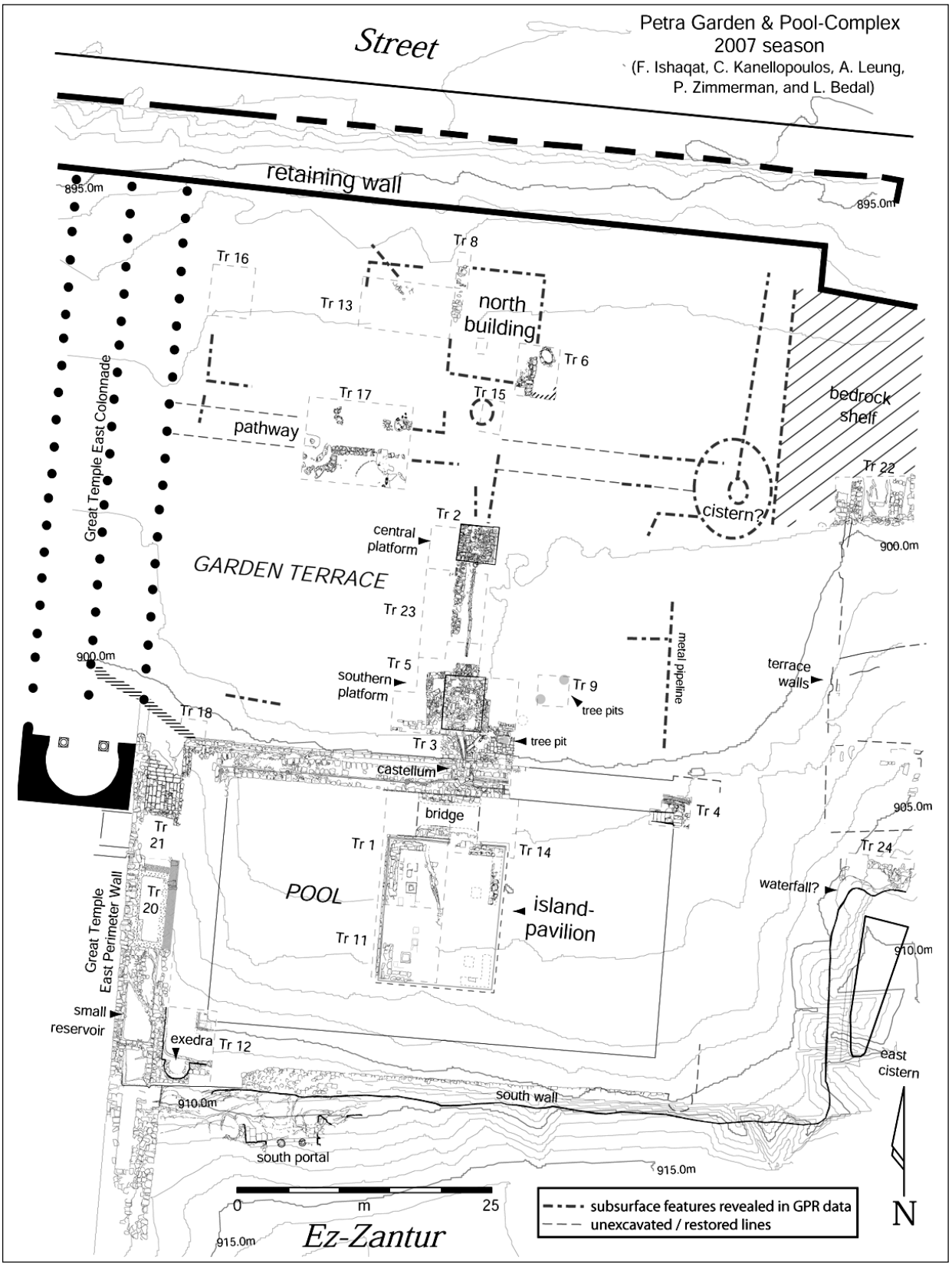
Introduction

A consortium of archaeologists from Penn State Erie / The Behrend College, the University of Minnesota - Morris, the University of British Columbia and Cornell University conducted the 2009 archaeological investigation of the Petra Garden and Pool Complex (PGPC) (**Fig. 1**) over a four-week season during the month of June. The fieldwork was carried out with the support of a number of grants from the same institutions[1]. We would like to thank former Director General of the Department of Antiquities, the late Dr Fawwaz Al-Khraysheh, for his support and granting of the work permit. The project's representative, Samiyah Falahat, was also extremely helpful in making the season run smoothly[2].

The collaborative team is undertaking excavation of the PGPC to explore and develop methods of excavating ancient garden complexes which are often believed to be too ephemeral to be detected after millennia of abandonment. The PGPC is particularly promising for this study as it is well structured with built walks, pavilions and irrigation systems, as well as enclosing architecture and rock cliff faces framing the monumental pool. These features are being successfully explored with the standard excavation techniques and recording systems used at Petra. Furthermore, the work is guided by the results of a particularly finely-gridded ground penetrating radar (GPR) survey, carried out in previous field seasons by Lawrence B. Conyers (Denver University) and reported in earlier publications (Bedal 2002; Conyers *et al.* 2002) . A second dimension to the project is to develop innovative methodologies to explore the cultivated areas of the garden terrace. Designed for the specific conditions of the site, these methods focus on the soils of the terrace, using techniques adapted from environmental archaeology with excavation carried out at a different pace to work on the surrounding architectural features. Kathryn L. Gleason is assisting the co-ordination of this approach, working with the team archaeologists on detecting large organic features, such as pits dug for new plants, evidence for the root systems of plants and the distinctive signatures of stake holes and fence posts. Flower pots (*ollae perforatae*) have been found in the garden soils

1. The 2009 season was funded in part by a University of Minnesota Grant-in-Aid and by other grants from the University of Minnesota, including an Office of International Programs travel grant and the Faculty Research Enhancement Fund. Additional funding was provided by Cornell University's Midas-Croesus Fund and Hirsch Fund for Archaeology, and a Penn State Global Funds award. We are especially grateful for the support of the participants in the University of British Columbia field school.

2. Participants in the 2009 field seasons of the PGPC are as follows: Leigh-Ann Bedal, director (Penn State Erie / The Behrend College), James G. Schryver, assistant director (University of Minnesota, Morris), Kathryn L. Gleason, senior consultant on garden archaeology (Cornell University), Jennifer H. Ramsay, archaeobotanist and field school director (University of British Columbia), Fawwaz Ishaqat, surveyor (Hashemite University), Andrea R. Shelton, ceramicist (North Carolina State University), John E. Foss, soils specialist (Soils Inc.), Catherine M. Kearns, garden archaeologist (Cornell University), Petra Vaiglova, assistant archaeobotanist and archaeologist (University of British Columbia), William A. Caccese, archaeologist, and Miranda L. Angus, registrar. Twelve workmen from the Bedoul tribe were employed, and 15 Canadian and American field-school students offered additional support. Logistical assistance, housing and warm hospitality were provided by the family of Dakhilallah Qoblan of Umm Ṣayḥūn. ACOR graciously provided lodging for the team in Amman.


Petra Garden & Pool-Complex
2007 season
(F. Ishaqat, C. Kanellopoulos, A. Leung, P. Zimmerman, and L. Bedal)
Street
retaining wall
895.0m
895.0m
Tr 8
Tr 16
Tr 13
north building
Tr 6
Tr 17
Tr 15
pathway
Great Temple East Colonnade
bedrock shelf
Tr 22
cistern?
Tr 2
central platform
GARDEN TERRACE
900.0m
Tr 23
900.0m
Tr 5
southern platform
Tr 9
tree pits
metal pipeline
terrace walls
Tr 18
Tr 3
tree pit
castellum
bridge
Tr 4
905.0m
Tr 21
Tr 1
Tr 14
Tr 24
POOL
island-pavilion
waterfall?
Tr 20
Great Temple East Perimeter Wall
Tr 11
910.0m
small reservoir
exedra
Tr 12
east cistern
910.0m
south wall
south portal
915.0m
0
m
25
915.0m
Ez-Zantur
subsurface features revealed in GPR data
unexcavated / restored lines
N

1. Site plan.

and in fills; these aid in both locating plants and in looking at plant trade and distribution, as discussed by Elizabeth Macaulay-Lewis (2006a, b). The team's soil scientist, John E. Foss, provides insights into the deposition of soils on the terrace through both man-made and natural processes. The PGPC garden soils are typically amended with fertilizers and these are being evaluated by Foss and team archaeological botanist, Jennifer H. Ramsay. In addition to identifying the location of plants, the team is tackling the very difficult problem of identifying the garden's plants. A phytolith study conducted by Carlos E. Cordova has shown very promising preliminary results demonstrating the cultivation of date palm trees (*Phoenix dactylifera*) in the Nabataean garden and the presence of Panicoideae grasses which grow only in the summertime in wet areas and therefore suggests frequent irrigation of the gardens during the dry, hot summers[3]. Faunal remains, such as rodents, land snails and other garden inhabitants, are being recovered for study of issues such as degree of cultivation, sunny versus shady areas of the garden and other habitat information. In forthcoming seasons, our goal will be to reconstruct the garden's layout, features and views, as well as revealing something of the character of its vegetation over time. In addition to illuminating this particular watered desert site, these methods contribute to the wider development of the emerging field of international garden archaeology.

Following the results of the previous field seasons (cf. Bedal 1999, 2002, 2004; Bedal *et al*. 2007), work in the PGPC moved forward with the goal of building upon our previous successes. In the pool area, the three-week 2003 field season had been devoted to removing the uppermost meters of heavy overburden across the pool area. In 2004, work in the pool area focused in the south-western corner where it revealed an exedra as well as the pool's south-west corner. Work also revealed more of the island-pavilion. On the garden terrace, the GPR survey and excavations during field seasons between 2001 and 2003 revealed substantial architectural elements, including foundations for a small building (or pavilion) and two platforms, water channels, an east - west gravel pathway, tree pits and associated cultivated soils belonging to the Nabataean period garden (PGPC phase II), as well as fragments of structures of a more domestic nature that predate the construction of the pool and garden terrace. Several of the trenches have been excavated down to bedrock, revealing the gravel and sandy layers of the natural terrace as well as information on the formation of the built terrace structure. These trenches, together with soil cores done by John Foss in 2001 prior to excavation, furthered the broad correlations of soils across the site. In 2005, discovery of flower pot fragments and several pits south of the east - west pathway provided encouraging evidence of plant locations within the garden. By the end of 2005, however, our understanding of the design of the garden and the circumstances of its construction and abandonment required further evidence before interpretation.

2007 and 2009 Field Seasons

The primary objective of the two-week (8-22 July) season in 2007 was to remove the deep overburden that covers the much of the pool area and has hindered excavation progress owing to its great depth and the logistical problems of removing it from the site[4]. The findings of the 2007 field season are reported below under the section titled "The pool complex".

The 2009 season of the PGPC excavations ran for a four week period (30 May - 25 June) with a focus on a number of issues previously raised, while also looking forward and investigating a number of questions aimed at framing future seasons of work. In terms of the latter, the guiding questions relate to the hydraulic systems delivering water from the az-Zanṭūr ridge to the pool, the systems distributing excess water across the garden terrace and the details of the layout of the garden terrace plantings and routes of access. Excavations were carried out in five different areas with the following goals in mind: (1) excavating an area in the south-western cor-

3. Preliminary report by Carlos E. Cordoba (Oklahoma State University) dated February 2011.
4. The project is deeply indebted to the late Dr Fawwaz al-Khraysheh, Director General of the Department of Antiquities, and Sulieman Farajat, Director of the Petra Archaeological Park, for providing a back hoe and dump truck for the duration of the 2007 season. Without this assistance, the tremendous progress in overburden removal could not have been accomplished.

ner of the pool in order to clarify the existence of a late wall or structure only partially defined in 2007, (2) continuing the excavation of a series of rooms along the western edge of the pool terrace that had been uncovered in the 2004 and 2007 campaigns, (3) exploring the existence (or lack thereof) of a hypothetical waterfall on the east escarpment by looking for a catchment basin at its base, (4) investigating the existence of a potential water basin and stone structure in the south-eastern corner of the site and (5) exposing a significant section of an east - west gravel pathway (discovered in 2005) that a GPR survey had indicated bisects the garden terrace in order to better understand its plan and related plantings. Large and small hand tools (hoe, shovel, pick and trowel) were used to excavate the earth which was then removed to the Katute dump site. Care was taken to collect and record material remains which consisted of architectural fragments, pottery sherds, lamps and coins, dating to the Nabataean, Roman, Late Roman - Byzantine, Early Islamic, Crusader and modern periods.

A number of analytical studies were also carried out during the 2009 field season. Soil samples were collected from various loci in all of the trenches for flotation, which was carried out under the direction of Jennifer H. Ramsay. The heavy fractions from the soils were separated out and the collected carbonized botanical remains exported for further study. Soils analyst, John E. Foss, spent a day on the site studying the soil deposits with the goal of understanding better the geological structure of the terrace and to determine the difference between wind-blown deposits, alluvial deposits and cultivated soils. Ceramicist, Andrea Shelton, oversaw the reading of the pottery buckets and initiated a review of ceramic finds from the entire site to contribute to a more precise understanding of the chronological development of the PGPC, as well as the distribution of local and imported ceramics. Fawwaz Ishaqat completed the GPS mapping of all trenches from this season and added this data to the mapping data from previous seasons.

The Pool Complex

Overburden Removal: Pool South and the South Wall

A massive earth removal effort was launched in 2007 in the southern portion of the pool area, between the island-pavilion and south wall (9.2 x 33 m). In this area, the overburden remained up to 4 meters deep above the level of the pool perimeter (previous excavations had worked it down from its original 14 m depth). A deep trench excavated in the south-west corner of the pool area (Trench 12, 2004) showed that the uppermost 2.5 m of the remaining overburden was primarily soft sand, with some large stones from architectural collapse, and showed no stratigraphic changes. Below this was a layer of dense stone collapse debris above a layer of greyish - brown clay and sediment overlying the bedrock of the pool perimeter (elev. 901.4 m). A 2 meter-wide trench (Trench 19) was opened to the south of the island-pavilion, providing an additional section that confirmed a similar makeup further to the east. This trench also exposed the uppermost preserved courses of the island-pavilion's rear (i.e. south) façade. The pavilion's south-east corner is badly damaged but the stones comprising the frame of the south doorway clearly show the triple fasciae that also frames the pavilion's north doorway.

Working from east to west, the sandy fill layer was removed by setting a team of workers to excavate with picks and hoes, followed by the immediate removal of the soil with the help of heavy machinery **(Figs. 2 and 3**). A single course of stones running 6.5 meters east - west near the top of the fill (elev. 903.07 - 903.88 m) was documented and removed. These stones were probably laid down by early *bedouin* as a diversion wall for controlling water runoff. In addition to numerous large stone blocks and other architectural elements (including a complete Nabataean-style capital), material finds consisted of five bronze coins (all illegible except for one Nabataean coin of Aretas IV), several fragments of Nabataean- and Roman-period lamps, and pottery sherds of mixed dates, all of which are presumed to have washed down from az-Zanṭūr. At present, approximately one meter depth of collapse debris and sediment remains covering the pool's southern perimeter.

In removing the overburden during the 2007 season, the nine uppermost courses of the south wall, which is built against the rock face that forms the site's southern border, was exposed along a 33 meter stretch **(Fig. 2).** The south wall face is beautifully preserved up to 4 meters in

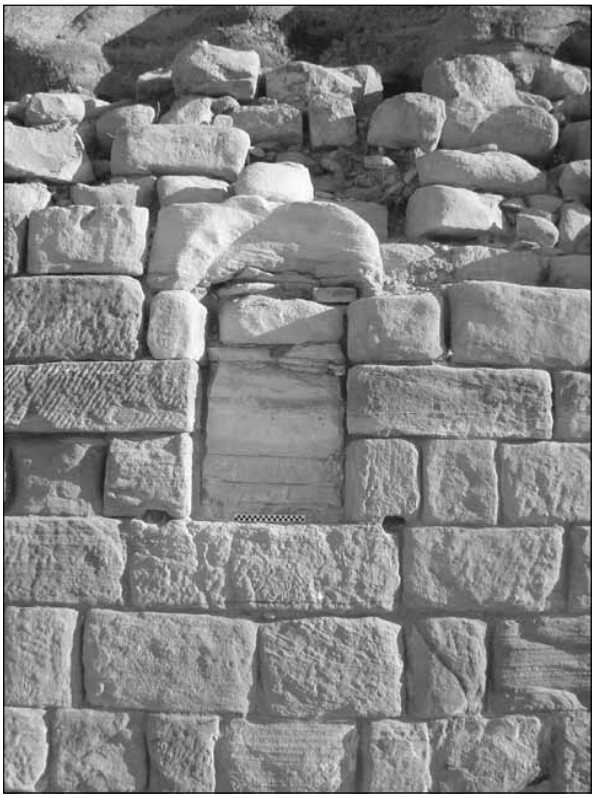
2. Excavating the sandy fill overburden between the island-pavilion (lower right) and south wall.

3. Removal of excavated overburden from the site with a backhoe and dump truck; island-pavilion in foreground.

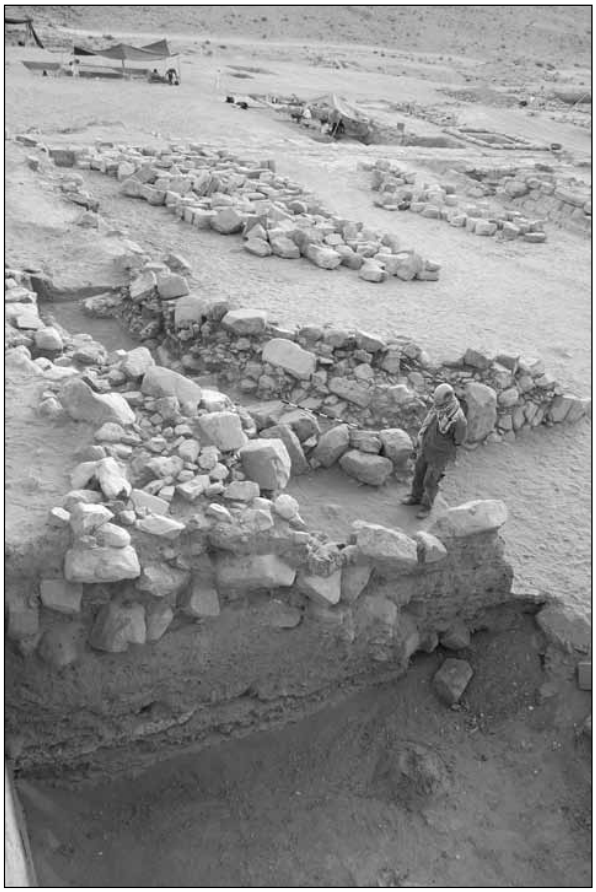
height (the lowest courses remain unexcavated) and creates an imposing backdrop for the pool and garden. If originally covered in white plaster, as we assume, it would have shimmered with the reflections of the light off the water of the pool. At the center of the wall, about 3 meters above the floor level, is a *nefesh* with a simple limestone block set into it and topped by a badly eroded carved arch stone **(Fig. 4)**. Two holes bored into the wall stones near the niche's bottom corners may have been used to hold a shelf, or perhaps a plaque, in position below the niche. The location of this *nefesh*, at the southern terminus of the site's central axis and visible through the island-pavilion's southern doorway, indicates its symbolic importance in the overall design of the garden and pool complex.

Overburden Removal: Pool South-West

The 2009 excavation in pool south-west, supervised by James G. Schryver, consisted of a baulk of overburden composed of alternating



4. Central niche (nefesh) in the south wall façade.



5. Pool south-west: delineation of secondary earthquake collapse (foreground) and the back side of the check dam / diversion wall (center, behind James Schryver).

strata of earth / rubble wash, earthquake collapse and post-Classical walls apparently constructed to retain the accumulated soil and control water runoff from az-Zanṭūr. The defined area (8 x 9 x 4.5 m) is immediately north of Trench 12 (2004) and runs up against the east face of the Great Temple east perimeter wall (GTEP wall). Careful delineation of the stone fall and constructed walls helped to distinguish the strata of rubble debris from two major earthquake collapses and the construction of a late (post-Classical) wall to support the earth - rubble wash that was coming down from az-Zanṭūr and filling the pool area. The wall revealed itself to be built of two faces of large recycled ashlar stones surrounding a core of rubble stones. The southern ashlar face of the upper portion of this wall had collapsed, revealing a packing of smaller stones (**Fig. 5**). Further excavation in this area will be necessary to fully understand just how deep into the fill of the pool this wall extends, thereby determining its date and stratigraphic relationship with the earlier architecture.

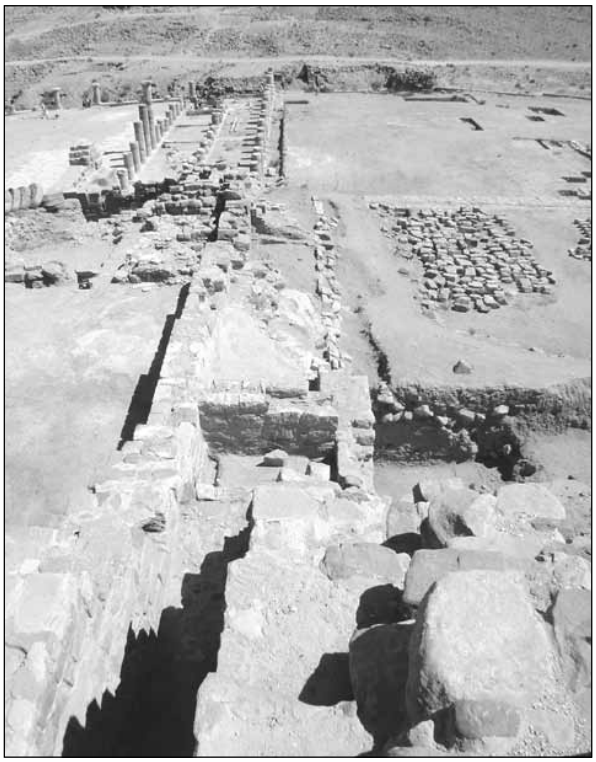
Evidence for this wall serving as a check dam or terrace wall that was a part of a larger system of soil retention across this part of the site came from our soil specialist, John E. Foss, who noted that the fills against the wall were water-lain and that certain surfaces within the fill may have been cultivated. The east - west wall of the check dam was further integrated with a wall running north - south along the western edge of the pool, directly above the pool's west perimeter, apparently to direct and divert water along the western edge of the pool area down to the garden terrace which functioned as an agricultural field in later periods. The construction of this wall may be associated with the collapse of the GTEP wall and the resulting redistribution of soils during the winter floods. The proposed cultivation of these soils seems to have been contemporary with a second collapse, as most of the stones from this collapse seem to have been collected and then thrown up against the base of the northern face of check dam in the form of a convex buttress. A later collapse must

have occurred once the area was no longer being cultivated as those stones were left in place, spread across the ground surface. These activities are all attributed to PGPC Phases V - VIII (Late Roman - Post-Classical / Medieval).

The Great Temple East Perimeter Wall

Another area that required attention during the 2007 and 2009 field seasons was the western boundary of the pool area that adjoins the Great Temple upper temenos (**Fig. 6**). The west face of the GTEP wall was uncovered by the Brown University excavations, along with two of the intermural rooms (Room C and the small reservoir)[5]. However, the continuation of the wall to the north of the small reservoir remained unexcavated.

Trenches 20 and 21 were opened to define the eastern face of the northern extension of the GTEP wall (the southern portion was exposed in 2004, Trench 12) and to begin excavating the intermural spaces. Trench 20 defines a single intermural room immediately to the north of the small reservoir. Work here revealed the upper courses of a baked brick construction that lines the interior walls (dimensions 7.25 x 2.20 m). The walls are single brick width (36 cm) on all sides, with steps measuring a single brick width in the southwest corner (**Fig. 7**). The interior face is lined with a thin coating of plaster. The bricks,



6. The Great Temple east perimeter wall separates the Great Temple upper temenos (left) from the pool complex (right).

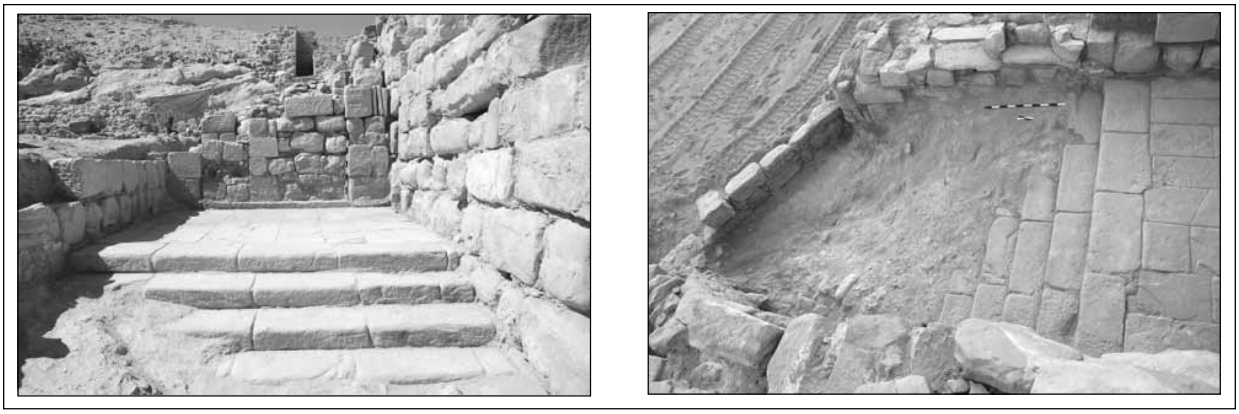
7. Trench 20: the south end of the brick pool (with steps) built inside an intermural space in the Great Temple east perimeter wall.

5. Martha Joukowsky, director of the Brown University Great Temple excavation project, visited the site during our first week in the field and gave us permission to excavate and publish the remaining portion of the Great Temple East Perimeter Wall as it is a shared boundary between the two sites.

which measure 36 x 36 x 6 - 8 cm, are poorly fired with heavy chaff and are cemented with a crumbly grey mortar tempered with small pottery fragments (primarily Nabataean fine ware). Diagnostics include Nabataean painted pottery dating to the second century AD providing a *terminus ante quem* for the construction of this installation in the second quarter of the second century AD. The brick construction is similar to some of the construction in the bath complex west of the Great Temple that has been assigned to the Roman - Byzantine period (Joukowsky 2007: 154-8). It can thus be deduced that the brick feature represents a secondary use of the intermural space within the GTEP Wall dating to the second or third century AD at the earliest. The heavy use of mortar and plaster, in addition to the presence of steps in one corner, suggests its function as a water basin or pool. The center of the basin is badly damaged by a large pit, filled with large stones in a greyish - brown ashy matrix. The trench was closed and sandbagged to protect the poorly preserved bricks pending future study.

Trench 21, located immediately north of Trench 20, measures 3.50 x 11.25 m. Its dimensions are defined by the width of the casemate wall and the length of the space north of Trench 20 to the north face of the pool and the Great Temple east exedra. Excavations began in 2007, defining the line of the east wall and clearing the topsoil and fill and that was heaped up against the west wall. In 2009, excavations continued under the supervision of William A. Caccese and Leigh-Ann Bedal with removal of sandy rubble fill, earthquake collapse and small dividing walls of later date (post-Classical / Medieval) that revealed the remnants of the original Nabataean structure. At the north end, a doorway between the Great Temple's east exedra and the pool leads to a well-preserved staircase constructed of sandstone paving slabs (**Figs. 8a and b**). This staircase provided access from the garden terrace to the pool level. At the top of the stairs is a landing leading to a broad (2 m wide) doorway and a room (foyer) with doors opening to the east - leading to the pool's west promenade - and to the south - leading to the room in Trench 20 described above.

During the Byzantine period, a wall was built up between the Great Temple's east colonnade and the pool wall[6], forming an oblique passageway from the colonnade into the staircase (**Fig. 8b**, far left). It is probably at this time that the doorway between the staircase and the foyer was first narrowed. Subsequent to the construction of the Early Byzantine wall, a greenish - grey clayey deposit, containing a high density of animal bones and pottery sherds, accumulated on the landing, staircase and the floor of the Great Temple's east exedra. Joukowsky notes that this thick grey deposition may be indicative of the use of the closed exedra area as a lime kiln (Joukowsky 2007: 110, Fig. 3.33), however, the nature of the deposit covering only the east half of the top steps and then spreading out across



8a and b. Staircase leading from garden terrace up to the pool-level landing and the door to the foyer (a), which was later narrowed and blocked. A deposit of grey clayey soil covers the lower steps and extends into the Great Temple east exedra.

6. The Byzantine wall was excavated by the Brown University Great Temple excavations in 1998 and was constructed at the same time as other intercolumnar walls and industrial installations on the site (Joukowsky 2007: 100).

the bottom of the stairs (**Fig. 8b**) and the exedra floor, suggests that the material originated from the pool - perhaps an effort to clean rubbish and stagnant water accumulated in the now unmaintained pool - and was thrown (or poured) down to fill the staircase and the exedra. Later the foyer doorway was completely blocked and the staircase landing and foyer spaces partitioned with narrow dividing walls constructed of re-used stones, possibly representing a squatter settlement that likely coincides with the Late Roman - Byzantine squatter settlement (PGPC Phase VI, forth-fifth centuries AD). Above this lies a deep accumulation of collapsed debris consisting of stone rubble and large architectural blocks in a sandy matrix (PGPC Phase VII) (Bedal *et al*. 2007: 166).

With approximately half a meter of fill remaining above floor level, Trench 21 was not completed by the end of the 2009 field season. A study of its full stratigraphy and material contents will commence on its completion in the next field season (planned for 2011) and should provide valuable information about the chronological sequence of construction, re-use, fill and earthquake collapse.

East Stepped Terraces

Along the eastern boundary of the garden - pool complex, excavations were initiated to explore elements of a stepped terrace feature. The terraces, which descend from south to north, are in alignment with the east cistern, located atop the east escarpment overlooking the pool, and a gap in the portico wall facing the Colonnaded Street at the boundary between the 'middle market' and the garden terrace.

Upper Terrace: Cave

Trench 24, under the supervision of Catherine M. Kearns, was opened on the uppermost of the stepped terraces in order to determine if there is a catch basin to collect water falling from the east cistern located directly above, thus testing the hypothesis of the use of a waterfall to channel water from the east cistern down to pool-level. The possible existence of a waterfall at this location was indicated by a number of factors. Firstly, its high elevation (908.731 m, approximately nine meters above the garden terrace) made it visible from many points in the Petra valley and thus would have commanded the attention of passersby. Secondly, for those standing in the pool's island-pavilion, the waterfall would have been along a direct line of sight to the larger waterfall located to the left of the row of the so-called 'Royal Tombs' at the east end of the valley. Finally, the Nabataean preoccupation with water and open display of a feature such as a waterfall would have certainly been in keeping with the theme of conspicuous display that was central to the larger Petra Garden and Pool Complex.

An exploratory sounding measuring 3 x 4 meters was opened at the base of the bedrock escarpment, with all sides confined by rocks and stones (**Fig. 9a**). The fill of this trench was likewise composed of a mix of large boulders and other stones that had fallen down from the east cistern and the bedrock ledge originally supporting its northern end, and wind- and water-born sand that had accumulated over the centu-

9a and b. Trench 24: looking down from the east cistern to the top lip of the cave mouth at center (a). The Nabataean wall runs parallel to the cave mouth. View into the top of the cave / cistern (b).

ries. After removing about a meter of this rubble fill, the top of an alignment of stone ashlars consistent with Nabataean-style masonry was discovered at the northern end of the trench, as were two shallow hearths filled with ash, one of which contained some sherds of coarse cooking ware of the Medieval period. To the south, the top lip of a cave appeared in the vertical face of the bedrock (**Fig. 9b**). This cave may have functioned as a cistern to catch the flow from the waterfall. Another possibility is that the cave functioned as a grotto, a popular feature in Hellenistic - Roman period luxury gardens, used for banquets or revered as sacred or mystical spaces. The possibility of a grotto is compelling. The elevation of this feature provides stimulating views of the pool and garden below and is also within line of sight of important features on the Petra skyline. However, the appearance of the top course of a monumental ashlar wall built east - west across the front of the cave opening reveals that the cave's view was blocked at some point and leads to some doubt of the waterfall hypothesis.

Further excavations in this area were impeded by large stone fall strewn across the area and the small area of the exploratory trench. Due to these logistical limitations and the apparent depth and scope of the cave, the decision was made to close the trench and proceed with excavations in a future season once proper preparations have been made. It is likely that this feature is key to understanding the water management system for the pool and garden terrace and possibly an indicator of social agency at the site.

Lower Terrace: Underground Water Channels

Trench 22, under the supervision of Jennifer H. Ramsay, was strategically placed in order to investigate two of the anomalies that had appeared in the north-west corner of the garden terrace area during the GPR survey conducted in this area in 2001 and refined in 2003 (Bedal *et al*. 2007: fig. 4). Initial interpretations of the radar data indicated that a cistern (appearing in the GPR as a large oval-shaped feature) lay under the ground in this area (Conyers *et al*. 2002a, b). To the east of this feature, the GPR data indicated a large, solid stone feature that defined the terrace's eastern boundary in line with the stepped terraces and was thought to be a well-preserved structure. The trench's southern baulk is defined by a late (post-Classical) field wall that forms the northern boundary of the 'raised field' that occupies the south-eastern quadrant of the garden terrace. Throughout the course of the season it was determined that this wall was indeed late, and that it ran perpendicular to and actually incorporated the northern end of a well-preserved Nabataean wall, constructed of sandstone ashlars, that functions as the west retaining wall for the stepped terraces, It is thought that the ashlar wall discovered in Trench 24 (see above) represents the southern terminus of this retaining wall.

Further excavation to the east of the Nabataean wall in Trench 22 revealed that the 'large stone structure' visible in the GPR data was actually a bedrock shelf that slopes downward from south to north and is cut to form a foundation for the retaining wall and to accommodate an underground water system (**Fig. 10a**). A channel running north - south was cut into the bedrock and covered with capstones of mixed size and shapes supported by arches (**Fig. 11**). The bottom of the channel had not been reached when the trench closed at 1.55 meters depth. Owing to its alignment with the cave / cistern in Trench 24, it is possible that this channel transported water from that water catchment feature down to the Colonnaded Street or the wadi. Two large, cut sandstone blocks were found *in situ* on the bedrock between the channel and the Nabataean wall providing evidence for a pavement (ramp?) or perhaps a staircase constructed over the channel.

Immediately to the west of the Nabatean wall, a second water channel capped with stone slabs (*ca*. 1 meter in length) runs parallel to the exterior (west) face of the Nabataean wall (**Fig. 10b**). A space of several centimeters between the capstones and the top of the soil fill gives a view of approximately two meters northward along the length of the channel interior where it is possible to see the intersection with a third channel that originates from the south-west. The general orientation of this third channel suggests that it may be the outflow from the underground cistern that is indicated by the GPR but eluded us this field season. The channel's capstones are covered by stone packing and a deposit of sandstone chips in a sandy red matrix that represents

10a and b. Trench 22: (a) bedrock with covered east channel (left of Jennifer Ramsay) and in situ paving stones (step?) east of the Nabataean wall (far right); (b) channel with slab capstones west of the Nabataean wall.

the leveling of the garden terrace that is found in other trenches further west. The stone chips are the debris from the quarrying activity that took place in preparation for the construction of the pool complex. Above that is a stratum of yellow sand that is the foundation for the garden soil, also found in other locations in the garden terrace. Segments of ceramic pipe of a form dated to the first century AD ('Amr and al-Momani 2001: fig. 24) were laid out along the west face

11. Trench 22: arch support for capstones on east channel.

of the Nabataean wall but were disturbed by a later pit that dug into the earlier strata. The post-Nabataean periods are represented in this trench by a grey stratum of agricultural soil (PGPC Phase VI, forth-fifth centuries AD) (Bedal *et al*. 2007: 166) found across the lower terrace, topped by a deep layer of rubble fill and the late field boundary that is believed to represent the Medieval / *bedouin* occupation of the site (PGPC Phase VIII-IX) (Bedal *et al*. 2007: 167).

The Garden Terrace

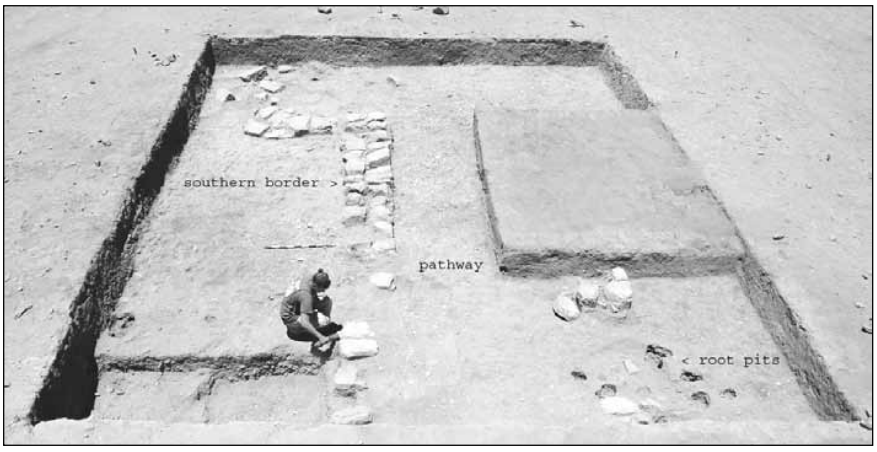
Two trenches were excavated on the garden terrace in 2009. The purpose of these trenches was to seek further information about the garden design and to further investigate some of the sub-surface features visible in the data produced by the ground-penetrating radar (GPR) surveys that were collected in 2001 (Conyers *et al*. 2002; Bedal 2002).

East - West Pathway

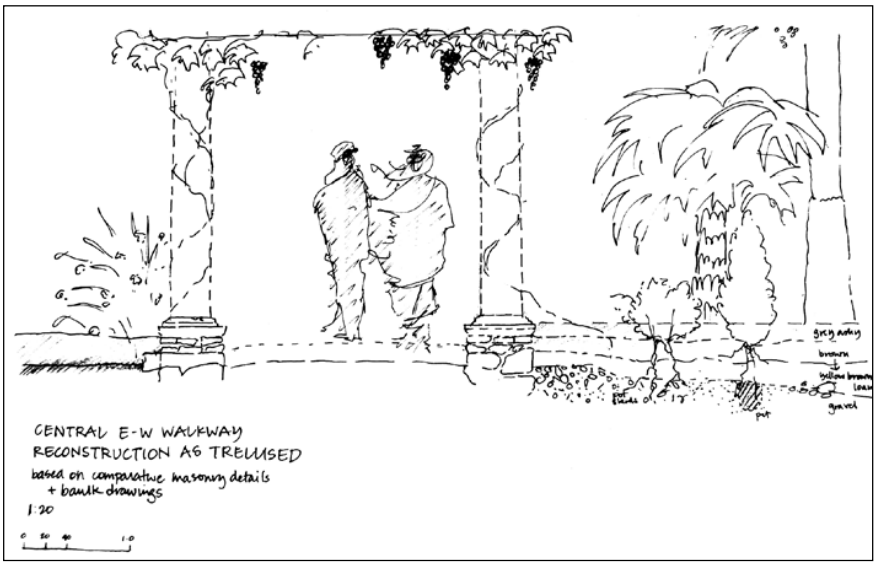
Trench 17, which was first opened in 2005 as a limited sounding (1.5 x 6 m) (Bedal *et al*. 2007: 158), was continued in 2009 under the supervision of Catherine M. Kearns and Kathryn L. Gleason. The goal of the 2005 trench, which was successfully realized, was to confirm the existence of a linear feature, already then thought to be a pathway, which was clearly visible in the 2001 GPR survey. In 2009, the trench was expanded to 8 x 10 m to more fully reveal what had indeed proven to be a gravel stone-lined pathway. Trench 17 revealed that the gravel path, which is two meters wide, was composed of yellow gravels in a sandy matrix retained to the north and south by a rough double course of

stone. The stones of the southern border were traced westward for more than four meters before turning into a semicircular niche on the south side of the path, a feature seen as a break in the line on the GPR plan (**Fig. 12**). The semicircular curve is largely destroyed past the initial arc. The presence of large chunks of grey mortar was unusual in the trench and may suggest that the apse contained a water feature. One mortar fragment has a finished surface on one side and the impression of a stone on the other, suggesting that it lined a pool or basin. The formation of stones on the north side of the path hints at a corresponding space on that side as well, but this feature was not fully excavated in the 2009 season and awaits further investigation. In general, the stones lining the pathway have been robbed out or lost at intervals, which are seen as gaps in the GPR readings. Furthermore, they are too irregular to be the finished edges of the original design. Their width suggests they may be the foundation stones for a more substantial architectural edge, such as might support a line of columns for a trellis or other linear garden architecture (**Fig. 13**). The stones correspond in level and character with the lower course of the central platform (see discussion below).

Another important goal of the excavation of Trench 17 was the recovery of more evidence for garden features such as the planting pits, beds or fragments of flower pots (*ollae perforatae*) associated with the Nabataean surface. This surface is poorly preserved under a deep (*ca* 36 cm) layer of grey agricultural soil that covers the entire terrace and contains evidence for continuous cultivation from the second to forth centuries AD. The brown Nabataean garden surface overlies a stratum of gravel in a yellow sandy



12. Trench 17: looking westward along the east - west pathway; excavated root pits in the lower left corner. Catherine Kearns cleaning.



13. Hypothetical reconstruction of the east - west pathway as a trellised walk (by Kathryn L. Gleason).

matrix that would have provided a solid foundation for the garden, as well as providing additional moisture through condensation.

A meticulous scraping of the surface to the north and south of the pathway revealed several features of interest. At the north edge of the pathway, root cavities appeared as changes in the soil color and these were carefully defined and excavated with small tools. One remarkable grouping was a large pit along the northern border that contained five smaller pits (**Fig. 12**). The large pit initially presented itself as a brown circular area within a break in the stones lining the central walk. It was not initially distinguished from the brown layer above until the last of the upper level was carefully trowelled down. Within it, small areas of soft, moist, brown gravel-free loam became visible and, when this material was excavated down to the level of the gravel, pits ranging in diameter from 10 to 40 cm were clear. Although most contained no pottery, all were sampled for botanical remains, including the collection of separate samples for phytoliths.

Central Axis

Trench 23 was opened in the area along the garden's north - south central axis under the supervision of James G. Schryver in order to explore the relationship between the two stone platforms and the water channeling system associated with these features. Other goals included the search for evidence of plantings and landscape design in this area of the garden and the clarification of chronological phasing. Trench 23 is bordered on the east by the post-Classical field wall that serves as the western boundary for the 'raised field' that dominates the southeastern quadrant of the garden terrace.

In 2005, two sections of a stone conduit were discovered north of the southern platform but disconnected from the platform itself, which has two channels running under it from the south (which originate in the *castellum*) but displays no trace of the emergence of these pipes on the northern side. During the 2009 season, more of the stone conduit was discovered running north - south along the central axis (**Fig. 14**). These stones had not been indicated in the GPR readings and so they provide a good reminder that, even with excellent results, the GPR data may not contain evidence for every feature that is present. The limestone channel was lined with mortar bearing the clear impression of a lead pipe along its preserved length. This suggests that the channel was buried, at least during the time the pipe was functioning. It appears that the channel was not open to the air after the pipe was robbed out, as the mortar impression would have been erased or badly eroded by any water flow or weathering. The northern end of the conduit disappears into the foundation of the central platform. Several stone from the internal packing of the central platform were removed to see if the channel continues through the platform and a small segment of the channel was revealed. However, it remains unclear what direction the channel took once it entered the platform due to a partial dismantling of its interior in antiquity, possibly the result of robbing for lead pipe.

Running parallel to the conduit to the west is a course of roughly dressed sandstones (**Fig. 14**) similar to the pathway border stones in Trench

14. Trench 23: looking south along the central axis toward the pool (background).

17 and probably serving as the western border for a comparable pathway that runs north - south along the central axis, between the pool and the center of the garden terrace. A parallel line of stones revealed in the trench's east baulk, directly underneath the later field wall, likely belongs to this pathway's eastern border. Careful scraping of the yellow - brown soil in a gap in the stone border revealed a patch of darker soil that may be a planting pit. A soil sample was collected and floated for archaeobotanical analysis.

A deeper sounding between the conduit and the east baulk provided information about the garden's subsoil in the northern area of the garden terrace. A deep stratum of yellowish - brown clayey soil overlies wadi gravel. Bedrock was not reached.

Synthesis: The Garden Terrace

The 2009 excavations on the garden terrace shed important new light on the hydraulic system responsible for distributing water throughout the garden terrace, as well as the phasing and details of the construction of the terrace, pavilions, walks and possible water features. Studies in the cultivated areas continued to find evidence of planting, adding to the range of preserved planting features to be anticipated in future work, *viz.* planting pits, multiple and single root cavities, and flower pots. These remains are not preserved as pristinely as in the region of Mount Vesuvius in Italy (cf. Jashemski 1993), but are possible to detect and study nonetheless.

The following discussion interprets the finds from the lowest to the uppermost levels of the site:

Natural Topography and Early Interventions: In consultation with our soil scientist, John E. Foss, we conclude that the southern portions of the garden terrace are composed of alluvial gravels and cobbles that covered the naturally sloping bedrock. At some point, a system of terraces was built into these natural fills. However, before the garden was built in its currently visible form, the soil evidence indicates that a check dam or other retention system was constructed to create a pond on the site of the garden terrace, at least along and to the east of the later central axis. This water feature is clearly indicated by layers of sands and silt loam with a deposition structure characteristic of still water. Such a feature would not naturally occur on a sloping site, thus suggesting the man-made creation of a check dam to capture flood or spring waters. The edges of this water body have yet to be found and there is no masonry floor beneath the deposits to suggest an architecturally built pool such as the one that is preserved in the southern half of the site. This kind of feature has more in common with Hasmonean water management systems and other contemporary eastern forms such as the Indian tank and bund systems than with the better known Roman practices of pools and water channels. These earliest strata have proven difficult to date thus far, with the majority of sherds being too worn to date securely.

To the west of the central axis, layers of well-sorted gravels and cobbles appear to be natural alluvial deposits and only a thin lens of silt has been observed in the south-eastern corner of Trench 17, suggesting a possible limit to the water feature to the east.

Early Garden Phases: the Area Between the Southern and Central Platforms of the Central Axis: The uppermost level of the water deposited strata is a yellow to brownish - yellow silt loam that is the layer into which the first garden cuttings were made and on top of / into which a stone water channel and the foundations for a walkway / pathway were laid. The water channel may originally have carried water in an open channel, but the insertion of the lead pipe indicates that the channel was then covered either by paving or by soil. It is also reasonable to postulate that the stone channel was used from the outset to support the lead pipe across the silty loams. These are stable when dry but unstable when saturated, and this may explain the eventual abandonment of the pipe.

The southern platform was evidently built at the time of the pipes, as its foundation also cuts into the silty loams and features two openings for a water channel visible on its south face. However, neither channel exits in / on the platform on the northern side because a later extension of the platform blocks the channel. The extension thus post-dates the removal of the lead pipe and the termination of this part of the irrigation system.

The garden's central platform does not ac-

commodate the channel at all. The southern end of the central platform is built flush with the top of the water channel with no accommodation for the diameter of the pipe, so while the channel appears to run under it, the entire platform may post-date the robbed channel.

Early Garden Features: East - West Pathway: The exposed area of the east - west pathway was not excavated deep enough to encounter the layered silty loams, so it is difficult to link it to the phasing of the water channel, although it is assumed to post-date the early pond feature. The walk can be phased with the central garden features by the other features and their stratigraphic relationships.

The pathway is well-built of gravel with a compacted surface. It appears likely that the stone edging currently seen along the walk originally was the rough foundation for courses of finer masonry, such as might have supported a colonnade for a trellis or other cover, or simply for a fine wall separating the walks from the beds. A similar wall in the Hasmonean palace complex at Jericho began with a colonnade, which was later filled with stones for a raised bed along the path. To either side, planting features are seen in the gravels and in a mixed gravel / loam with evidence of fertilizer. Remains of a darker brown soil may also have been associated with these planting features. It abuts the stones and only in one area of Trench 22 does it cover them, though incompletely.

One of the exciting finds of recent field seasons is the presence of pits in a range of sizes, from the large diameter pits found in Trench 9, and the smaller pit found in Trench 17 with flower pot sherds within it, to very small dark linear cavities running both vertically and horizontally within the soil, noted easily within the yellow loams and gravels. These cavities and other soil stains and features were excavated extensively in 2009. One remarkable grouping is a large pit in Trench 17, which contained the five smaller pits described above. The area of yellow gravel marking the pathway in the middle of the western third of the trench was left relatively unexplored, but a band of gravel is visible imitating the apsidal curve of the stone feature as well as skirting a large circular pit, suggesting that the gravel of the pathway continued into the apsidal area and might have circumnavigated a tree pit in the center of the pathway.

Some time before the deposition of the grey agricultural layer, any upper layers of stonework were removed, leaving the uneven sub-courses exposed. Gaps contain pits of brown loam, some with small pits, as at the east end of Trench 17, where a mature multi-stemmed shrub or tree seems to have nestled into the stones. The pit and the stones were buried by the grey ashy layer over time.

The Later Evolution of the Garden: We have the strong impression that the garden was cultivated over a long period of time, even after its finer masonry and decorative appointments had weathered away or been removed for re-use elsewhere. For example, the edging of the central walk was robbed of the fine stone courses over time, but there is no evidence of the kind of rubble and debris that comes with the systematic robbing of an abandoned place. The areas of cultivated soil remain without significant debris on the surface. The finer stones were removed yet the pathway and garden continued to function with the garden soils left to either side of the pathway. This is further reflected in the dating of pottery and coins within the garden soils. In many parts of Trench 17, the lower levels of the cultivated garden soil had early dates, while late coinage and pottery was consistently seen in the upper levels. This would be characteristic of stable, mature garden soils with shrubs and trees that would not have been plowed or even hoed deeply owing to their root systems. However, in some areas of other trenches, datable material was mixed throughout. This could indicate deeper hoeing. The introduction of new plants also affords the possibility that later materials were introduced to lower levels of unplowed or hoed soils, either by the act of planting the new tree or shrub, or as artifacts within the soil packed around the roots of the new plant from the nursery (if the plant was not planted bare root). The presence of stratigraphic deposition of datable artifacts suggests that the soil was not turned over deeply. This is consistent with the picture of a mature garden that has emerged from other evidence; one does not tend to deeply hoe soils containing the established root systems of trees and shrubs the way one might a

flower bed. In sum, we need to further chart the stratigraphy of datable pottery and coins to fully assess the age of the garden.

Finally, it appears that soot or other burnt material was introduced to garden soils across the entire terrace, building up the earlier beds and eventually covering the central walk and all but the upper courses of the central platforms. Here again, one has the impression of a steady practice of amendment and gradual change over time. However, it is possible that a single act of bringing in the dark soils could have been carried out to freshen up the grove or to re-use the older garden as a field. This layer then remained stable for the remainder of the site's history. John Foss characterizes this grey level as a buried 'A' surface. Its structure suggests that it is a very old surface, built up over hundreds of years, as it has developed the beginnings of a 'B' horizon below it. Pottery from all cultivated soil layers was unusually encrusted with mineral deposits, indicating that the soil was irrigated through its history.

In sum, by the Early Byzantine period, the garden terrace was either a large shady grove where visitors walked freely among the trees, since the 30 cm of ashy deposit would not be enough to harm mature trees or shrubs. Or the garden was eventually turned over to cultivation as a vineyard or field with the central platforms still exposed. The surface of this ashy level was cultivated by the local Bedoul *bedouin* as a wheat field in the 20th century and no signs of beaten paths or other features to indicate that these uniform layers of dark sooty soils were divided up for planting beds or other uses.

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