EXCAVATIONS TABAQAT AR RUṬŪBAH, A YARMUKIAN SITE IN WĀDĪ QUSAYBAH, NORTHERN JORDAN

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Abstract

During August 2018, the University of Toronto mounted excavations at a Yarmukian site called Tabaqat Ar Ruṭūbah (طبقة الرُّطوبَة WQ 117), which the Wādī Qusaybah Survey first discovered in 2012, and subjected to small test excavations in 2014. The site is about 0.35ha in size and in 2014 we encountered stone and mud-brick building foundations as well as pits. Although thick colluvium at the site obscures much of its area, where Neolithic deposits are closer to the surface, we have found up to 2m of stratification that may span a period from *ca*. 6200 to perhaps 5700 cal. BC. This provides an excellent opportunity to study changes in important aspects of Yarmukian material culture, including its pottery, over time. The site also exhibits some enigmatic aspects, including its rarity of sickle elements and a complete lack of mammalian bone, both of which are usually fairly abundant at sites of this period.

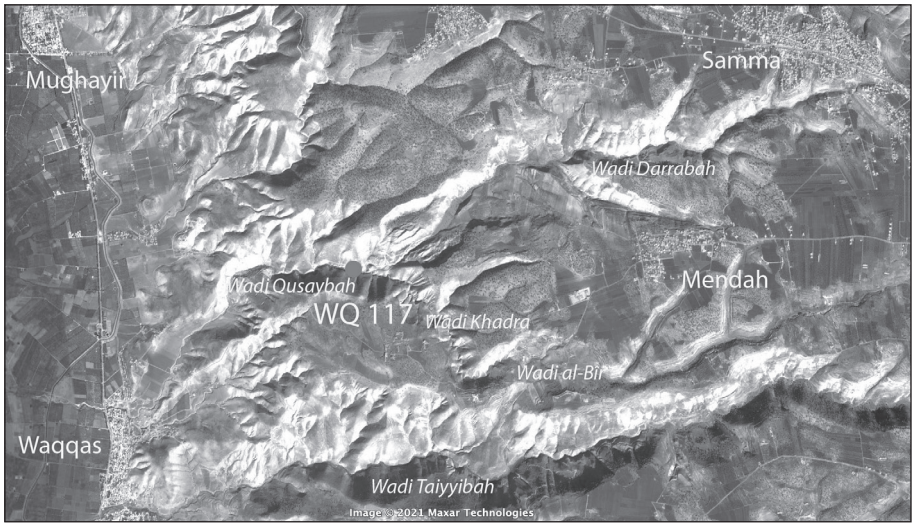
Introduction and Background

In 2012 and 2013, the University of Toronto's Wādī Ziqlāb Laboratory undertook surveys in the catchment basin of Wādī Qusaybah, west of the town of At Tayyibah, and in two small *wadis* on the edge of the Jordan Rift immediately north and south of Wādī Qusaybah's main channel. The main targets of the survey were late prehistoric sites, especially Neolithic ones. These sometimes lie buried under recent colluvium that makes visibility poor and renders them difficult to detect without subsurface testing by augers or small excavations (Field and Banning 1998), while other sites of the early Holocene have likely disappeared through *wadi* down-cutting and erosion. Consequently, the survey employed innovative Bayesian survey methods that focused search on spaces ("polygons" in our GIS predictive model) that were likely fragments of early Holocene land surfaces and whose probabilities of containing detectable Neolithic remains were updated in light of each day's survey results (Banning *et al.* 2013; Hitchings 2021; Hitchings *et al.* 2013; 2016; Stewart *et al.* 2016).

The survey discovered sites of various ages but also several "candidate" Neolithic sites where possibly Neolithic artifacts or only very small numbers of more definite Neolithic artifacts occurred. We tested three of these locations with small trenches in 2014, and found evidence for Yarmukian occupation at one of them to be sufficiently promising to warrant more substantial excavation in 2018 (**Fig. 1**). We describe the results of these excavations here.

Excavation and Recording Methods

As in previous field seasons in Wādī Ziqlāb and Wādī Al Bīr, we excavated each excavation unit or "Area" stratigraphically by *loci*, which we can subdivide further into "bags" or lots, so that "bags" are our smallest regular unit of spatial-stratigraphic context. In the remainder of this report, reference to contexts will be of the form J24.010, meaning *locus* 010 in Area J24, while artifact numbers are in the form WQ117.J24.6.127, meaning artifact 127 from



1. Location of Ṯabaqat Ar Ruṯūbah (WQ117) in Wādī Quṯaybah, northern Jordan (courtesy Google Earth).

bag 6 in Area J24. During the 2018 excavation, the sedimentary characteristics and several top and bottom levels of each "bag" were recorded on paper forms with additional information, mainly record photos, in a FileMaker Pro database on iPads, while additional photos were taken with a DSLR camera. We drew bag-by-bag sketch maps and section drawings on paper forms, and generated final architectural plans from photogrammetry using a digital camera mounted on a stadia rod. The 2014 test excavations, by contrast, relied on iPads for all recording except mapping, which was on paper forms.

With the exception of overlying colluvium, nearly all excavated sediments were screened with 3.5mm mesh. Excavation was mainly by trowel except for the use of picks and hoes to break up and remove thick colluvial sediment or very compact sediments.

From each context, we collected any lithics, pottery, faunal remains, basalt fragments, or other artifacts either *in situ* or on the screens. We also collected charcoal or other datable materials from useful contexts for radiocarbon dating, enclosing these in aluminum-foil pouches to protect them from contamination before putting them in plastic bags. We placed lithics in plastic bags but pottery in paper bags so that sherds could dry slowly and to prevent condensation that could damage them.

2. View of Ṯabaqat Ar Ruṯūbah from across Wādī Quṯaybah (K. Gibbs).

Physical Environment of Ṯabaqat Ar Ruṯūbah (WQ 117)

Ṯabaqat Ar Ruṯūbah occupies a terrace or bench at 32°33'23"N 35°38'7"E, between -10 and 20m asl, and about 380m downstream of the confluence of Wādī Aḍ Ḍarrābah and Wādī Khaḍrā, the two main tributaries of Wādī Quṯaybah (**Figs. 1, 2**). It is also just downstream from what was, until about a decade ago, a reliable spring called 'Ayn Tura'i; falling water tables recently caused this spring to dry up. Despite this, vegetation in the *wadi* channel is strongly hydrophytic, with abundant oleander, tamarisk and *Arundo donax* reeds.

The terrace is likely a remnant of the "Middle Terrace," typically a bedrock "strath" terrace that, on the basis of observations in nearby Wādī Aṭ Ṯayyibah and Wādī Ziqlāb, likely dates to the mid-Pleistocene (Maher 2011; Ullah 2013). There appear to be little to no remnants of the "Lower Terrace" in this part of the *wadi*, which is deeply incised. What may be the basal deposit of the terrace, below the Neolithic deposits, is a pale yellow (10YR 8/2) marl. Deep colluvium accumulated from the adjacent hillslope overlies the terrace so that its surface now slopes about 15°, with a SW (230°) aspect, and extends approximately 30m from

the colluvial hillslope before steeply plunging to the *wadi* channel about 15m below. Evidence of an old stream channel occurs in section about a meter below the toe of the terrace slope. A substantial gully divides the terrace into two main portions while several small, entrenched gullies, all originating in the colluvial slopes to the north, cross it before emptying into the *wadi* canyon at the southern edge of the site. A crudely bulldozed path or road bisects the site with a nearly east-west orientation (**Fig. 2**).

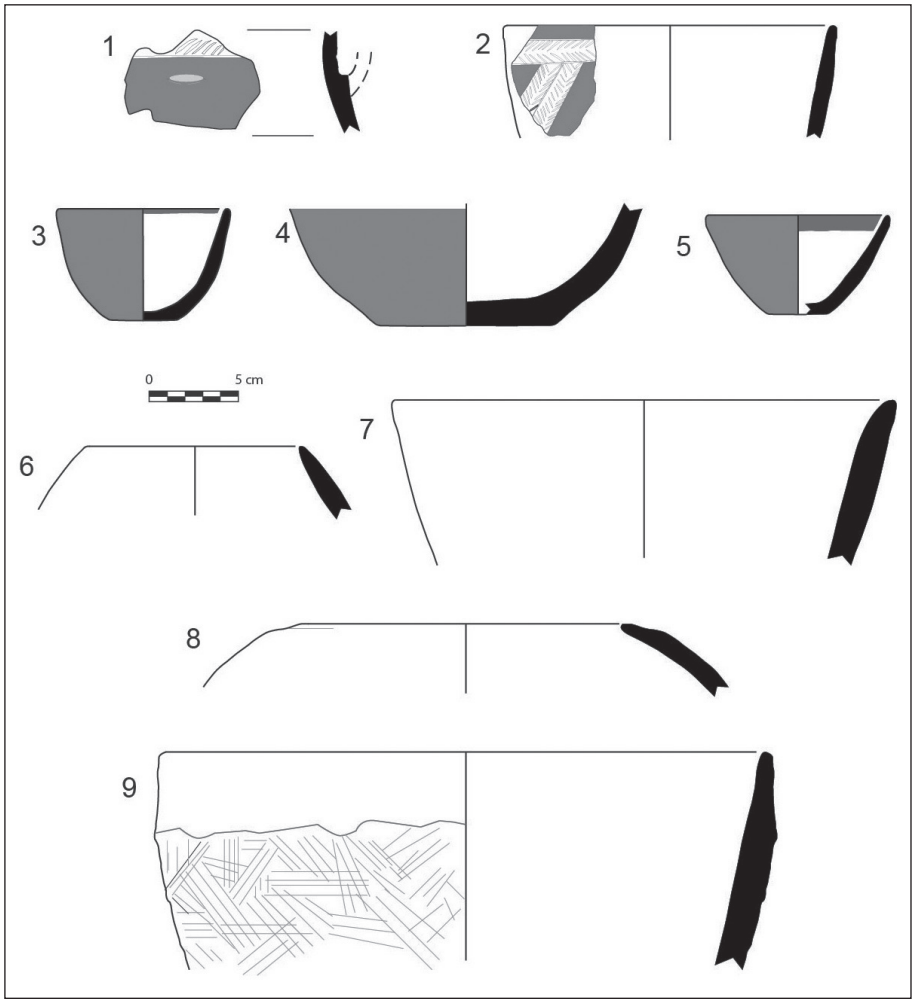
Finds from the 2012 Survey and Test Probes

Survey of polygons 117 and 118in Wādī Quṯaybah on 30 April 2012 involved three transects at approximately 4m intervals downslope of the road cut that someone had recently bulldozed into the slope. All three transects encountered lithics and some pottery on polygon 118, including a nearly complete bowl (**Fig. 3.3**, **Table 1**) that appeared to be Neolithic. Almost certainly, the bulldozing had redeposited these artifacts onto the modern surface. We defined site WQ 117 as a site occupying most of polygon 118 and at least part of polygon 117 to its west.

Given these promising surface finds, and with permission from the Department of Antiquities, on 15 May 2012 we excavated two 1×1m test probes, one on either side of the dirt road. We excavated Test Pit 1, upslope of the road, to a depth of about 0.9m, while Test Pit 2, below it, went to a depth of 1.05m.

Test Pit 1 yielded several lithics and just one sherd in its uppermost 10cm, and more abundant lithics from a depth of 40-50cm. Overall, this unit yielded little cultural material, and mainly colluvial deposits filled with angular cobbles (**Table 2**).

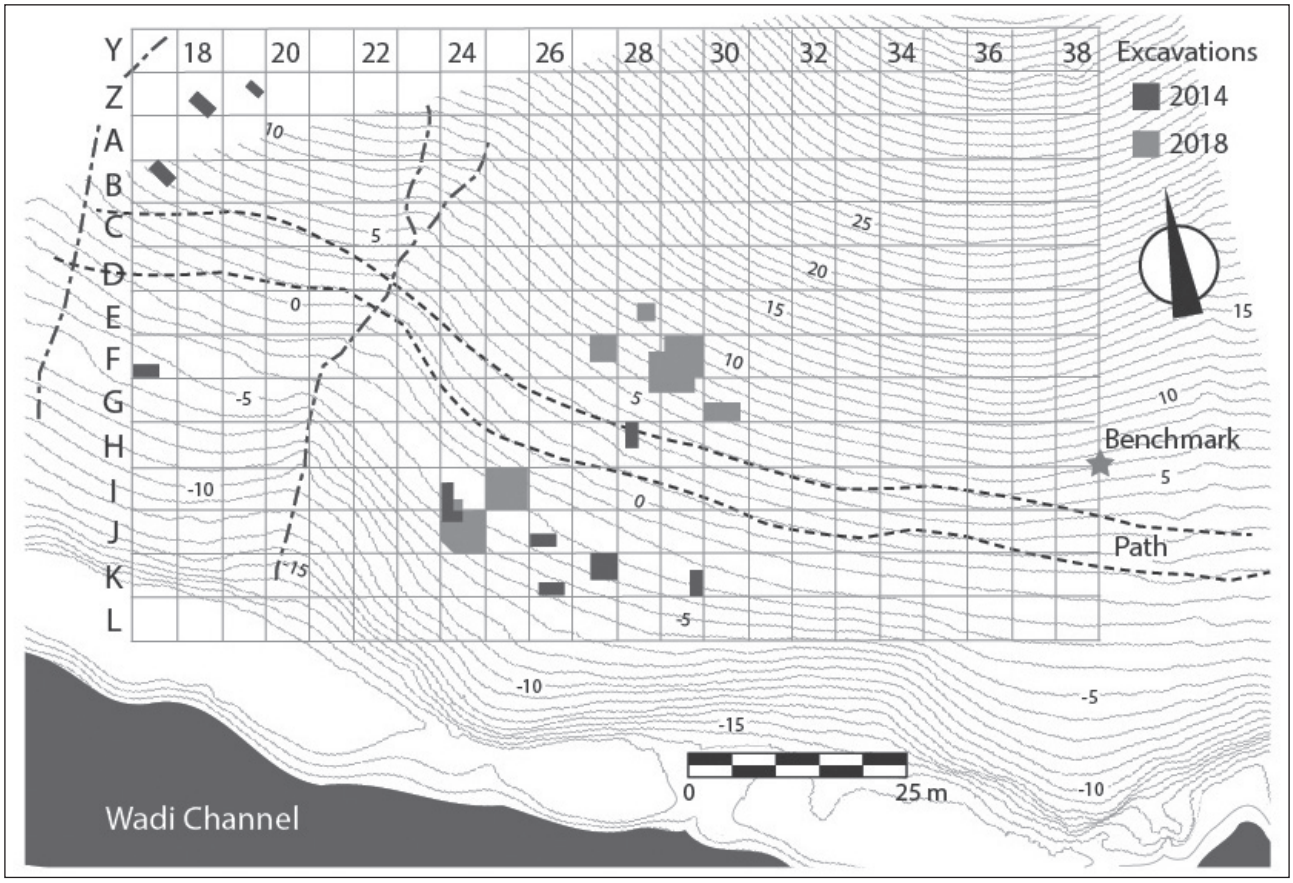
Test Pit 2 had colluvium with very few artifacts in its upper 40cm but, below this, lithic artifact density increased. Half of a limestone loom weight occurred at a depth of about 45cm. Most of the artifacts were below 80cm,



3. Diagnostic pottery from the 2012 survey and test probes (K. Abu Jayyab; for descriptions see Table 1).

Table 1. Sherds from the 2012 survey and test probes that appear in **Fig. 3**. Abbreviations are Art No (artifact number), Ext Col (exterior colour), Int Col (interior colour), Ext Core (exterior core), Int Core (interior core), Tr (trace), Lmst (limestone), Mod (moderate), Freq (frequent), Occ (occasional). Artifact numbers consist of the transect number, a period, then the individual artifact number, or site and test-pit number, spit number, and individual artifact number, separated by periods.

No	Art No	Ext Color	Int Color	Core	Ext Core	Int Core	Slip	Forming	Inclusions
1	10663.1	Red	Buff	Buff			Red	Coil	Mod Lmst
2	WQ117. TP2.8.105	Red	Buff	Buff			Red	Coil	Limestone
3	10691.2	Red	Buff	Grey	Buff	Buff	Red slip	Pinch	Freq coarse Lmst, Occ fine chaff
4	10652.1	Red	Red	Grey	Buff	Buff	Red slip	Pinch	Mod-rare chert, Occ Fine chaff
5	10701.1	Red	Buff	Buff	Buff	Buff	Red slip	Pinch	Mod fine chaff, Mod-freq Lmst
6	WQ117. TP2.4.101	Buff	Buff	Buff	Buff	Buff	None	Coil	Lmst & Chert
7	10622.1	Buff	Orange	Orange	Buff	Orange	None Scraped	Coil	Lmst
8	10691.1	Buff	Orange	Buff	Buff	Orange	None	Coil	Freq Chert & Lmst
9	10691.2	Buff	Buff	Buff	Buff	Buff	None Scraped	Coil	Very course Lmst and Chert



4. Locations of 2014 test trenches and 2018 excavations at Ṯabaqat Ar Ruṯūbah (S. Edwards, E. Banning, K. Gibbs and I. Ullah).

Table 2. Summary of the sediment characteristics and finds in the 2012 test pits.

Spit	Depth (cm)	Test Pit 1	Test Pit 2
1	0-10	Colluvial, one sherd, few lithics	Compact colluvium with angular cobbles (*ca.* 15cm) and grey matrix
2	10-20	Quite a few angular pebbles	Less rocks, less compact
3	20-30		Possible brick or tabun fragments near East section
4	30-40	Still very rocky, sediment slightly lighter	Sediment beginning to look lighter with more limestone content but most of the inclusions are small (*ca.* 5cm) angular limestone
5	40-50	Even more rocky, increase in lithics, no pottery	Many small (*ca.* 2cm) limestone pebbles, often fairly rounded, increasing angular limestone colluvium (*ca.* 15cm), half a limestone loom weight, lithic density…. (cut off)
6	50-60		Mostly fairly loose but with some larger stones (removed)
7	60-70	Decrease in the frequency of rocks and cobbles, matrix more compact	
8	70-80	Fewer rocks	Quite loose with many angular rocks and a pocket of ashy deposit at East side, whiter, more compact material near SW corner
9	80-90	No pottery, much more compact than above	Still quite loose and darker near NE corner, higher density of artifacts, especially lithics, nice Yarmukian rim with decoration
10	90-100		Goes to 105cm, possible mud brick in hard white (marl?) material at NW corner

including a herringbone-decorated rim sherd at about 85cm and what excavators then identified as a mud brick at about 100cm. In retrospect, this "brick" may have been a chunk of the marl that underlies the Neolithic deposits, and into which a series of pits is cut (see below).

Table 3: Locations of diagnostic pottery in Test Pit 2.

Spit	Depth (cm)	Test Pit 2 Finds
1	0-10	
2	10-20	
3	20-30	
4	30-40	holemouth rim sherd (Fig. 3.6)
5	40-50	bowl sherd
6	50-60	handle, rim sherd
7	60-70	
8	70-80	base sherd, rim (bowl) sherd (Fig. 3.5)
9	80-90	
10	90-100	no artifacts

2014 Test Excavations

The finds in the 2012 test pits led to further excavation at this site on a somewhat larger scale in 2014 with the goal of determining its size and assessing whether there were any well-preserved Neolithic deposits or architecture.

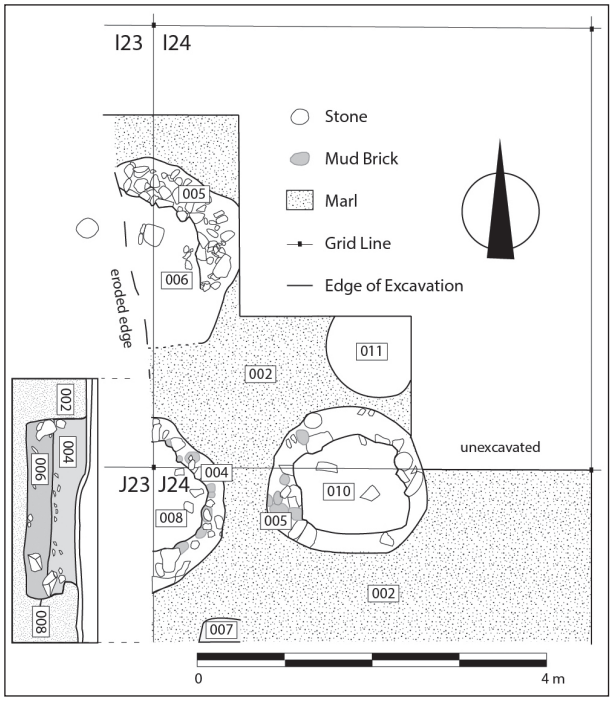
In 2014, we gridded the site into 5×5m squares ("Areas"), with a base line extending westward from a benchmark at H40, with a backsight of 270° onto a cell tower on the western horizon (**Fig. 4**).

We found pottery eroding out of the road cut at several points from Area B16 in the west as far as Area I3, some 80m to the east (**Fig. 4**), and this guided our selection of areas for excavation. The B16 pottery occurred in a cobble-filled deposit that may be the remnant of an ancient gully, and some, but not all, of the other pottery finds were in similar cobble-filled deposits.

Initial excavation units were 1×2m test trenches in Areas I24, J26, K26, and K29, and a 2×2m trench in K27. Later, we added a 1×2m trench in J24, and a 1×1.5m one in H28.

Most of the 2014 excavations at the site encountered thick deposits of relatively recent colluvium and never reached deposits of Neolithic age. Even though this colluvium sometimes contained Yarmukian sherds, there was little hope of reaching *in situ* Yarmukian material in ancient context without removing many cubic meters of colluvium.

The only 2014 test units that were able to reach Yarmukian levels below the colluvium were those in I24 and J24, on the edge of the broad gully that separates polygons 117 and 118. Here, the colluvium was much thinner than in areas even a few metres upslope, and excavations revealed two roughly circular pits cut into the marl, which erosion had truncated at the terrace edge. A small portion of a third pit was exposed just upslope of the J24 one. One of these pits (I24.007), contained a loose, ashy and stony fill (I24.004), and exhibited a curved stone feature, possibly remnants of a wall (I24.005), within its eastern perimeter. Similar pits occurred in Area J24 (**Fig. 5**) and one of these, in the western portion of J24, along the terrace edge, was similar to the I24 one except for its lack of ashy deposit and the presence of what appeared to be mud bricks, rather than a stone feature. Some stones and a conical lump of unfired clay accompanied the mud bricks at the bottom of this pit. The other J24 pit was not sufficiently exposed to reveal its nature or contents in 2014, but was exposed more fully in 2018.



5. Plan of the western portion of the South Field, including pit 010 at the boundary of Areas I24 and J24 (K. Abu Jayyab and E. Banning).

These pits yielded substantial amounts of Yarmukian pottery, mostly from I24.003 and I24.004, and a large fragment of an incised stone "pebble" figurine (see **Fig. 13a**). Excavations in J24.008, recovered a biconical spindle whorl and a fragment of a grinding stone in addition to Yarmukian pottery.

2018 Excavations

The 2018 excavations explored the vicinity of the old I24 and J24 test trenches and a new area north of the road cut. In the remainder of this report, we refer to these two portions of the site, above and below the road cut, as the "North Field" and "South Field".

Further excavations in the South Field began with a quickly aborted excavation in I25, where colluvium once again impeded investigation. Subsequently, we reopened the I24-J24 excavation but concentrated on completely excavating a single pit (J24.010).

Identification of pottery in the upslope part of the road cut informed our decision to add excavation areas above it in the North Field, initially with a 2×2m trench in G30, which we extended to 2×4m after encountering a curving stone wall. Another 2×4m trench in Area G29 encountered another curving stone wall that was better preserved, and we subsequently added further trenches in Areas E28, F27, F29, and G28. These yielded considerable exposures of architecture and, in some cases, evidence for multiple phases of Yarmukian occupation (see below).

Excavations in the South Field of WQ117

The first unit in the South Field subject to excavation in 2018, I25, did not progress deeply enough to penetrate the recent colluvium before reassignment of its excavators to the North Field.

However, after removal of colluvium and backfill from the entirety of Area J24 (aside from the SW corner, lost to erosion), the yellow-white (10YR 8/2), marly *locus* J24.002 extended across the entire unit, except near

the western end of the north section, where the 2014 excavation had previously caught the corner of a possible pit. Removal of a portion of the adjacent Area I24 to 1.5m north of the grid line exposed the remainder of this pit J24.005 and its fill, *locus* J24.010, as well as the corner of yet another pit (I24.011) in the NE portion of this small extension into I24 (**Fig. 5**).

Locus J24.010 (the pit fill) was excavated to a depth of 1.1m below the top surface of J24.002 (the marl surface). The pit's upper edges proved difficult to identify clearly, partly because the pit is markedly bell-shaped, and partly because chunks of the white marly material that presumably derives from *locus* J24.002 had often fallen in around the pit's periphery. In addition to those chunks of marly material, the pit also included randomly scattered mud bricks and brick fragments, as well as bricks along the pit edges. Otherwise, the matrix of the pit fill ranged from compact to loose, with many small, angular to subangular pebbles and occasional darker pockets of ashy sediment. This fill contained few sherds except in its deeper portions, all clearly Yarmukian. As in the 2014 excavation of nearby pits, this included relatively fine, well-fired pottery, with finely executed herringbone-incised patterns, especially in sediment at the bottom of the pit. The pit fill also included flakes of flint debitage, some likely fire-cracked rock, and a few pieces of crab claw and carapace, as well as many snail shells and shell fragments. Radiocarbon dates on charcoal recovered from J24.010 indicate this pit fill dates approximately 6200-6100 cal BC (UOC-7909, UOC-7910, and UOC07911; **Table 4**).

There was insufficient time to excavate *locus* I24.011 (another pit north of J24.010) to any depth, but removal of its uppermost fill revealed a layer of mud bricks or mud-brick tumble. This seems similar to the situation in J24.010, except that the bricks may possibly be arranged to cover the pit fill. Only future excavation will determine if this is the case.

Excavations in the North Field of WQ117

The results of excavations in this area were quite different than those in the South Field. Not far below the surface, and under recent colluvium, were linear and curvilinear stone walls, all with complex stratigraphic histories of additions, re-buildings, and renovations.

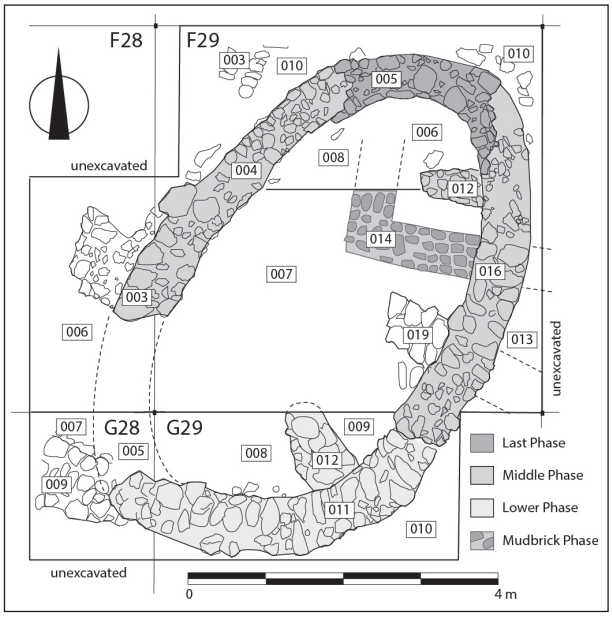
Area G30

G30 contained a curved wall, which at its east end was built against an outcrop of limestone bedrock. Unfortunately, if this wall was part of a larger structure, most of it must have been destroyed by bulldozing of the road and subsequent erosion.

Areas F28, F29, G28, G29

Our investigation of Late Neolithic occupation of this part of the site indicates that the builders of the architecture compensated for the slope by building large walls, backed by fill, to create terraces on which to construct buildings **(Fig. 6**).

The earliest phase that excavation in Area G28 reached revealed a straight, well-constructed, fieldstone wall (G28.009) running roughly east to west near the southern edge of the excavation. This substantial wall was wider than the one that overlay it (G28.011), preserved to three courses, and built more carefully than the walls of later phases. The fill adjacent to wall 009 (G28.007) contained few artifacts, but these included finely made Yarmukian pottery with a high incidence of herringbone incision. A mud brick packed against the first course of cobbles in the wall covered the leg of a clay figurine (see



6. Oval building in Areas F28-G29, and portions of earlier architecture, including the SW corner of the mudbrick building (loci F29.009 and F29.014), and stone walls F28.003, F29.019 and G28.009 (K. Abu Jayyab, E. Gibbon, I. Schwartz, and E. Banning).

Fig. 13b), while a pebble incised with parallel lines (see **Fig. 15a**) lay nearby. Perpendicular to the lowest course of wall G28.009 was a north-south wall (G28.010), preserved only to one course, that disappeared into the west baulk of G28. The identical founding level of walls G28.009 and 010 suggests that they are part of the same structure, but no surface associated with these walls was evident. Excavation continued below the base of these walls, 20cm into what appeared to be culturally sterile sediment, but it is possible that there is earlier cultural material deeper in Areas G28 and G29.

Excavation of the remains above wall G28.009 in G28-G29 showed that builders of a large structure that was mostly upslope in F28-F29 began by constructing a large stone wall (G29.011) running roughly east-west but curving northwards at its east end into Area F29. This wall was founded at a noticeably lower elevation in G28-G29 than what appears to be the founding level of wall F29.016, and wall 011 also varies in its preserved height from two courses in G28 to five courses close to the juncture between G29 and F29. A north-south wall (G29.012) that abuts the north side of wall G29.011 subdivides the presumably interior space and is not as well constructed. The base of wall G29.012 is also slightly higher than that of wall 011. The fill (G28.005, above G29.008) west of wall G29.012 has an exceptionally high density of sub-angular cobbles, chunks of mudbrick, flint flakes, as well as a high density of Neolithic sherds, several of them with characteristic Yarmukian herringbone incisions, and a small piece of soft limestone incised with lines (see **Fig. 15a**). Our first impression was that this was a colluvium that had accumulated against wall 011, but later excavations in F28.006 demonstrated that this was intentional fill placed to level off an area extending north into Area F29 (and possibly farther) on which to build a Neolithic structure, whether the oval building to be discussed below or another whose plan and size are currently unknown. It was also used as a foundation for the south end of the oval building. Consequently, we interpret wall G28/G29.011 as a retaining wall and foundation. Where it begins to curve northward at its west end, it has apparently been lost to erosion, and the cobble-filled *locus* 005 also terminates on approximately the curve one would expect if wall 011 was the southern part of an oval or subrectangular structure. The lighter-coloured fill (G29.009) east of wall G29.012 was substantially different than G28.005, consisting mainly of angular pebbles, and this difference, too, is consistent with the interpretation that both it and *locus* 005 were intentional fills.

A mud-brick structure that was partially exposed in F29 may have been built on this terrace, unless it belongs to a still earlier phase. Its full extent is currently unknown. We were only able to expose the top of its SW corner (F29.014), so most of its stratigraphic relationships are yet unknown, although walls F29.012 to the north and F29.016 to the east clearly overly it. Large, flat stones over an area of 0.6×0.8m just south of the mud-brick wall (*locus* F29.019) may be a pavement but are more likely a remnant of yet another east-west wall, either from the same phase as the mud brick one or from yet another building phase. If it is a wall, it appears to have continued east, where it underlies wall F29.016 and deposit F29.013.

In a later phase, a new building with an oval plan was founded some 20cm above the mud brick, consisting of walls F28.003, F29.004, and F29.016, and with a later repair, F29.005. It used portions of older walls, including wall G29.011, as foundations (**Fig. 6**). Vertically arranged slabs, somewhat like orthostats, line the interior face of F29.005. Although the southern portion of this building has been lost to erosion along the slope, there is clear evidence that wall F28.003 overlies the G28.005/F23.006 fill and it is likely that the building originally extended some 7m from north to south and 4.5m from east to west.

Large amounts of Neolithic pottery were associated with deposits inside this oval building, including many flat-lying sherds on a surface about 20cm above the mud bricks of the earlier building's wall F29.014. However, a later surface within this building has a number of Early Bronze Age sherds, and it is possible that at least the latest phase of the oval building, including its curved northern wall, F29.005, dates to Early Bronze. We currently do not have useful radiocarbon evidence for the date

of this building, however, as the only charcoal available was from the interface between the top of wall F29.005 and deposit F29.001, very near the surface. Both these specimens returned dates in the early second millennium AD (see **Table 4**).

Area E28

The purpose of excavation in this Area was to determine whether occupational remains and architecture like that found in F29-G29 extended upslope and to explore the site's stratification. Excavation in 2018 was limited to a 2×2m portion of the unit. E28's stratification shows evidence for several distinct phases of occupation.

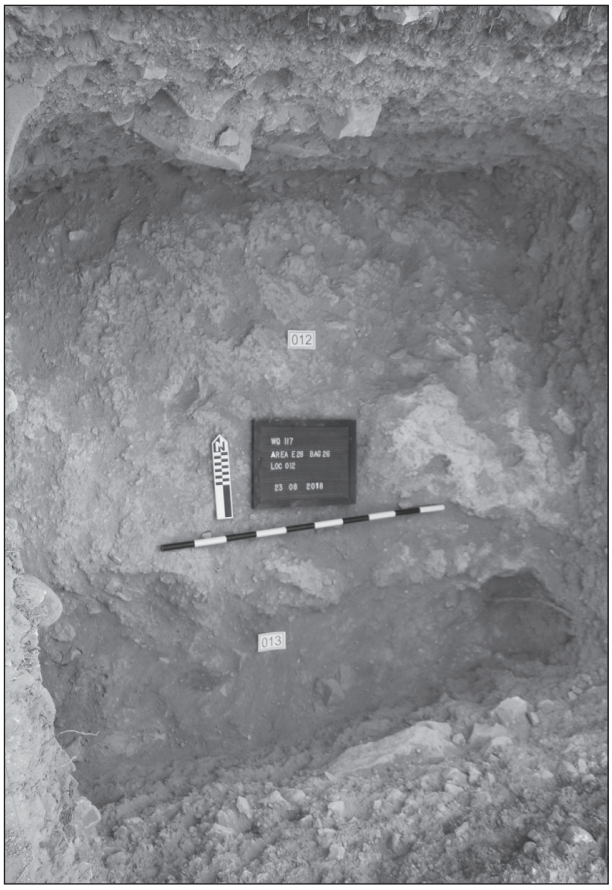
The deepest deposit reached in this unit was a marl, *locus* E28.012, with a hard, pale yellow-white surface (Munsell 10YR 8/3). A pit (E28.013) that cut into this marl contained somewhat ashy fill and large sherds of pottery, many lithic flakes, and snail shells, similar to the finds in I24-J24 and the deepest levels of F27. Pit 013 extended along the entire south baulk of the unit, indicating that its diameter exceeds 2m, but we were only able to expose a narrow portion.

Some 5cm above the E28.012 surface was a probable hearth (E28.009), circular or oval in shape, edged with mud bricks or their fragments. A number of sherds from the same vessel lay flat in the middle of this hearth, along with many brick fragments. The surface associated with the hearth is the top of *locus* E28.011.

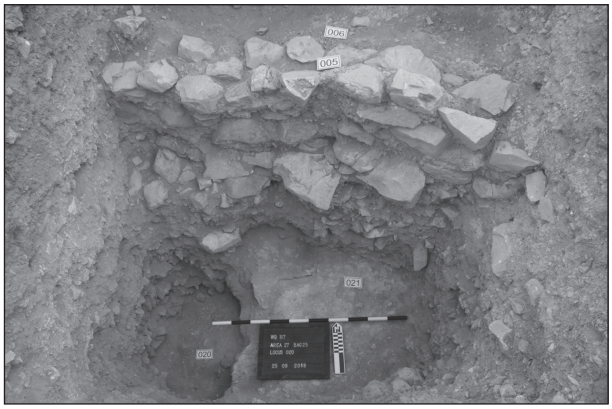
Locus E28.006 was an ashy deposit, 20-25cm thick, that occurred only in the western part of the excavation. It is possible that it was a pit dug into *loci* E28.007 and 008 but there was no clear pit edge, possibly because the loose, cobble-filled nature of the surrounding deposit (E28.007) made it hard to identify.

Higher up, *locus* E28.014 was a small fieldstone wall running SE/NW, with only one course preserved. It was not obvious what surface was associated with it, although *locus* E28.005 accumulated against its south face. As this wall runs roughly parallel to a similar wall (*locus* 005) in F27 at nearly the same elevation, it is possible that it is contemporary with both F27.005 and the oval building in F29-G29.

Just above E28.005 and the remnant of wall 014 was *locus* E28.004, apparently a colluvium with cobbles, sherds and lithics presumably carried downslope from a deposit to the north or northeast. This *locus* also contained a substantially intact jar base and a fairly large basalt quern, whose degree of preservation suggests they had not been transported very far. These finds demonstrate that the site extends at least somewhat farther to the north.



7. View of Area E28 toward end of excavation, with marly deposit E28.012 and top of pit E28.013 exposed (Rasha Elendari).



8. View of Area F27 near end of excavation, showing marly locus F27.021 and pit F27.020 well below wall F27.005 (Ahmad Thaher).

Table 4. Details of radiocarbon determinations from Ṯabaqat Ar Ruṯūbah. Calibrations are 95.4% credible intervals by OxCal v. 4.4 (Bronk Ramsey 2013) using the 2020 calibration curve (Reimer *et al.* 2020).

Lab ID	ID and *Locus*	Material	14C yr BP		F14C		D14C ‰		14C ‰		cal BC
UOC-7912	935128a F29.001	charcoal	972	21	0.8910	0.0023	-108.99	2.29	-116.28	2.27	1023-1153 (27.9%) 1077-1156 (67.6%) cal AD
UOC-7913	235128b F29.001	Arbutus sp charcoal	825	21	0.9024	0.0023	-97.59	2.32	-104.98	2.30	1177-1193 (7.1%) 1203-1269 (88.3%) cal AD
UOC-7916	935138 F27.009	charcoal	7202	27	0.4080	0.0014	-592.03	1.38	-595.36	1.37	6160-6151 (0.08%) 6090-5991 (94.7%)
UOC-7909	450445 J24.010	charcoal	7212	30	0.4075	0.0015	-592.51	1.53	-595.84	1.52	6216-6187 (4.9%) 6177-6142 (5.4%) 6095-5996 (85.2%)
UOC-7910	450472a J24.010	Quercus sp charcoal	7334	26	0.4013	0.0013	-598.67	1.29	-601.96	1.27	6236-6084 (95.4%)
UOC-7911	450472b J24.010	charcoal	7276	29	0.4043	0.0015	-595.74	1.47	-599.05	1.46	6222-6071 (95.4%)
UOC-7917	J24.010	Oxy-chilus sp shell	8983	28	0.3269	0.0011	-673.15	1.13	-675.82	1.12	8286-8173 (82.1%) 8114-8091 (4.1%) 8076-8062 (1.2%)
UOC-7918	F27.010	Mela-nopis sp shell	11193	32	0.2482	0.0010	-751.77	0.99	-753.81	0.99	11216-11137 (95.4%)

Area F27

F27 is the westernmost unit opened in the North Field during 2018. As in Area E28, excavation was restricted to a 2×2m area in the northeast corner of the unit. Its goal was to determine whether the occupational levels exposed in F28-G29 continued to the west and to obtain a long stratified sequence. Excavation here revealed three discrete occupational phases, each with pottery diagnostic of the Yarmukian.

The earliest phase discovered in F27 is associated with a yellow-white, marly deposit (F27.021, 10YR 8/3) very similar to *locus* E28.012 and *locus* 002 in Areas I24 and J24. As in those Areas, it was cut by a pit (F27.020). Although the excavation only exposed a small area in the northeast corner of this pit, with insufficient room to allow excavation to a depth greater than 50cm, it appears to be roughly 40cm in diameter at the top, assuming it is roughly circular. Pit F27.020 was filled with loose, ashy, sediment dense with angular cobbles. This deposit also included pottery sherds, incised pebbles, and a crude limestone "mortar." It seems likely that this pit, like *locus* E28.012, belongs to the same occupational phase as the pit features discovered in I24 and J24 on the basis of both similarities in artifacts, including incised pebbles and limestone mortars, and the basal marl deposit into which they are cut.

The most distinctive feature of the middle

phase is a double-leaf mudbrick wall F27.015), preserved to a height of two courses, running roughly north-south, and founded on top of the compact *locus* F27.019. The excavation uncovered too little to discern the nature of the building to which it belongs, other than that it may have been rectangular. Its associated surface may have been the top of *locus* F27.019, but this was not entirely clear. This phase may be contemporary with the mud-brick phase below the oval building in Areas F28-G29. Above it was a thin, compact clay layer (F27.014) that produced a large quantity of fine herringbone-decorated sherds and clearly separated it from the following phase.

The latest phase in F27 includes a double-leaf fieldstone wall, preserved four courses high (*locus* F27.005). It appears to have been constructed on top of *locus* F27.012, and deposits 011, 010, 009, 008 and 007 accumulated against its south face. Most of the pottery recovered from these sediments is coarse, with only a few sherds exhibiting herringbone-incised decoration. One, *locus* F27.009, yielded a radiocarbon date of 6090-5990 cal BC at 94.75 credible interval (**Table 4**). Given the large proportion of coarse wares and the similar elevation of wall F27.005 to the oval building in F29-G29 (founded about 1m lower than F29.005 but similar to elevation of G29.011), they may belong to the same phase.

Radiocarbon Chronology

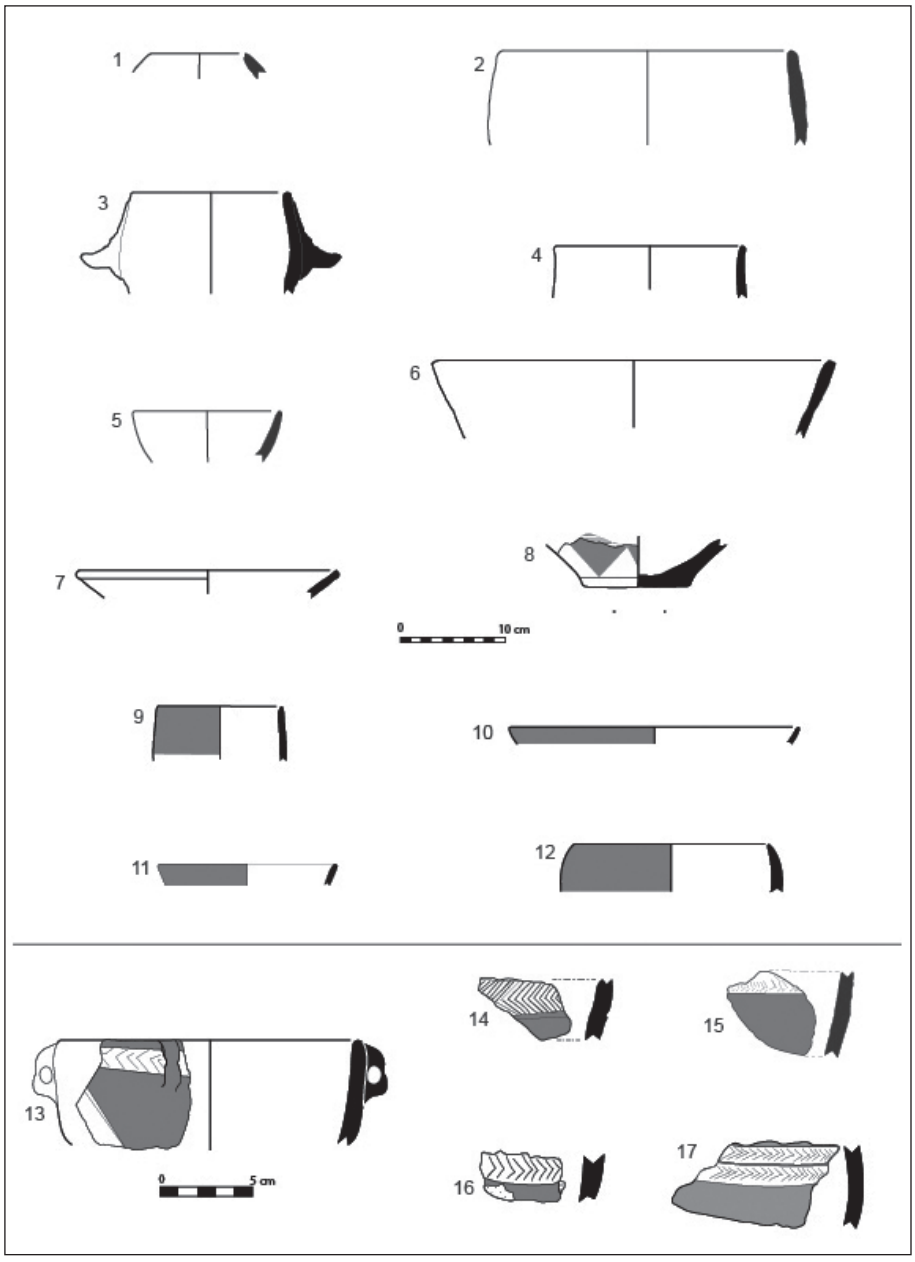
To date, we have submitted eight small charcoal fragments and two snail shells to the A. E. Lalonde AMS Laboratory at University of Ottawa for radiocarbon assay. Two of the smallest charcoal fragments were undatable.

Of the remaining six charcoal fragments, four yielded dates consistent with the Yarmukian Late Neolithic, in the late seventh millennium cal BC (**Table 4**). Three of these came from the pit fill, J24.010, and one from F27.009. A Bayesian analysis of the three dates from the pit on the assumption that they all pertain to the same phase is currently unconstrained by any other evidence, so only gives a very broad indication of the beginning of occupation at the site, between 6910 and 6075 cal BC at 95.4% probability, with considerable left skew, and the end of this first phase between 6215 and 5645 cal BC, with large skew to the right (overall agreement 86.2 and individual agreements all above 97.1). If we make the assumption that the three charcoals from J24.010 are all dating the same event, they provide a combined date of 6221-6118, 6111-6073 cal BC at the 95.4% credible interval.

A single date on a small piece of charcoal from F27.009 yielded a date of 6090-5990 cal BC at 94.75 credible interval. As this came from sediment piled against one face of wall F27.005, it unfortunately does not provide strong evidence for its date, as the charcoal could be residual, although it is consistent with the Yarmukian.

Two dates on small charcoal fragments from the interface between the top of wall F29.005 and bottom of F29.001, provided date estimates less than one thousand years old. As this was very close to the modern surface and from a context that clearly post-dates the destruction of wall F27.005, it is likely that the charcoal originated from shrubs burned in a brushfire or perhaps a shepherd's hearth in the 11th or 12th century AD (Fatimid or early Ayyubid period).

The two dates on snail shell were only to establish whether they were old, and potentially contemporary with the Neolithic use of the site, or recent intrusions. As land snails burrow down as much as 25cm seasonally, to protect themselves from heat and aridity in summer or, in the highlands, from winter cold, it is necessary to ask whether they are likely to be contemporary with the Neolithic materials or are intrusive. Radiocarbon dating land-snail shell is complicated because there are potentially large reservoir effects due to snails' incorporation of carbon from limestone into their shells. In published studies, this can result in an offset of 300 to several thousand years (Douka 2017). The resulting dates, uncorrected for this reservoir effect (**Table 4**), are both substantially earlier than those from the charcoals. Notably, snail determination UOC-7917 comes from the same context (J24.010) as three of the charcoals discussed above. The 82% credible interval for this shell is some 2000 years earlier than that of the charcoals. The difference between the charcoal date from F27.009 and snail date from F27.010 is even greater, some 5000 years.



9. Selection of diagnostic pottery from the 2018 excavations at Ṯabaqat Ar Ruṯūbah (K. Abu Jayyab and E. Banning; for descriptions see table 5).

These would be plausible reservoir offsets, with the particularly large one for *Melanopsis* sp. perhaps resulting from its habitat in highly calcareous spring waters, and indicate that the shells are quite old, although we cannot be certain that they entered those deposits during its Neolithic occupation.

Neolithic Pottery

Our preliminary assessment of pottery from Ṯabaqat Ar Ruṯūbah indicates that it belongs almost entirely to the Late Neolithic period. Apart from a very small number of Hellenistic, Roman or Byzantine and Islamic sherds recovered as surface finds on the site's western terrace, and some Early Bronze sherds in the uppermost phase of the oval building in F29 and in upper colluvial rubble, the pottery has its strongest parallels to such Yarmukian sites as 'Ayn Rāḥūb, Jabal Abū Ath THawwāb, Al Munhaṭṭah and Sha'ar Hagolan (Stekelis 1951, 1972; Garfinkel 1992, 1993, 1999; Kafafi 1989; 1993; Garfinkel and Miller 2002). This includes numerous sherds with incised herringbone pattern, often on a reserved band adjacent to fields of red slip (**Fig. 9, Table 5**). In addition to herringbone-incised pottery, we recovered a number of sherds with red slip, red

Table 5. Descriptions of sherds that appear in **Fig. 9**. Abbreviations are Art No (artifact number), Ext Col (exterior colour), Int Col (interior colour), Ext Core (exterior core), Int Core (interior core), Tr (trace), Lmst (limestone).

#	Art No	Ext Col	Int Col	Core	Ext Core	Int Core	Slip	Forming	Inclusions
1	E28.7.3	10YR8/3	10YR8/4	5YR5/1	7YR8/4	7YR6/6		Coil rim	Tr Mica, 3% Lmst, 0.5% Chert, 1% Oxide, 1% Voids
2	E28.16.103	10YR8/3	7.5YR7/3	10YR6/1	10YR8/1	10YR8/1		Coil rim, neck	8% Lmst, 2% Calcite, 5% Chaff
3	E28.14.102	7.5YR7/2	7.5YR8/1	10YR/7/1				Coil rim, neck, shoulder	2.5% Lmst, 2.5% Calcite
4	E28.4.101	10YR8/1	10YR8/2	10YR8/1				Col rim, neck, shoulder	n/a
5	E28.7.2	7.5YR7/4	7.5YR7/4	7.5YR8/3	7.5YR7/3	7.5YR8/4		Coil rim, body	Tr Mica, 2% Lmst, 1% Calcite, 3% Chert, 5% Grog
6	E28.21.101	10YR8/4	10YR8/4	10YR6/1				Coil rim	5% Lmst, 15% Voids
7	F28.21.103	10YR8/3	10YR8/3	n/a	10YR8/1	10YR5/1	5YR5/6	Coil rim	105 Lmst, 15% Voids
8	F28.9.105	5YR7/8	5YR7/6	5YR8/2	5YR8/2	5YR8/2		Coil body, slab base	Tr Mica, 3% Lmst, 1% Chert, 5% Voids
9	F28.19.104	7.5YR7/4	7.5YR7/4	10YR7/1				Coil rim, neck	5% Lmst
10	F27.12.101	10YR8/2	10YR8/3	10YR8/2			5YR6/6	Coil rim	2% Lmst, 1% Calcite, 3% Voids
11	F27.20.101	5YR8/2	5YR8//2	10YR8/1			10R5/4	Hand-made rim, body	3% Lmst, 2% Oxide, 2% Chaff
12	F28.19.102	10YR8/2	7.5YR8/3	10YR7/2				Coil rim, body	3% Lmst, 4% Calcite, 5% Voids
13	F27.6.101	10YR8/4	7.5YR7/4	10YR8/1			2.5YR5/6	Coil rim, neck shoulder	n/a
14	E28.23.104	10YR6/3	7.5Yr7/3	7.5YR6/1	7.5YR7/2	7.5YR7/2		–	2% Lmst, 1% Calcite, 2% Flint
15	E28.16.101	10YR7/4	10YR7/2	10YR8/3			5YR6/6	Coil rim, body	3% Lmst, 1% Flint, 3% Chaff
16	E24.1.101	2.5YR7/6	5YR7/4	5YR7/3				Coil body	Tr Mica, 10% Lmst, 3% Chert, 3% Oxide, 5% Voids
17	F27.12.103	10YR8/3	10R7/3				5YR5/4	Coil body	1% Lmst, 4% Grog, 5% Voids

slip and burnish, and red painted designs that include fine parallel lines, triangular motifs, and wide bands. However, the painted pottery from the site appears to lack the burnish and cream or white slip associated with Jericho IX/ Lodian painted pottery (Garfinkel 1999: 68).

In the descriptions that appear here, we classify sherds according to Garfinkel's (1999) typological labels for ease of comparison with other sites. The Late Neolithic pottery is handmade, mainly by coiling where forming can be determined, and is generally well fired. Some sherds are thin-walled and carefully executed, while others are coarse and thick,

sometimes with roughened surfaces, and appear to derive from very large vessels, such as large jar types E1, E2, E4 or F1 (Garfinkel 1999: 21, 34-43, 50-53). Most of the pottery could be locally produced but a petrographic analysis of sherds from the 2014 excavation indicates the presence of volcanic inclusions in some vessels. These may be imports from a source to the north, perhaps in the vicinity of Tall Ash SHūnah Ash SHamāliyyah, where basalt outcrops are extensive, or potters may have used basalt from broken grinding stones as temper, since there are no basalt outcrops in Wādī Qus̱aybah's drainage basin.

Many of the forms associated with the Yarmukian occur in our sample. They include small and medium-sized, deep and shallow bowls, medium and large hole-mouth jars, and necked jars, types C1, C2, C5, E1, D1 (Garfinkel 1999: 21-48). Also present are large *pithoi*, "chalices" (type C4), at least one example of a miniature bowl or cup (type A1), and a possible jar lid.

Handles include small strap handles on both deep bowls and necked jars, often at the juncture between the neck and shoulder of jars, as in types D1 and F2 (Garfinkel 1999: 21, 43-49, 53). These are usually oriented vertically, although we have some examples that were clearly oriented horizontally. Lug handles, sometimes pierced, and small knobs and ledge handles are often located near the rims of holemouth jars or bowls, as in types E1 and F1 (Garfinkel 1999: 21, 34-3, 50-53). We have one example of an intentional piercing of the vessel wall within the opening of a strap handle, its purpose unknown.

Flat, disk, and round bases all occur, along with a few ring bases, type C4 (Garfinkel 1999: 32). There are several examples of bases with rounded impressions, possibly by pebbles, to give a lumpy appearance (*cf.* Garfinkel 1999: 58-59).

Surface treatment and decoration are among the most useful distinguishing characteristics of Yarmukian assemblages, and the pottery from T̲abaqat Ar Ruṯūbah displays most of the range of such treatments. Bands of herringbone incision, often in reserve within a red-slipped field are common, either singly or in double bands, and in horizontal, zig-zag and triangular arrangements. In rarer instances, somewhat random placements of incisions or rows of incised longitudinal dashes replace the nested chevrons in these bands. Sometimes there are triangles or zigzags that extend below horizontal bands with incision. However, red or brown slip or painting are also fairly common surface treatments, sometimes in combination with incised bands, the most common cases being broad bands of red or brown paint or slip, especially below the rim. Diagonal and triangular patterns of broad or narrow red lines and large, nested chevrons (*cf*. Garfinkel 1999: photo 35), often depending from either a band on the rim or an incised band, also occur, but are less common.

Much of the pottery came from fill deposits, pit fills, or deposits with high densities of cobbles that may be remnants of ancient gullies. However, some flat-lying sherds indicate deposition on prehistoric surfaces. For example, in Area F29 (*locus* F29.007), there were many refitting fragments of a necked jar that appears to have broken where it was found, on top of *locus* F29.014.

Aside from the Early Bronze Age pottery that may indicate a brief re-use of the site, and very few Hellenistic or later sherds already mentioned, the Yarmukian pottery seems to exhibit some spatial and probable chrono-stratigraphic variation that warrants more detailed analysis. Many of the finer herringbone-incised sherds, with relatively narrow and well-executed bands of incised chevrons, come from the pit features in South Field Areas I24 and J24 or in the deepest *loci* of the North Field. By contrast, many of the vessels associated with the later stone architecture in Areas F29, G29 and G30 tend to be coarser, thick-walled vessels with more limited decoration. Lug handles and knobs are also relatively common on this later pottery. Pottery with incised herringbone decoration does occur in these deposits, but its execution is often cruder than that of incised pottery in older deposits below the stone architecture and some of the better examples could be residual. This suggests some changes in the decoration and *chaînes opératoires* of pottery at the site over time. Our preliminary impression is that painted decoration, often on thick-walled

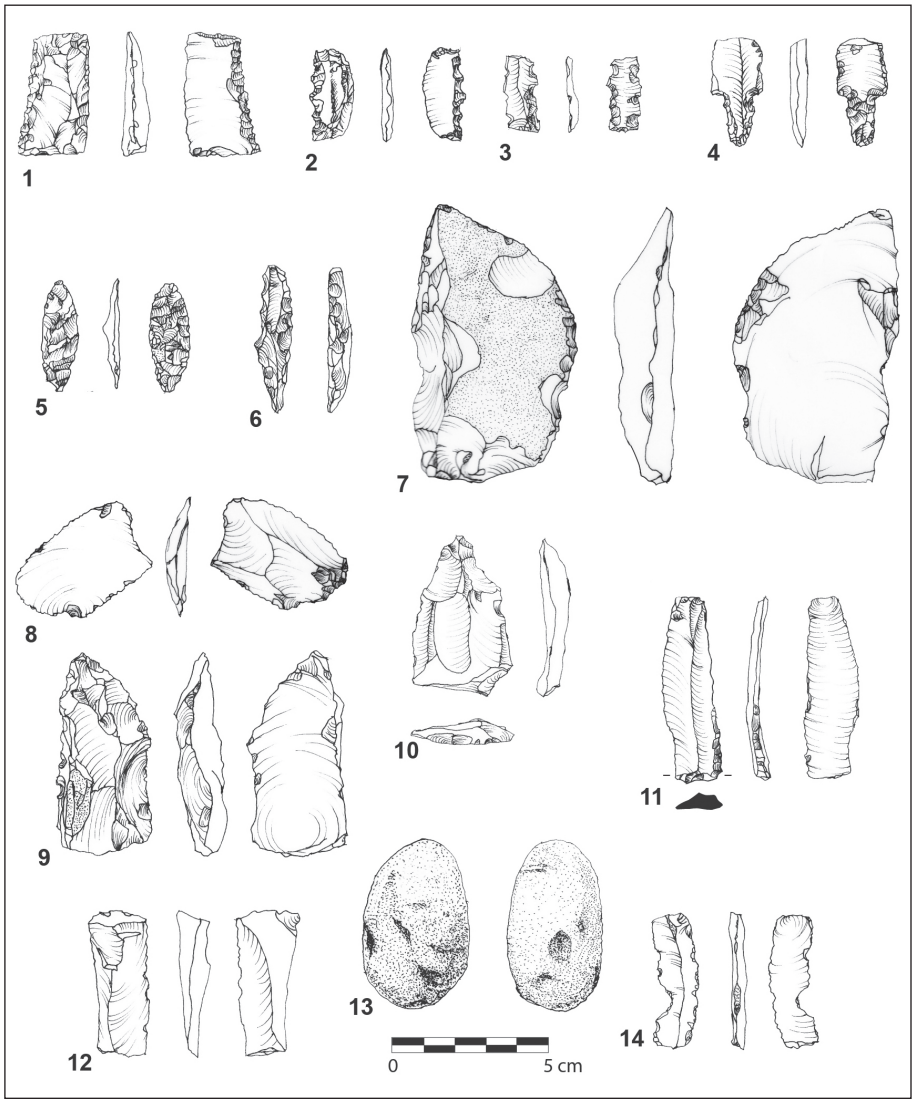
vessels, is also more common in association with the later stone building and in the road cut in B16, including thick lines and triangle motifs, than in deeper deposits or I24 and J24. If this preliminary observation is accurate, we may have evidence for the gradual development of Yarmukian pottery production over the course of several centuries, although without adoption of traits that would associate it with Jericho IX or Wādī Rabāh, as conventionally defined. This will be a focus for further research and evidence from further radiocarbon dating may also help to confirm or refute this hypothesis.

Lithics and Ground Stone

Lithic debitage from relatively high-quality flint, easily available in the site's vicinity, is common at Tabaqat Ar Ruṭūbah, but formal tools are very few in number. Otherwise, the assemblage appears similar to Yarmukian assemblages from Al Munhattah (Gopher 1989), Beisamoun (Groman-Yaroslavski and Rosenberg 2010), Sha'ar Hagolan (Matskevich 2005), Jabal Abū Ath THawwāb (Wada 2001), 'Ayn Ghazāl (Rollefson 1993), and Tall Abū As Suwwān (al-Nahar 2013).

The most easily recognizable formal tools are sickle elements, although these are surprisingly rare (**Fig. 10.1-3**). The 2014 excavations found a small one of Gopher's type D and an average-size one of his type C/E with steep unifacial backing and fine denticulations made by bifacial retouch on the cutting edge (Gopher 1989; Barkai and Gopher 1999). Two of these came from the same pit in I24. We have observed no sickle elements at all among the lithics from the 2018 excavations.

In the North Field, F29.001, unfortunately



10. Chipped-stone tools and hammerstone from Tabaqat Ar Ruṭūbah, including sickle elements (1-3), projectile points (4-5), borers (6, 10), scrapers (7-8), backed knives (9, 11), utilized blade (12), hammerstone (13), and retouched and notched blade (14) (C. Solomon).

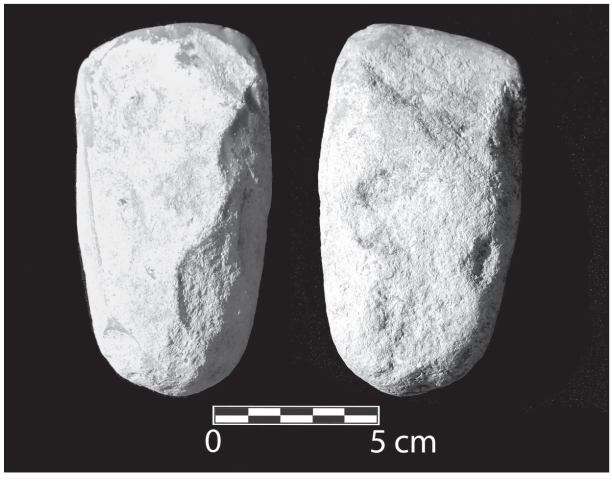
a recent colluvial context, yielded a ground flint adze. The adze (**Fig. 11**) is 117.5mm long, 61.3mm wide at its widest, and 28mm thick, and shows cortex over a good deal of its surface but use polish and some small chips along its working edge.

A small, leaf-shaped arrowhead from I26.002 (**see Fig. 10.5**) appears to be a Herzliya point similar to two from Al Munhattah (Gopher 1994: fig. 5.17.20-21) and one from Jabal Abū Ath THawwāb (Wada 2001: fig. 8.5). The 2018 field season also yielded a single, broken, projectile point from a surface context (**Fig. 10.4**) whose remaining tang and shoulder indicate that it is a small Jericho point whose barbs are not very prominent.

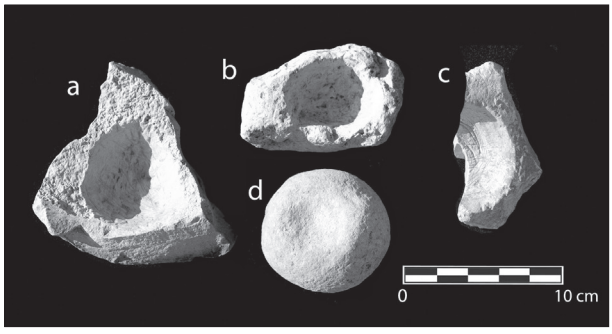
Most of the chipped-stone material consists of unretouched flakes, some of which may have been expedient tools, while the majority are unused debris.

Most of the cores from the site are amorphous and indicate expedient manufacture. The most abundant types are multiplatform cores and single-platform cores with uni-directional removals. Dual-platform cores also occur. The majority of removals are consistent with flake-based technology.

Groundstone tools were reasonably common at the site, including fragments of upper grinding stones and complete handstones or polishing stones. One complete basalt upper milling stone from F29.004 is 27cm long, 18cm wide and 10cm high, with a mass of 8.6kg. A preliminary report on starch recovered from its milling surface appears below.



11. Stone adze from F29.001.



12. Limestone "cup-hole" mortars (a, WQ117.J24.35.935153 from locus 010; b, WQ117.J24.33.935152, from locus 010; c, WQ117.F27.24 from locus 020), and an unfinished pierced cobble (d, WQ117.F29.8.174329 from locus 005), possibly intended as a weight.

Table 6: Summary of lithics from excavations at Tabaqat Ar Ruṭūbah.

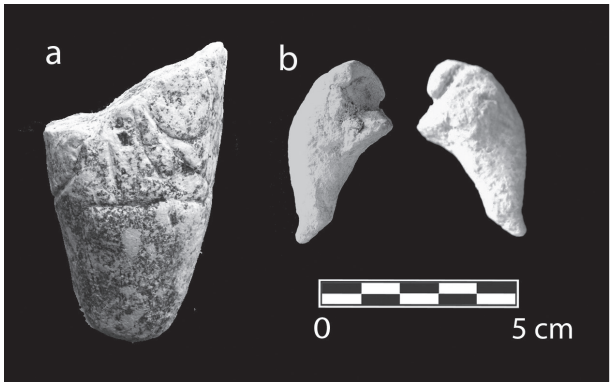
		Count	%
Tools			
	Utilized Flakes	8	9.6
	Utilized Blades	8	9.6
	Retouched Flakes	11	13.3
	Retouched Blades	8	9.6
	Arrowheads	2	2.4
	Sickle Elements	3	3.6
	Burins	5	6.0
	Borers	3	3.6
	Denticulates	2	2.4
	Notches	4	4.8
	Scrapers	14	16.9
	Cortical Scrapers	9	10.8
	Truncations	1	1.2
	Backed Pieces	0	0.0
	Axes, Adzes, Chisels	1	1.2
	Bifacial Knives	1	1.2
	Backed Knifes	1	1.2
	Choppers	0	0.0
	Core Tools	1	1.2
	Tool Fragments	1	1.2
	Retouched Tool Total	83	1.5
Waste Products and Unretouched Debitage			
	Cores	65	1.2
	Flakes	2840	52.8
	Blades and Bladelets	228	4.2
	Core Trimming Elements (CTEs)	1017	18.9
	Chunks	1103	20.5
	Chips	111	2.1
	Indeterminates	10	0.2
	Waste Total	5374	98.5
Total		**5457**	**100.0**
Groundstone Tools and Fragments		**63**	

A common category of groundstone tool at the site consists of small concave hollows in angular and subangular limestone cobbles that may have been meant as capstones for bow drills, as door sockets, or as small mortars. However, only one of them (**Fig. 12c**) shows rotary striations that you would expect to result from such a use, most instead showing linear chisel marks from their manufacture (*cf*. Rosenberg and Garfinkel 2014: 77-82) and no clear evidence of either pounding or rotary use damage. Two of these came from the same context in the J24.010 pit, and one of these looks somewhat similar to, though generally cruder than, stone "bowlets" at Sha'ar Hagolan (**Fig. 12b**, Rosenberg and Garfinkel 2014: 90-111). Another was observed but not collected in the gully immediately west of I24. Similar "mortars" or "bowlets" occur at other Late Neolithic sites in the region besides Sha'ar Hagolan, such as Nahal Zehora II (Gopher 2012: fig. 24.12), although the examples from our site tend to be made from very irregular fragments of soft limestone rather than from rounded pebbles or cobbles. Given that Sha'ar Hagolan is next to the Yarmuk River, a convenient source of rounded cobbles, this difference may just reflect the predominant available raw material.

There were also fragments of probable pestles while a limestone slab and a round cobble show attempted piercings. In the slab, abandonment of the attempt was because the two conical indentations did not line up, while in the cobble the piercing may just be unfinished (**Fig. 12d**).

Figurines, Incised Stones, Spindle Whorls, and Pierced Disks

As noted above, the small 2014 test excavation of a pit remnant in I24.007 discovered a broken stone figurine. Its exact features, or even its proper orientation, are difficult to discern, but it has curvilinear incisions possibly intended to represent arms (**Fig. 13a**).



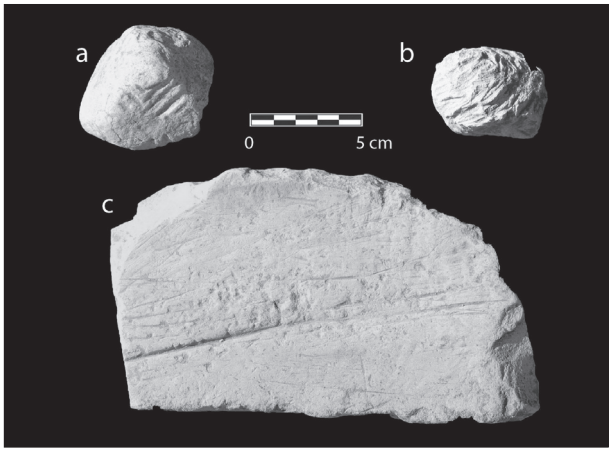
13. Broken stone figurine (a) from I24.006 and leg from a clay figurine (b, G28.11.174301 from locus 005).

Locus G28.005 also produced the leg of what was almost certainly a seated, cowrie-eyed clay figurine (**Fig. 13b**), similar to some of those that occur in large numbers at Sha'ar Hagolan (Garfinkel and Miller 2002: 188-200).

Another notable find from the site was a flat, sub-triangular stone with a linear groove (**Fig. 14**). This was in the same deposit (F29.005) that contained a biconical spindle whorl, a possible unfinished loom weight, and one of the small "mortars." While this could have functioned as a "shaft straightener" or a tool for sharpening bone tools (Vered 2013), it seems likely that it also has symbolic connotations.

Other instances of probable symbols are unusual, incised pebbles, about 5-8cm in maximum dimension. One of these incised stones, from G28.005, has a roughly pyramidal

14. "Shaft straightener" with possible symbolic connotations (F29.8.174328 from locus 005).



15. Incised pebbles (a, G28.11.174302 from locus 005), (b, F28.13.935147 from locus 006), and a limestone slab with incised lines (c, J24.33.450465 from locus 010).

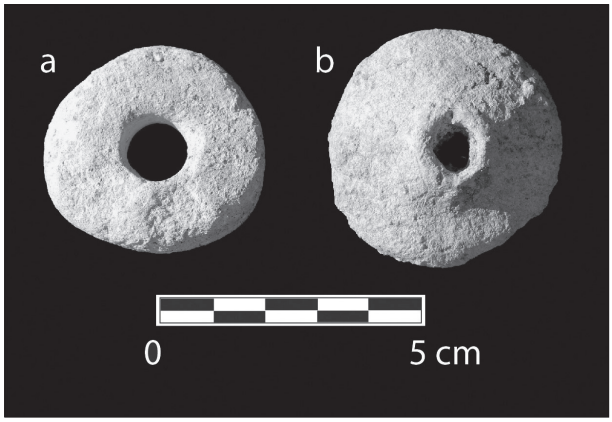
shape with a few short incisions on one side in a pattern that recalls a herringbone motif (**Fig. 15a**). It is possible that this could have served as a stamp seal or a gaming piece (*cf.* Garfinkel 2014; Kafafi 2006: 86). Another soft limestone pebble from F28.006 is ovoid and covered with short, somewhat random incisions, giving it the overall effect of a walnut shell (**Fig. 15b**).

A flat, limestone slab from the pit fill, J24.010, shows some sub-parallel incisions, one of them somewhat deep and with V-shaped section (**Fig. 15c**), but it is not clear if these were intentional or resulted from use as a cutting board while slicing some material.

A biconical ceramic spindle whorl from F29.005 (**Fig. 16a**) is similar to another found in Area J24 during the 2014 test excavations. Such spindle whorls often occur in Yarmukian assemblages in the region, such as Al Munhattah (Garfinkel 1992: fig. 85.15-28) and Sha'ar Hagolan (Garfinkel and Miller 2002: 31, fig.2.28). A pierced limestone disk from G30.004 (**Fig. 16b**) could also have been used as a spindle whorl (Stekelis 1951: 10; Heidkamp 2015: 34-37), although other functions are possible.

Faunal Remains

As in the 2014 test excavations, the 2018 excavations recovered no mammalian faunal macro-remains at all. This is unusual, as Yarmukian sites typically yield substantial amounts of bone and teeth. Yarmukian levels at Sha'ar Hagolan, for example, admittedly from a much larger excavated area, yielded more than 18,000 bones or fragments with a NISP greater than 1900, mainly from goats, sheep, and pigs (Marom 2011: 62, 69).



16. A pierced stone disk (a, G30.9.935132 from locus 004) and a biconical but rather unbalanced spindle whorl (b, F29.8.174330 from locus 005).

Unusually, the rare faunal remains from Tabaqat Ar Ruṭūbah are neither mammalian nor avian, but represent species we might expect in streamside habitats.

One fragment of shell from a freshwater mussel (Unionidae, possibly *Unio terminalis*), and one claw fragment of freshwater crab (*Potamon potamios,* Gherardi and Micheli 1989) were found in excavations at this site in 2014, both in Area J24. In 2018, excavations uncovered further crab claws and fragments from pit 010 in I24/J24.

The excavations also recovered a fairly large number of land snails' shells in multiple contexts. These include the large *Helix engaddensis* as well as generally much smaller snails, including, according to preliminary analysis, *Xerocrassa stimulata*, *X. mienisi*, *X. langloisiana*, *Melanopsis ammonis/ buccinoidea.*, *Oxychilius sp.*, *Sphincterochila sp.*, and a few others that are less common (identifications based on Heller 2009; Heller *et al.* 2005; Neubert *et al.* 2015).

Of the species that occur at the site, only *H. engaddensis* could have served as human food (Bar 1977), and we have no evidence that they did, but some of the others are good environmental indicators (*cf.* Colonese *et al.* 2013). For example, *Xerocrassa stimulata* aestivates on the lower branches of *wadi*-bottom shrubs during summer, and moves up the slopes in winter to feed on vegetation there, and is well adapted to very dry conditions (Heller 2009: 62-63). The Oxychilidae and some of the Spincterochilidae tend to forage under and around boulders and damp leaf litter, while *Melanopsis sp*. are fresh-water snails that favour stream-side habitats where they subsist on leaves, algae and cyanobacteria, but especially wet willow leaves (Heller 2009: 210-212). Thus we might expect most of these snails to have been present when the Qusaybah stream was very close to the foot of the site, rather than some 15m below, as it is today. This could also contribute to explanation of some of the crab remains, which may or may not represent food, as crabs walk some distance away from their streams. However, freshwater snails like

Melanopsis sp. can also enter the site in the clay used for mud bricks.

It is difficult to say how common mulluscan species are in other Yarmukian assemblages, as most of the faunal reports only include mammals and birds, and most mentions of molluscan remains from Neolithic sites more generally focus on imported marine shell. Marom (2011), for example, does not mention molluscan remains from Sha'ar Hagolan while, not surprisingly, small snail shells do occur in micromorphological samples (Arpin 2005).

Potential Diagenetic Effects

We have attempted to determine whether the absence of mammalian remains at the site is due to diagenetic destruction, even though we might expect that bone would be subject to much the same preservation opportunities as mollusk shell and crab carapace. pH below about 6.0 should break down the inorganic components of bone, mainly bioapatite, which is most stable at pH 7.8 (Berna *et al.* 2004; Kendall *et al.* 2018: 26; Nicholson 1996). Our extensive sampling of site sediments (**Table 7**) demonstrates pH levels that, as expected, are slightly basic (8.4 ± 0.3, n = 26). The limestone environment of Wādī Quṣaybah, not surprisingly, has produced slightly alkaline conditions that should not be especially destructive of the inorganic components of bone or teeth, although we can expect them to be destructive of collagen. Another potential destructive mechanism is fluctuating hydrology. Having once been close to the stream, and in an environment that would have experienced occasionally heavy rains during winters, separated by long, dry summers, we could expect the mid-Holocene water table at the terrace to have risen and fallen seasonally for perhaps a millennium after site abandonment, as is also consistent with the deposition of calcium carbonate deposits on many of the site's artifacts. Cyclical wetting and drying can be very destructive of bone, especially once the alkaline environment has removed collagen, leaving the bone more porous (Kendall *et al.* 2018: 26). However, these pH and climatic conditions are common to most Neolithic sites in the region, many of which still preserve substantial amounts of bone and teeth, albeit often in poor condition. Many of the bones found in the terraces of Wādī Ziqlāb, for example, have thick encrustrations of carbonate, and have suffered considerable destruction, yet identifiable bone fragments nonetheless occur in the hundreds or even thousands at those sites (Banning *et al.* 1994: 156; Kadowaki *et al.* 2008: 121). Currently, the most compelling hypotheses for the general absence of bone at the site may be that the site's users were unusually thorough about disposal of animal remains in the nearby stream, or that they did not process or consume mammals at the site, although this problem will require further research.

Plant Remains

Flotation of sediment samples from the site yielded light fractions containing very little evidence for charred seeds or charcoal,

Table 7: pH values for sediment samples from Tabaqat Ar Ruṭūbah, along with mean and standard deviation.

Square	Bag	*Locus*	pH	Comments
E28	6	004	8.0	
E28	8	006	8.5	Ash layer
E28	15	009	8.3	Burned mudbrick
E28	15	009	8.1	Hearth
E28	18	011	8.2	Under hearth
E28	23	010	8.3	Dark spot with FCS
E28	26	013	8.5	
E28	28	013	8.4	Pit fill
F27	9	009	8.5	
F27	18	017	8.4	
F27	21	019	8.6	
F29	14	006	8.4	
F29	4	006	8.6	
F29	13	007	8.5	
F29	13	007	8.4	
F29	38	007	8.2	
G30	12	004	8.1	
G30	5	004	8.4	
I24	30	010	8.6	
I24	57	010	8.9	
J24	30	010	8.8	
H10	52	012	8.1	
H11	18	010	8.8	
H11	21	011	8.8	
H11	28	014	8.8	
H12	16	010	8.0	
Mean			8.4	
s.d.			0.3	

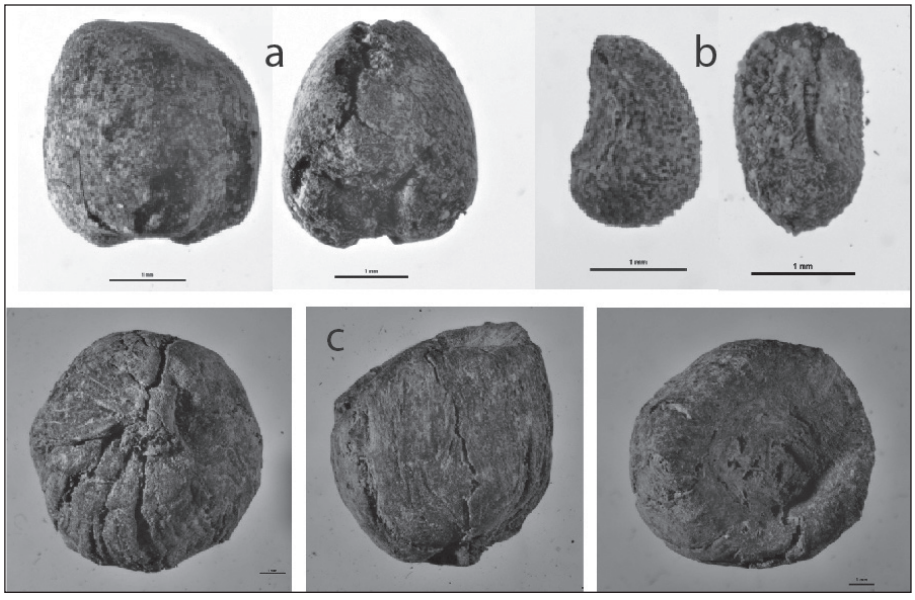
along with very small snail shells. The examination of heavy fractions for various classes of micro-refuse, although interrupted by pandemic-related lab closures, is underway. We also have some evidence for plant use from starches detected on some of the grinding stones found at the site.

Preliminary results from analysis of light fractions from 22 flotation sample elements in 14 different contexts has yielded low quantities of botanical remains. Volumes of sample elements ranged from 1.2 to 5.6 L. Only 29% of contexts yielded any wood charcoal, with a maximum density of only 0.002 g/L in *locus* F27.017. The fragmentary nature of this wood charcoal makes identification to species level very difficult. Other carbonized plant remains occurred in similarly low quantities. Fragmentary plant remains with no identifiable characteristics occurred in about 86% of contexts analyzed, with highest densities in *loci* I27.019 (0.002 g/L), E28.006 (0.001 g/L), and I24.010 (0.001 g/L). Only three carbonized seeds were recovered, each from different contexts. Thus, seed densities are of little interpretive value, but we nonetheless report them here. *Locus* E28.009 yielded one weedy legume (density 0.1 seed/L), likely a vetch (**Fig. 17a**, *Vicia sp.*). *Locus* F27.009 yielded an unidentified seed with distinctive ridging and measuring 2×1mm (density 0.213 seeds/L; **Fig. 17b**). We have found no matches to reference images for it to date but a larger reference collection may allow us identify it in future. Excavators labelled a large, heavily damaged seed from J24.010 (density 0.233 seeds/L) as an olive pit in the field (**Fig. 17c**) but experimental grinding and breakage of modern charred olive pits sheds doubt on this identification. Unfortunately, heavy wear on this specimen inhibits identification even to a taxonomic family.

Overall, the low densities of wood charcoal, seeds and other plant fragments at WQ117 suggest either poor preservation or that little plant processing or disposal of plant refuse occurred in the excavated parts of the site.

Starches recovered from several of the groundstone artifacts from the 2018 excavations may shed light on their likely uses. Extraction of starch residues involved spot sampling with disposable pipette tips and distilled water, and targeted pitted areas on and around ground surfaces. To test for environmental or contamination-related residues, comparative samples were taken from areas of the artifacts that were less likely to be working surfaces, such as breaks, bottoms, possible handles, and unaltered faces. In addition, traps of distilled water on microscope slides were placed around the laboratory space to check for possible contamination, and all equipment and materials used in the analysis process were regularly checked for modern starches.

The large basalt upper milling stone from F29.004 had starch within the recesses of its rough use surface. Most of the starch grains coming from this stone are small and likely from some sort of grain. They are altered or damaged in such a way that more research will



17. Charred seeds: (a) weedy legume, probably Vicia sp., from E28.15, locus 009, (b) unidentified from F27.9, locus 009, and (c) damaged specimen from J24.31, locus 010 that was doubtfully identified as olive in the field, but possibly belongs to Arbutus sp. Small scales in the photos are all 1mm.

be necessary to identify them securely. None of this starch is obviously pea or lentil, although a few grains from this stone and one of the mortars may come from a legume. Unfortunately, they are not sufficiently diagnostic and further analysis will be necessary.

Discussion and Conclusions

Ṯabaqat Ar Ruṯūbah is more substantial than early work at the site led us to suspect, even though it remains a rather small site. Given the distribution of sherds in the road cut through the site and finds in the North and South Fields, it probably has a current area on the order of 0.35ha, but the large gully that separates the western and eastern terraces has likely eroded away at least 500m^2 and the site has also lost an unknown area to erosion along its southern edge. Its size before these losses was probably no more than 0.5ha. The very substantial architecture in the northern part of the site was a surprise, with considerable use of mud brick as well as stone architecture to form large, well-constructed buildings, to judge by the several phases of the oval building and its predecessors in Areas G28 to F29, and glimpses of buildings in other units.

The finds from the pits in the lower part of the terrace in Areas I24 and J24 appear somewhat different than the Yarmukian artifacts associated with some of these buildings, and the discovery of similar pits dug into what may be the same marly surface in the lowest levels of Areas F27 and E28 would seem to confirm that the pits belong to an early phase of the Yarmukian. The stratigraphy and phasing of the stone and mudbrick architecture that succeeded the pits offers an opportunity to "fine-tune" our understanding of Yarmukian chronology and technological development, especially in ceramics, as the Yarmukian is more typically treated as an indivisible category. Given that it may have lasted for some 800 years (Banning 2007), it would be surprising to find no change at all in its material culture, and Ṯabaqat Ar Ruṯūbah seems an excellent place to interrogate the data for cultural and technological change in the period of the Yarmukian›s florescence, and perhaps also to understand its relationship to Jericho IX/Lodian assemblages at other sites.

The site is also interesting for its close parallels to Al Munhaṯṯah, where there were also many Neolithic pits, and strong differences, in some respects, from the much larger settlement at Sha'ar Hagolan. It provides another example of the highly diverse types of site that coexisted in the centuries around 6000 cal BC.

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