

THE 2009 ‘AYN GHARANDAL SURVEY AND PRESERVATION PROJECT

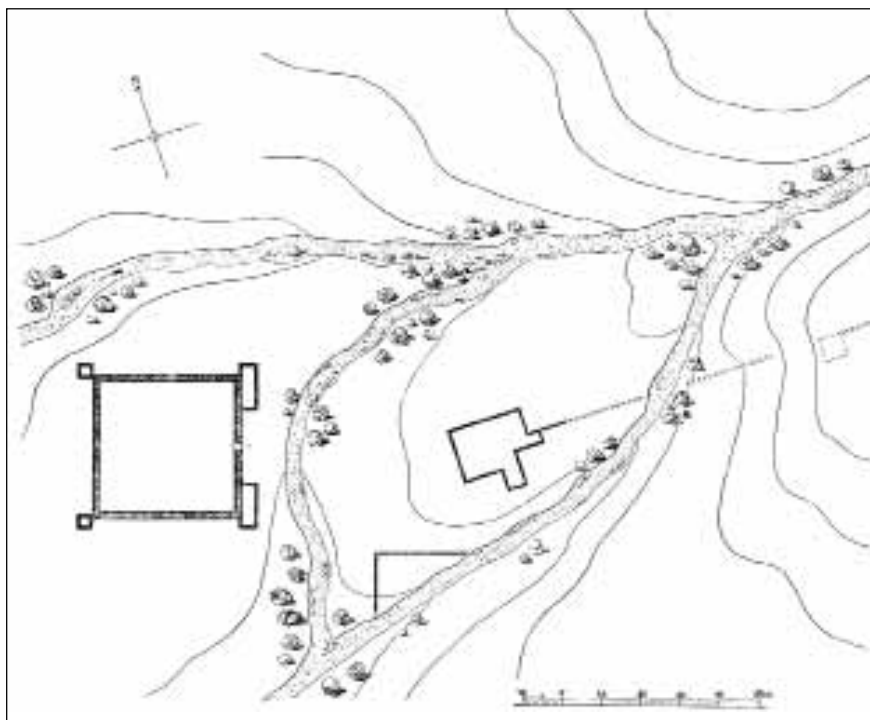
Robert Darby, Erin Darby, and Andi Shelton

Introduction

The 2009 season marked the initial investigation of ‘Ayn Gharandal by the ‘Ayn Gharandal Archaeological Project.¹ The site lies ca. 100km N of the Gulf of ‘Aqaba, ca. 40km SW of Petra, and ca. 200.0m W of the mouth of Wādī Gharandal on the eastern edge of the Wādī ‘Arabah. The ruins rest alongside the modern paved road running E from the nearby Dead Sea highway. The presence of an artesian spring in

the mouth of the wadi presumably served as the reason for human occupation at the site.

‘Ayn Gharandal and its surroundings were visited by many of the early twentieth century explorers to the region (Frank 1934: 231-32; Glueck 1935: 39-40). Alois Musil was the first to record the ruins of a Roman *castellum* at ‘Ayn Gharandal in 1902 (Musil 1907: 193-97; **Fig. 1**). Musil’s description of the site also includes at least two additional structures near the fort, as



1. Musil’s plan of ‘Ayn Gharandal (Musil 1907: 196, fig. 142).

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Antiquities of Jordan, Dr. Barbara Porter, Director of ACOR, Dr. Chris Tuttle, Associate Director of ACOR, and Dr. Bethany Walker for their continual support and assistance. We would also like to thank Dr. Sawsan Alfakhry, Director of Aqaba Antiquities, and Khalil Hamdan, Aktham Oweidi, and Rula Qussous of the Jordanian Department of Antiquities in Amman for all their help with the project.

well as miscellaneous walls, towers, and a basin in the vicinity of the spring. Many of these structures do not appear in his drawing. Unfortunately, Musil's plan of 'Ayn Gharandal remains the only recording of the site's ruins. T.E. Lawrence also passed through 'Ayn Gharandal in 1914 as part of the Palestine (Wilderness of Zin) Survey. Lawrence notes the presence of two structures at the site and references Musil's work (Woolley and Lawrence 1915: 14-15).

'Ayn Gharandal has received moderate attention from archaeologists in recent years (Raikes 1985: 101; King *et al.* 1989: 207; Smith *et al.* 1997: 59-60; Henry *et al.* 2001: 1-19; Gibson 2007). The site, however, has not been the primary focus of their work. Rather, it has been included as part of larger regional surveys. Pottery collected from the surface in these surveys (King *et al.* 1989: 212-13; Smith *et al.* 1997: 59-60) suggests the site was occupied from the Nabataean through Roman/Byzantine periods. While these recent projects have produced important results for the site's regional context, little new information has emerged about the site and its structures.

It has long been believed that the name Gharandal is derived from *Arieldela* listed in the *Notitia Dignitatum* (Or. 34.44) as the location of the *Cohors II Galatarum* (Musil 1907: 195, n. 20). The name also appears in the Beer Sheva Edicts as *Ariddela* (frag.V, line 5). Alternately, Walmsley has argued that Gharandal in the southern Ghor is a more likely candidate for *Ariddela* (Walmsley 1998: 433-41). A total lack of any evidence from 'Ayn Gharandal confirming its identification leaves the ancient name of the place and the unit garrisoned there a matter of scholarly speculation. Moreover, the occupational history of the site during the pre-Roman and post-Byzantine periods remains unclear.

Overview of Goals and Procedure for the 2009 Season

The goals of the 2009 'Ayn Gharandal Survey and Preservation Project were as follows:

- Record all visible architectural remains, produce a preliminary state plan, and generate 3-D models of the site;
- Collect and record all material culture from the surface;
- Establish a permanent and expandable (200

m²) site grid for future excavation;

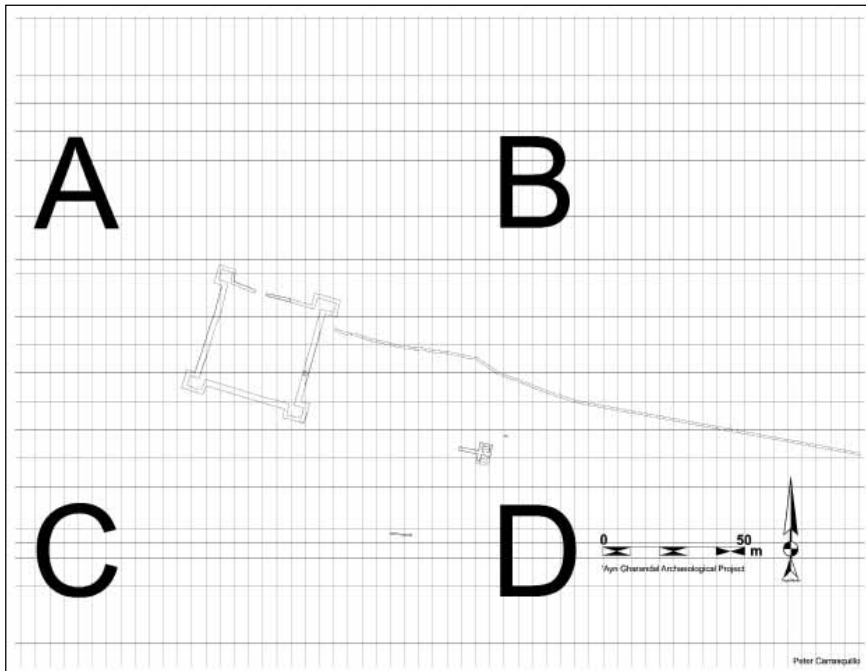
- Preserve the threatened remains already exposed by illicit digging.

A new plan of the site was generated in the 2009 season that includes a bathhouse, a fort, an aqueduct system, and one possible domestic structure. The remains were surveyed and programmed into AutoCad by James Bucko (independent researcher); and subsequent plans and 3-D models were generated from this data by Peter Carasquillo (North Carolina State University).

Additionally, all surface materials found in and around the main structures were collected for analysis. The fort and the possible domestic structure were surveyed by area, while the bathhouse was divided into 5.0m x 5.0m squares. The resulting materials were given to the excavators under permanent loan from the Jordanian Department of Antiquities and were shipped to North Carolina where they were analyzed by Andi Shelton (independent researcher).

A 200.00m² site grid was established, with a temporary bench mark (TBM) located along the E wall of the fort. The entire site was divided into 5.0m x 5.0 m squares, with the TBM at the center, thus creating four quadrants. The N grid line was oriented on geographic or true north rather than magnetic north. The NW quadrant is entitled quadrant A, the NE is quadrant B, the SE is quadrant C, and the SW is quadrant D. Within each quadrant the squares are numbered according to row and then by column. Square names include the quadrant, the row, and the column, as in Quadrant D, Row 2, Column 1, or D:2/1. The grid can be expanded in any direction from the center point, providing flexibility for subsequent excavation and survey seasons. Areas are named after the main structures and include the squares in which those structures are found as well as the squares in the structures' general vicinity (**Fig. 2**).

Finally, photographs taken and sent to the DoA in 2007 (Gibson 2007) and subsequent visits to the site by the authors revealed that two rooms of a Roman bathhouse had been looted. Sand presumably from inside the structure was piled around the rooms and contained many visible bricks and *tubuli* (**Fig. 3**). The looting also exposed at least four walls of one room in the bathhouse. Every wall was covered with plas-



2. Site plan with grid quadrants.



3. Bathhouse with mound of looters' debris.

ter and at least two contained springers and voussoirs for a barrel vault (**Fig. 4**). In order to protect the standing architecture and the *in situ* plaster, the entire structure was backfilled.

AREA DESCRIPTIONS

I. Bathhouse

Located in D:5/13, D:6/11, D:6/12, D:6/13, D:6/14, D:7/12, D:7/13, and D:7/14.

Architectural Remains

In the two looted rooms of the bathhouse the

interior faces of several walls were visible (**Fig. 5**). These include some portion of the N, S, E, and W walls from the Northern Room and the N and W walls of the Southern Room. After concluding the surface survey of material around the bathhouse, the very tops of the visible walls were cleaned in order to ascertain the external faces of these walls. Several of the walls still exhibited remains of concrete for the vaulting of the structure, including the central wall between the Northern and Southern rooms, the W walls of both rooms, and the E wall of the Northern



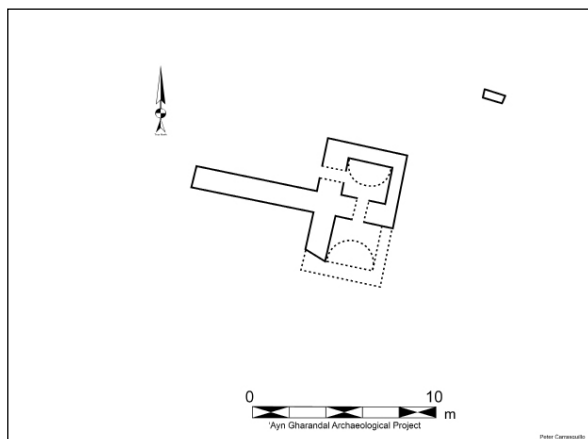
4. Overview of the Northern room of the bathhouse.



5. Overview of the bathhouse.

Room. Although much of the structure remained buried in the surrounding dunes, it was possible to create a plan of the two exposed rooms (**Fig. 6**).

The Southern Room was badly disturbed. The only well-preserved wall was the N wall, shared with the S wall of the Northern Room. The face of this N wall contained thick plaster, and three courses of roughly cut stones were



6. Plan of the bathhouse.

visible. The W wall also contained plaster but was poorly preserved and still largely buried. Although only one course of the W wall was visible, at least one voussoir was identified, proving that the Southern Room was barrel vaulted. Finally, the E wall of the Southern Room was almost entirely robbed out; and the S wall was totally absent (**Fig. 7**).

In the Northern Room the walls were better preserved, though they varied in quality. The N and S walls of the room were constructed of undressed stones and chink stones, and both walls were missing any outer finished layer of plaster. The S wall, which was shared with the N wall of the Southern Room, contained concrete and rubble, extending half way across the wall on its eastern side. At the time of the survey, only two courses of stones were visible in the sand, though earlier photographs taken in February, 2009 show a doorway leading to the Southern Room (**Fig. 8**).



7. The Southern room of the bathhouse.



8. Doorway in S wall of Northern room of the bathhouse (photo courtesy of Niemi, T. and Rucker, J.).

The W wall of the Northern Room was barely visible, but a row of springers was identified just above the surface. The SW corner of this wall remained intact, but the NW corner was disturbed and partially collapsed. Earlier photographs show a doorway in the W wall, currently covered with wind-blown sand (Gibson 2007).

Finally, the E wall was the best preserved with at least two stone courses visible. Its plaster was in fine condition with many layers, including a finished outer veneer. Two voussoirs on the S end of the wall exhibited diagonal tooling marks and preserved the remains of bonding cement (Fig. 9). In the NE corner another voussoir was placed vertically (rather than horizontally). The plaster and overarching voussoir in the NE corner impeded an exact measurement for this interior corner of the room.

In the process of cleaning the looters' deposit, an undisturbed wall was discovered running E-W from the central wall between the two rooms. The evidence for this wall includes its SE corner with the Southern Room as well as stones to the W of the bathhouse following the central wall's orientation. The corner with the Southern Room preserved at least one layer of plaster. If this E-W wall represents another room/courtyard, it probably lies adjacent to the Northern Room, as suggested by the previous photographs recording a doorway in the W wall of the Northern Room.

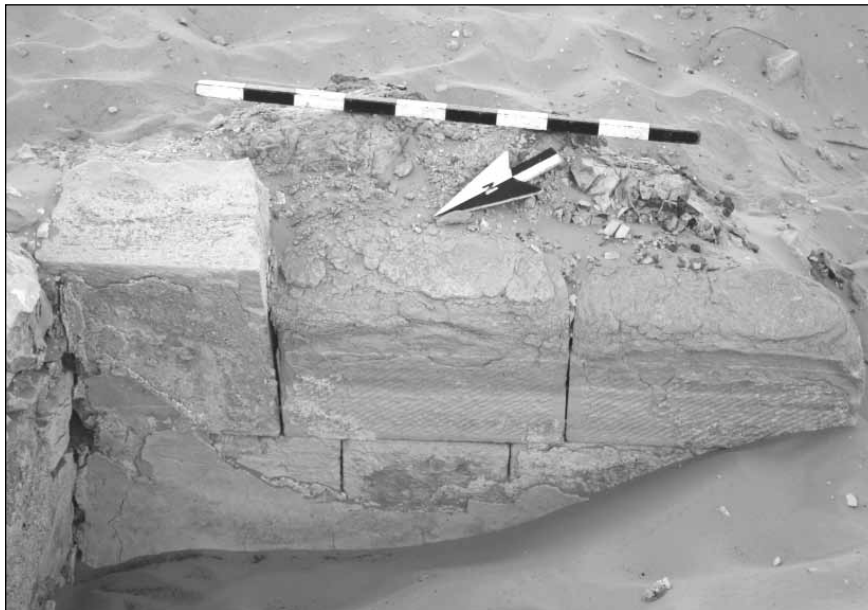
Object Distribution

Because the bathhouse was looted, the surface around the visible walls was divided into 5.0m x 5.0m squares in an attempt to reconstruct the looters' activities as well as the relationship between the looters' debris and the actual deposition of objects in the bathhouse prior to disturbance. As expected, different squares produced different distribution patterns (Figs. 10, 11).

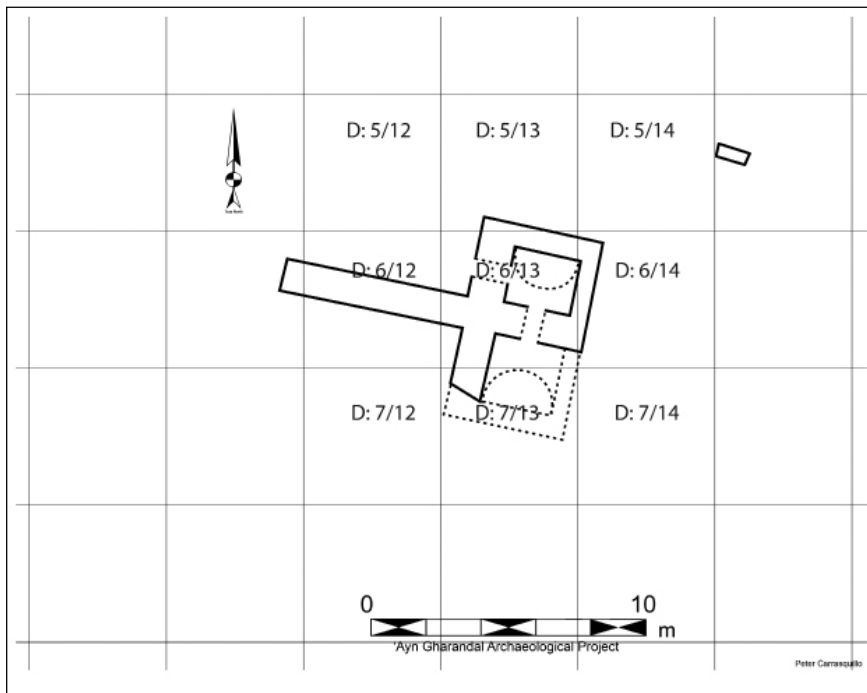
The largest number of hypocaust bricks came from Square D:5/14, directly to the NE of the Northern Room of the bathhouse. While bricks were found in other areas, it was very clear that the looters pushed most of the debris from the bath into the area N of this room. Further, the three largest concentrations of *tubuli* were found in squares adjacent to the N and E walls of the Northern Room (D:5/13, D:5/14, and D:6/14). This suggests the *tubuli* were intact in the walls prior to their disturbance by the modern looters, a hypothesis that is further supported by the number of tube fragments with plaster and concrete adhering to the surface.

In general, the finds associated with the bathhouse were significantly more modest on the W side (D:5/12, D:6/12, D:7/12), which may indicate the W side of the structure was not disturbed by looting. This supposition is further supported by the layers of hardpacked earth underlying the thin layer of loose sand created by the looters.

Additionally, only a few objects were found



9. Detail of in situ voussoirs in the E wall of the Northern room of the bathhouse.



10. Area of the bathhouse with associated grid squares.

Square	Potsherd	Tubuli	Brick/Tile	Other
D:5/14	9	89	172	
D:6/14	3	117	48	
D:7/14	1	2	0	
D:5/13	0	124	15	
D:6/13	2	30	17	Painted plaster fragment
D:7/13	0	24	6	
D:5/12	14	1	3	
D:6/12	8	10	0	
D:7/12	0	0	0	
TOTAL	37	397	261	1

*Table data reflects objects counted in the field before ceramic analysis.

11. Bathhouse object distribution table.

in the southern row of squares (D:7/12, D:7/13, D:7/14). One explanation is that the Southern Room was disturbed prior to the recent looting by seasonal flooding from the wadi. Moreover, both N-S walls of the Southern Room (which is located primarily to the north of D:7/13) were disturbed, particularly on the eastern side.

The small number of pottery finds coming from this 15.0 m x 15.0 m area must be compared with the large number of sherds from the fort area and 62 sherds in the 15.0 x 10.0 m area of the possible domestic structure. This deposition may indicate that only minimal pottery originally remained on the floors of either exposed room. If pottery had been present, it would have consti-

tuted complete vessels of interest to the looters; however, the general lack of potsherds suggests that little was preserved.

Finally, the large number of burnt hypocaust bricks, floor tiles, and *tubuli* fragments indicate that the Northern Room or both rooms were related to the heating system of the bath—either the *caldarium* or *tepidarium*. Furthermore, in all four corners of the Northern Room small amounts of ash were visible due to chimney flues from this heating system. The bricks and floor tiles also prove that the looters disturbed the Northern Room to considerable depth, ripping through the floor and pulling up the sub-floor material.

II. Fort

Located in A:1/8, A:2/8, A:2/7, A:3/7, A:4/7, A:5/7, A:5/6, A:6/6, A:7/6 A:7/5, A:6/5, A:6/4, A:6/3, A:6/2, A:6/1, A:5/1, B:5/1, B:5/2, B:4/2, B:4/1, B:3/2, B:3/1, B:2/1, B:1/1, D:1/1, D:2/1, D:3/1, C:4/1, C:3/1, C:2/1, C:1/1, C:3/2, C:3/3, C:2/3, C:2/4, C:2/5, C:2/6, C:1/6, C:1/7, and C:1/8.

Architectural Remains

Only small segments of the fort walls were visible, though certain key sections of walls were identified, including two corner towers (NW and SE). Because the ruins of the fort lie buried in deep sand, it was not possible to take exact measurements for the fort walls. Based on the mounded sand and the few visible wall segments, the fort measured ca. 38.0 m x 38.0 m, which is consistent with Kennedy's 2004 assessment of the site (Kennedy 2004: 210).

Evidence for the fort's corner towers includes built construction visible in the SE and NW corners, as well as mounded debris on all four corners of the fort. Musil's odd reconstruction of the fort, with two rectangular towers on the NE and SE, appears to be entirely conjectural. Rather, the remains of the SE tower walls indicate the presence of a square tower; and the debris in the NE corner of the fort does not show any irregularity. The plan of the fort appears to follow the standard Late Roman *quadriburgium* design

with four square projecting corner towers (Fig. 12). Lastly, a possible gate was recorded along the N wall of the fort (Fig. 13). Musil locates the gate on the E, which cannot be substantiated.

Object Distribution

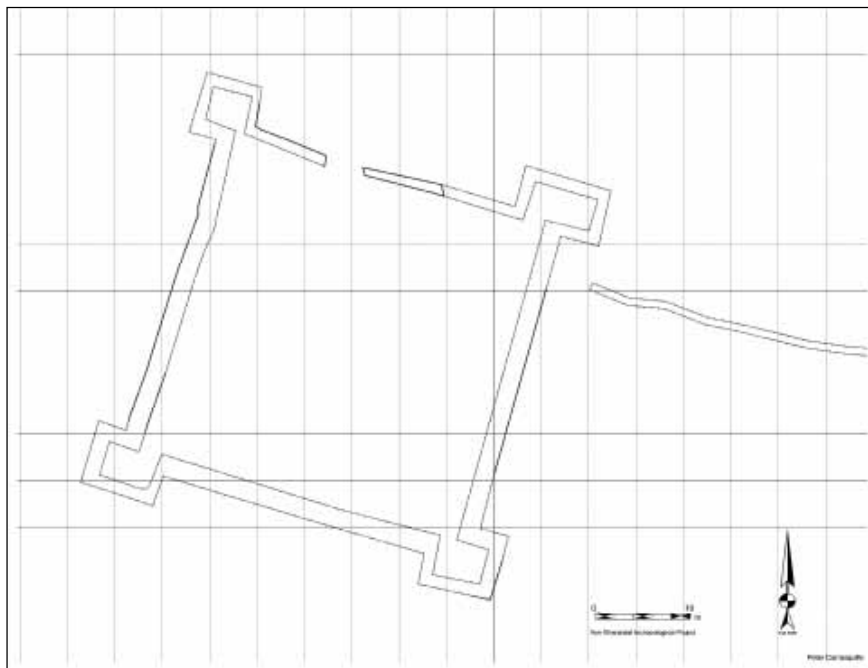
The sherds collected from the fort represent many different vessel types, sizes, and fabrics. The surveyed area was dictated by the visible mounds around the fort walls and corner towers and totaled approximately 40.0 m x 40.0 m. Most of the pottery was found on the tops of the walls and the sloping debris outside the walls, while relatively few sherds were found in the sloping sand and debris inside the walls, with little to none in the center of the fort. The paucity of finds in the center may be due to deep sand accumulation.

III. Possible Domestic Structure

Located in D:12/6, D:12/7, and D:12/8.

Architectural Remains

One wall of a structure was detected S of the modern road. This wall line may be part of a domestic structure. Although the visible wall sits at the same elevation as the modern road, the depth of the bedrock indicates much of the structure may still be extant. Of further interest, this structure does not appear to follow the same



12. Plan of the castellum.

directional orientation as the fort or bathhouse but lies on a different axis.

The E-W wall measures 7.54 m in length and ca. 0.67 m in width (**Fig. 14**). This wall line is comprised of fairly rough or uncut rocks and stones. According to Musil's plan, this is the E-W wall of a large structure SE of the fort.

Object Distribution

More pottery was recovered in this small flat area than in the entire area of the bathhouse, despite the bath's larger size and deeper soil deposition, full of recently looted remains. The pottery collected reflects a broad range of shapes, sizes, and fabrics, including fragments of at least one oil lamp.

IV. Aqueduct

Architectural Remains

A line of mounds running E from the fort to Wādi Gharandal was recorded (**Fig. 15**). Musil's plan shows a conjectural line of stones extending from the wadi to a large structure, now identified as the bathhouse. He erroneously believed this to be a defensive wall guarding the spring (Musil 1907: 196). This feature bears the markings of an elevated aqueduct system, based upon the regular spacing between piers and its apparent origin at the source of the spring. The total length of the aqueduct is ca. 190.3 m, and it is ca. 0.78 m wide. The aqueduct line is broken in one place, and in another area a separate structure appears to adjoin the aqueduct to its S.



13. Possible gate in the N wall of the castellum facing south.



14. Wall of possible domestic structure.



15. Line of the aqueduct running E towards Wādī Gharandal.

It is possible that the adjacent structure that was observed is part of the bathhouse, but that is unclear at present. Moreover, Musil did not show the “defensive wall,” i.e. the aqueduct, continuing past the bathhouse into the NE end of the fort, which is now clear in the new plan. No pottery was collected from this area.

Ceramic Analysis

During the 2009 'Ayn Gharandal survey season 1,344 ceramic sherds were collected, including pottery (668), lamps (3), *tubuli* (410), and bricks (263). The ceramics were analyzed according to survey area. Based primarily on fabric, the sherds were categorized into broad chronological groups (Fig. 16). Diagnostic sherds were analyzed further to determine more specific dating, form, and production origin.

Sample Catalogue

The following is a sample of pottery collected from the area of the fort during the 2009

survey (Fig. 17). This material, along with additional material from other areas of the site, will be published more fully in future reports.

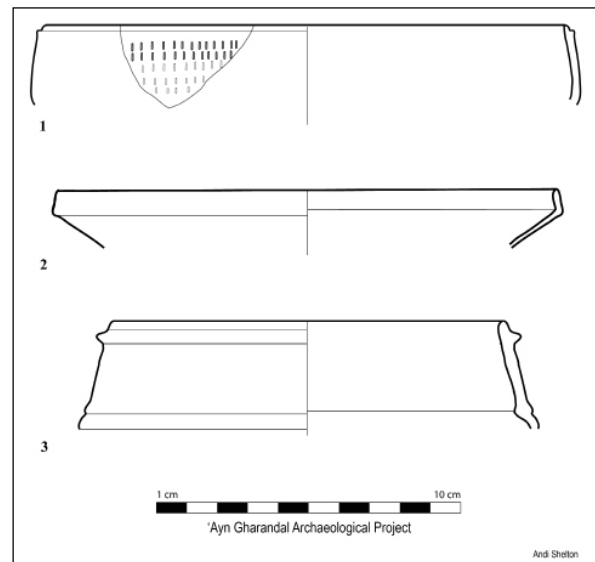
Figure 17.1. Bowl with rouletting. Notched rim. Thin white slip on exterior. D. 17 cm. Fabric: 2.5YR6.6; Exterior: 2.5YR5/6; Interior: 2.5YR6/6.

Figure 17.2. Semi-fine ware carinated bowl. D. 16 cm. Fabric 2.5YR5/1; Exterior 2.5YR6/1; Interior: 2.5YR5/1.

Figure 17.3. Jar/Cooking pot with triangular rim. Red slip on exterior. D. 14 cm. Fabric: 2.5YR6.6; Exterior: 10YR5/6; Interior: 2.5YR6/6.

Ceramic Analysis

The majority of the pottery sherds consisted



17. Selection of pottery collected from the area of the castellum.

Chronological Frequency							
AREA	Nabataean	Nabataean/ Early Roman	Roman	Late Roman/Early Byzantine	Byzantine	Unknown	Total Sherds by Area
Bath	0	3	10	20	4	2	39
Fort	3	45	235	216	48	23	570
Domestic? Structure	0	6	22	17	13	4	62
Total Sherds by Period*	3	54	267	253	65	29	671

*Chronology follows Kennedy 1991: 8-9.

16. 'Ayn Gharandal pottery chronology chart.

of coarse ware dating from the Early Roman (ER) –Early Byzantine (EB) periods (second through fourth/fifth centuries A.D.). Most of these sherds were extremely small, weather-worn body fragments, thus rendering further identification and specific dating difficult. Most sherds appear to come from coarse table wares or small-medium storage vessels, with a dearth of cooking wares and large storage vessels. The small amount of fine wares recovered, mostly from the Fort, date to the Late Nabataean-Early Roman periods (Fig. 18). It is interesting to note the absence of Late Byzantine/Early Islamic pottery.

While most of the pottery appears to have been produced in or around the Petra region, a fair quantity of sherds, 23 total, consist of ‘Aqaba ware, originating from ancient Aila on the Red Sea. One imported amphora sherd found in the possible domestic structure is most probably a Peacock and Williams Class 45 amphora, which is fairly common in the Eastern Mediterranean. Another 8 sherds remain unidentified and are probably imported. Only 4 handmade sherds were identified. In sum, the surface pottery collected in the 2009 season indicates occupation at ‘Ayn Gharandal peaked during the Early Roman through Byzantine periods, at which time the site was supplied primarily with ceramics from the major regional production centers.

The bath area yielded a large quantity of *tubuli*, both round water pipes and rectangular chimney flues (Figs. 19, 20). Although no exact parallel for the water pipes has been identified thus far, they appear most similar to fourth century pipes found elsewhere in the region. The pottery from the bathhouse dates predominantly to the Late Roman/Early Byzantine period.



18. A sampling of Late Nabataean/Early Roman fine ware from the castellum.

A large number of unstamped hypocaust bricks were recovered from the bathhouse. The vast majority of bricks were *bessales* (ca. 18.7 cm x 18.7 cm with a thickness of 2.7 cm). However, fragments of larger bricks, probably *sesquipedales* and *bipedales*, were also recovered. The heavy ash and soot deposits found on many of the *bessales* indicate their use as *pilae* to support the elevated floor, which was built using the larger bricks.

Site Synthesis

The results of the 2009 ‘Ayn Gharandal survey have contributed significantly to our understanding of both the site’s architecture and its rich historical past (Fig. 21). First, the past season has confirmed the presence of a previously unknown bathhouse at the site. In contrast, Musil originally identified only one of the three structures recorded on his plan. The largest structure is correctly labeled as a Roman fort; but Musil’s second structure, to the E of the fort,



19. Water pipe fragments from the bathhouse.



20. Chimney flue fragments from the bathhouse.

lacked any identification. More recently, the building has mistakenly been labeled as a reservoir (Kennedy and Riley 1990: 208; Kennedy 2004: 210). When the new plan is compared with Musil's, the external walls of the Northern and Southern Rooms, as well as the W wall of the bathhouse, all appear to correlate with the unidentified structure E of the fort, suggesting they are the same building. Further, Musil's drawing preserves at least three more major walls of the structure that are not currently visible. If Musil's drawing is accurate, the bathhouse is considerably larger than is presently visible and may be well-preserved in several locations.

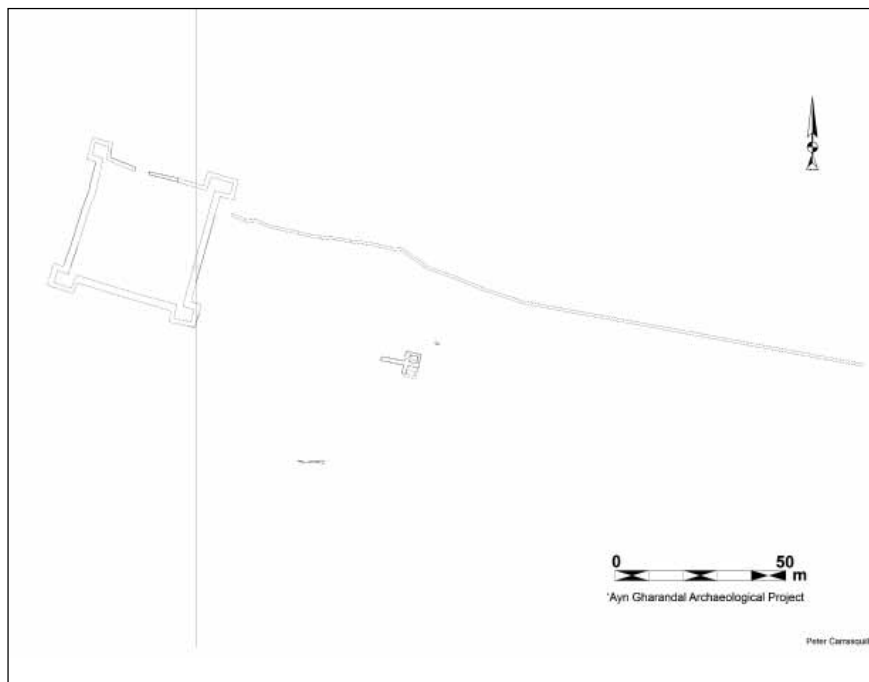
The recent season also corrects other details on Musil's plan. Renewed investigation shows that the fort towers appear to follow the standard *quadriburgium* pattern, and the gate may be located in the fort's N wall. Further, Musil did not recognize that the E fort wall connects to an aqueduct system that appears to have served both the fort and its bathhouse. Finally, the second unidentified structure, which Musil recorded SE of the fort, may be domestic. This interpretation is based on the pottery collected around its now buried walls; however, this identification remains tenuous.

Finally, Musil orients the bathhouse due N in contrast to the fort, which he orients to the NE. The new plan shows that the bathhouse is clear-

ly oriented in alignment with the fort towards (cardinal or magnetic) north, as is the case in a number of other Roman army camps and bathhouses throughout the region (R. Darby forthcoming dissertation). The fort and bathhouse at 'Ayn Gharandal parallel other Late Roman sites in the region in both design and geographic location, controlling the scarce water resources along an important N-S trade route through the Wādī 'Arabah. The construction of the road and the numerous military installations along it including, Bersabee, Chermela, Thamara ('En Hazeva), Zoara, and Arieldela (Gharandal), are attributed in the *Onomasticon* of Eusebius to the transfer of the *Legio X Fretensis* from Jerusalem to Aila at the beginning of the fourth century A.D. (*On.* 11, 42, 50, 118, 129; Erickson-Gini 2007: 91; Millar 1996: 188). In a broader historical context, the Roman military presence at 'Ayn Gharandal during Late Antiquity appears directly related to the reorganization and redeployment of the legions of *Arabia* and *Palaestina* to the eastern frontier under Diocletian and the Tetrarchs in ca. 300 A.D. (Parker 2006: 541-62; Erickson-Gini 2007: 98; Kennedy and Falahat 2009: 150-69).

Future Excavation and Preservation

In the 2009 season the 'Ayn Gharandal Archaeological Project completed a new site plan,



21. 'Ayn Gharandal site plan.

created an expandable site grid, collected surface materials, preserved the endangered remains of the bathhouse, and generated a hypothetical 3-D model of its ruins (**Fig. 22**). In 2010, test excavations will be conducted in the fort, the bathhouse, and the possible domestic structure in order to establish the levels of soil and occupational deposition, clarify architectural features, and recover the first stratified remains from the site. The project will also clear the looters trenches in the bathhouse to further record its architectural remains and aid in developing a long-term conservation strategy before backfilling the structure.

Future seasons will collect sherds from the areas surrounding the aqueduct, the area W of the fort, and the area S of the modern road. The project will also map structures on the periphery of the site--a possible tower on the mountain ridge to the SE, an ancient roadway to the SE, and at least two structures at the mouth of the wadi. Excavations in upcoming seasons at 'Ayn Gharandal will continue first in the areas investigated during the 2010 season before expanding into adjacent squares.

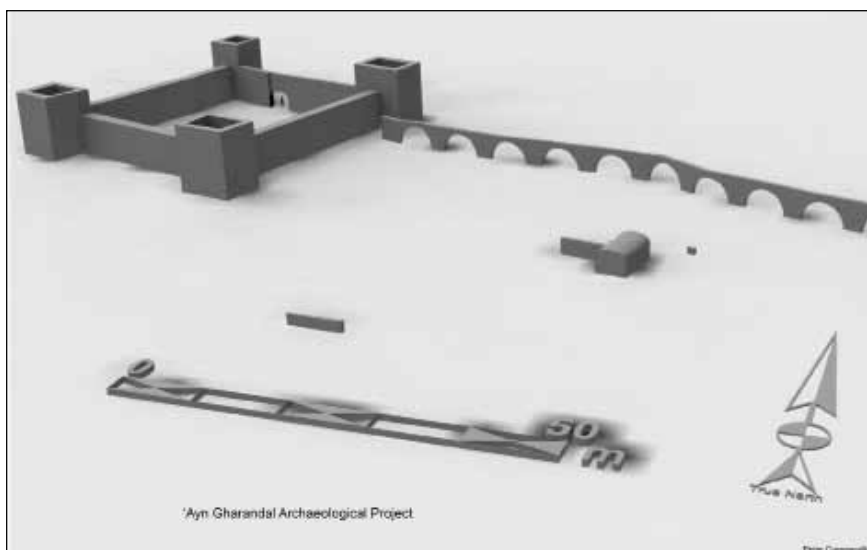
Preservation will remain an integral aspect of the project's goals. Two factors immediately affect Gharandal. First, the site's proximity to the Dead Sea highway makes it an excellent candidate for tourism, as well as potential looting. Second, the future completion of any canal between the Dead Sea and the Red Sea and the resulting construction, tourism, and business

influx to the area make it essential to identify all the remains at 'Ayn Gharandal and to protect and preserve them. Because the site has already been looted at least once, looters know of its whereabouts, regardless of the amount of visible structures. For that reason, backfilling is a temporary solution to the preservation and looting problem. A more effective long-term solution is full excavation and site preservation so that the antiquities are systematically recovered and delivered to the Department of Antiquities for further research and museum display.

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22. Hypothetical 3-D digital model of 'Ayn Gharandal.

Bibliography

- Darby, R.
Forthcoming Bathing on the Edge of Empire: A Regional Study of Late Roman Military Baths in Provincia Arabia and Palaestina. Ph.D. diss., University of Missouri, Columbia.
- Erickson-Gini, T.
2007 The Nabataean—Roman Negev in the Third Century CE. Pp. 91-100 in A. Lewin et al. (eds.), *The late Roman Army in the Near East from Diocletian to the Arab Conquest : proceedings of a colloquium held at Potenza, Acerenza and Matera, Italy (May 2005)*. BAR International Series 1717.
- Frank, F.
1934 Aus der Araba. *ZDPV* 57: 231-232.
- Gibson, E.
2007 Report to the Jordanian Department of Antiquities in association with an as yet unpublished survey of ancient roads in the region.
- Glueck, N.
1935 Explorations in Eastern Palestine II. *AASOR* XV: 1-202.
- Henry, D.O., et al.
2001 Survey of Prehistoric Sites, Wadi Arabah, Southern Jordan. *BASOR* 323: 3-8.
- Kennedy, D.
2004 *The Roman Army in Jordan*. 2nd ed. London: 209-211.
- Kennedy, D. and Riley, D.N.
1990 *Rome's Desert Frontier from the Air*. London: 207-209.
- King, G.R.D., et al.
1989 Survey of Byzantine and Islamic Sites in Jordan: Third Preliminary Report (1982), The Wadi 'Arabah (Part 2). *ADAJ* 33: 212-213.
- Millar, F.
1996 *The Roman Near East: 31 BC – AD 337*. Cambridge, MA and London: Harvard University Press.
- Musil, A.
1907 *Arabia Petraea II Edom*. Vienna.
- Parker, S.T.
2006 *The Roman Frontier in Central Jordan: Final Report on the Limes Arabicus Project 1980-1989*. Washington D.C.: Dumbarton Oaks.
- Raikes, T.D.
1985 The Character of the Wadi Araba. Pp. 95-101 in A. Hadidi (ed.), *SHAJ* 2. Amman: Department of Antiquities.
- Smith, A.M., Stevens, M. and Niemi, T.M.
1997 The South-east Arabah archaeological reconnaissance. *ADAJ* 38: 469-483.
1997 The South-east Araba Archaeological Survey: A preliminary report on the 1994 Season. *BASOR* 305: 45-71.
- Walmsley, A.
1988 Gharandal in Jibal: First Season Report. *ADAJ* 42: 433-441.
- Woolley, C. and Lawrence, T.E.
The Wilderness of Zin. *PEFA* 3: 105-106.

